Environmental Protection for Polar Waters

Proposals for provisions for inclusion in an environmental protection chapter of the mandatory Polar Code

Briefing

from

Antarctic & Southern Ocean Coalition (ASOC)
Earthjustice
Friends of the Earth International (FOEI)*
International Fund for Animal Welfare (IFAW)*
Oceana
Pacific Environment*
WWF*[1]

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[1] * Bodies with consultative status at the IMO.

Contents

1. Introduction

This briefing elaborates on the environmental protection measures considered necessary for the protection of polar environments from the impacts of vessels operating in Polar Regions. It identifies provisions relating to both accidental and operational impacts of vessels along with measures which would support the management of vessels to minimize environmental impacts.

Fundamental unresolved issues remain, including those concerning the geographic boundary of waters covered by the Polar Code, and the fact that provisional language in the draft Code contains a boundary that excludes important large Arctic marine ecosystem waters. While this briefing does not elaborate on those issues, we believe that the environmental provisions of the Polar Code should apply to all large Arctic and Antarctic marine ecosystems.[2]

2. Background

The International Maritime Organization (IMO) has recognised that polar waters require special measures over and above routine environmental safeguards to protect the global oceans. These additional measures provide for appropriate protection of unique polar waters, which demonstrate greater sensitivity to a range of harmful substances arising from vessels operating in these waters. For example, the waters south of 60 degrees South are designated as an Antarctic Special Area for the purposes of MARPOL Annex I (oil), Annex II (noxious liquids) and Annex V (garbage). In addition, a recent amendment to MARPOL Annex I now prohibits the carriage and use of heavy fuel oils in Antarctic waters. A systematic assessment of the threat to polar waters from the full range of shipping operations has not, however, been undertaken and as a result the approach to protecting polar waters has been piecemeal.

In addition, it is important that the Polar Code reflects an issue of particular significance in the Arctic region: the unique vulnerability of indigenous and other local communities to the risks of shipping. Indigenous and other local communities live amidst and depend upon these marine environments for livelihood, health and culture.[3] Indigenous and other local communities will be most acutely affected by increased shipping in the Arctic, and thus provisions that meet their needs should be an integral part of protections contained in the Code.[4] Given the fact that the draft Polar Code utilizes a risk-based approach, measures that respect indigenous rights and that prevent or minimize specific impacts to

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[2] For detailed information, reference eNGO submissions DE 55/12/8 and DE 55/12/17.

[3] Arctic Council, *Arctic Marine Shipping Assessment 2009 Report* 5 (April 2009) ("Importantly, many local Arctic residents today depend heavily on marine resources for subsistence and the local economy; over-the-ice travel and boat transport allow the use of large marine areas during much of the year."), *available at* http://pame.is/amsa/amsa-2009-report [hereinafter AMSA].

[4] *Id.* ("Arctic residents express concern for the social, cultural and environmental effects of [Arctic development] expansion. The possibility of oil spills is a major concern and hunters are especially concerned about the disruption of marine species and their hunting practices. The costs and benefit of Arctic shipping will likely be unevenly distributed among and within communities and regions. Constructive and early engagement of local residents in planned Arctic marine development projects can help to reduce negative impacts and to increase positive benefits.").

culture, livelihood, health and environment should be developed through consultation with indigenous and local communities, in the drafting of the Polar Code.[5]

The volume and nature of shipping in remote Polar Regions is changing. There is increasing traffic from a wide range of vessels and vessel types in the Arctic and the Southern Ocean. At the same time there are significant recorded decreases in sea ice cover in each Polar Region, particularly during summer months, which is likely to accelerate this trend.[6] The number of icebergs calving from glaciers or from collapsing ice sheets is expected to increase in both oceans. These changes, and in particular the decrease in sea ice extent, are influencing the way shipping is conducted, and with increased ships operating in the area comes an increased probability of maritime incidents. The potential for environmental problems are compounded as larger, non-ice class ships enter the market.

In the Southern Ocean, shipping and fishing continue to increase, leading to an elevated risk of incidents and potentially disastrous accidents. In Antarctica over the past two decades, tourism has been characterized by steep increases, diversification, and geographic expansion.[7] Some operating companies are now owned by parent companies that are not traditional Antarctic operators, and involve practices such as the use of larger ships from the global cruise industry and the use of ships flagged by non-Antarctic Treaty parties. It is, however, not only cruise ships that are a concern, in the previous summer season (2010/11), the loss of 25 people in the Southern Ocean including the three crew of the yacht *Berserk* and 22 people from the fishing vessel *No. 1 In Sung* made headlines around the world. With these losses in mind and a number of incidents in recent years[8] that could have ended in disaster, it is clear that there is a strong need for a mandatory Polar Code.

[5] The right of indigenous peoples to be consulted on matters of importance to them has been established by, *inter alia,* international conventions, UN declarations and resolutions. Examples include: Articles 18-19 of the UN General Assembly, *United Nations Declaration on the Rights of Indigenous Peoples : resolution / adopted by the General Assembly*, 2 October 2007, A/RES/61/295; Article 27 of the UN General Assembly, *International Covenant on Civil and Political Rights*, 16 December 1966, United Nations, Treaty Series, vol. 999, p. 171; Article 7 of the International Labour Organization (ILO), *ILO Declaration on Fundamental Principles and Rights at Work*, June 1988.

[6] In some areas of the Antarctic sea-ice is increasing, particularly in the Ross Sea. Constable, A.J., Doust, S. (2009) Southern Ocean Sentinel – an international program to assess climate change impacts on marine ecosystems: report of an international Workshop, Hobart, April 2009. ACE CRC, Commonwealth of Australia, and WWF-Australia.

[7] ASOC (2008) *A decade of Antarctic tourism: Status, change, and actions needed*. XXXI ATCM, ASOC IP041.

[8] In February 2007, a fire on the *Nisshin Maru* whale processing vessel resulted in the loss of one life and loss of power for several days. In November 2007, the *M/S Explorer* sank and while fortunately everyone on board was rescued the loss of fuel oil could not be prevented. The loss of power to the *Argos Georgia* in the Ross Sea in December 2007, resulted in the fishing vessel drifting for 15 days until replacement parts could be airlifted to the vessel. In December 2008, the *MV Ushuaia* ran aground at the entrance to Wilhemina Bay north-west Antarctic Peninsula, resulting in hull damage and the spillage of an unknown amount of fuel. In February 2009 the *Ocean Nova* grounded, reportedly in extremely high winds, on the Western Antarctic Peninsula. In 2009, the Russian icebreaker, *Kapitan Khlebnikov* was stuck in ice in the Weddell Sea for a number of days with 184 passengers, staff and crew on board. In recent years there have been reports of a number of fishing vessels beset in ice in the Amundsen Sea.

In the Arctic, approximately 3,000 vessels currently operate (6,000 vessels, if the North Pacific Great Circle Route is included),[9] and that number is likely to grow as summer sea ice wanes.[10] Community re-supply, fishing, and marine transport of oil, gas, and minerals all constitute significant portions of Arctic vessel activity.[11] According to the Arctic Council's Arctic Marine Shipping Assessment 2009 Report (AMSA), "[n]atural resource development and regional trade are the key drivers of increased Arctic marine activity."[12] In addition, cruise ship activity in Arctic waters is rapidly expanding. In 2004, about 250 passenger ships operated within the region, with cruise ships carrying more than 1.2 million passengers; by 2007, the number of cruise ship passengers had more than doubled.[13] Arctic cruise ships are also venturing into new territory. In 2008, twenty-eight vessels planned to travel to Uummannaq, Greenland, with some continuing northward to Qaanaaq – both locations far north of the Arctic Circle.[14] Within Arctic Canada, planned cruise itineraries doubled between 2005 and 2006 to 22 and have increased at a rate of 9.5 percent on average over the past four years.[15] Nascent trans-Arctic shipping activities are also beginning: In September 2009, two German cargo ships completed a commercial voyage from South Korea to the Netherlands via the Northeast Passage.[16] In August 2011, the tanker *Vladimir Tikhonov* – carrying 120,000 tons of natural gas condensate – and the tanker *STI Heritage* also navigated the route.[17] Moreover, icebreaker escort requests for Russian Arctic waters have grown to 15 in 2011, from 4 in 2010, indicating an increased interest in the Northeast Passage.[18]

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[9] Arctic Council, *Arctic Marine Shipping Assessment 2009 Report* 72 (2009), *available at* http://pame.arcticportal.org/images/stories/PDF_Files/AMSA_2009_Report_2nd_print.pdf [hereinafter AMSA].

[10] *See* AMSA, at 25-32; J. Richter-Menge et al., *Sea Ice Cover*, in NOAA Arctic Report Card 2008, Oct. 14, 2008, *available at* http://www.arctic.noaa.gov/report08/seaice.html (noting that in 2007, the extent of Arctic sea ice cover was 39 percent lower than the long-term average from 1979 to 2000); R. Lindsay & J. Zhang, *The Thinning of Arctic Sea Ice, 1988–2003: Have We Passed a Tipping Point?*, 18 J. of Climate 4879 (2005); Associated Press, *Arctic is Seeing Thinner Sea Ice, Experts Warn*, msnbc.com, April 6, 2009, *available at* http://www.msnbc.msn.com/id/30074699/ (finding that 90 percent of Arctic sea ice is only 1 or 2 years old); National Snow and Ice Data Center, *Media Advisory: Arctic sea ice reaches lowest extent for 2011*, Sept. 15, 2011 (noting that Arctic sea ice extent in 2011 had reached the second lowest level since satellite records began).

[11] AMSA, at 75-77; *see also* USGS Newsroom, *90 Billion Barrels of Oil and 1,670 Trillion Cubic Feet of Natural Gas Assessed in the Arctic*, July 23, 2008, *available at* http://www.usgs.gov/newsroom/article.asp?ID=1980 (estimating that the Arctic holds about 13 percent of the undiscovered oil, 30 percent of the undiscovered natural gas, and 20 percent of the undiscovered natural gas liquids in the world).

[12] AMSA, at 120.

[13] *Id*. at 71, 79.

[14] *Id*. at 81.

[15] J. Dawson et al., Cruise Tourism in Arctic Canada: Community Report for Gjoa Haven, Social Sciences and Humanities – Research Council of Canada, 2011.

[16] N. Jameson, *Ships Complete North East Passage*,Sept. 14, 2009, *available at* www.sustainableshipping.com.

[17] Gleb Bryanski, *Russia's Putin says Arctic trade route to rival Suez*, Reuters Canada, Sept. 22, 2011, *available at* *http://ca.reuters.com/article/topNews/idCATRE78L5TC20110922?pageNumber=1&virtualBrandChannel=0.*

[18] *Id.*

With the current level of shipping activity in the Arctic, shipping accidents are relatively common. From 1995 to 2004, nearly 300 accidents and incidents occurred in the region.[19] The risk to Arctic waters from shipping is exemplified by the 2004 grounding and breakup of the bulk carrier *M/V Selendang Ayu*, which lost power near the Aleutian Islands while travelling to China. During operations to rescue the crew from the *Selendang Ayu* six of the crew died. The vessel also discharged an estimated 1.7 million liters of intermediate fuel oil into Alaskan waters.[20] For several weeks severe weather and the remoteness of the spill delayed cleanup and the search for oiled animals. Six sea otter and 1,603 bird carcasses were finally recovered. The cleanup effort ended in June 2006.[21]

Recently, there has been a spate of incidents in the Canadian Arctic. In August 2010, the expedition cruise ship *Clippper Adventurer* stranded itself on an escarpment in Coronation Gulf.[22] The same month, the oil tanker *Mokami* ran aground near Pangnirtung. The following month, the fuel tanker *MV Nanny* ran aground on a sandbar in Simpson Strait. The vessel was carrying 2.4 million gallons of fuel at the time.[23] Fortunately, no injuries or fuel spillage occurred in any of these episodes.

In addition to accidents, legally permissible, routine vessel discharges of oil and chemicals (in the Arctic) and of sewage, grey water, sewage sludge, and garbage threaten vulnerable polar waters. Furthermore, increased vessel emissions of black carbon and ozone precursors such as nitrogen oxide will harm human health and contribute to regional warming – which, in turn, will have global climatic ramifications.[24,25,26] The Arctic has warmed at twice the rate of the rest of the world over the past century,[27] and may rise another four to seven degrees Celsius over the next century.[28] Air and water pollution from vessels poses a threat to the four million inhabitants, including over thirty different indigenous peoples, of the Arctic and the ecosystems upon which they rely.

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[19] AMSA, at 86.

[20] Committee for Risk of Vessel Accidents and Spills in the Aleutian Islands: A Study to Design a Comprehensive Risk Assessment, *Special Report 293: Risk of Vessel Accidents and Spills in the Aleutian Islands: Designing a Comprehensive Risk Assessment*, Transportation Research Board of the National Academies 2 (2008) *available at* http://books.nap.edu/catalog.php?record_id=12443.

[21] AMSA, at 151.

[22] E.J. Stewart and J. Dawson, *A Matter of Good Fortune? The Grounding of the* Clipper Adventurer *in the Northwest Passage, Arctic Canada*, InfoNorth, 64 Arctic 2 (2011).

[23] Natalie Bruckner-Menchelli, *Fuel tanker runs aground in Arctic*, Sept. 2, 2010, *available at* www.sustainableshipping.com.

[24] *Hearing on the Role of Black Carbon as a Factor in Climate Change: Hearing Before the House Comm. on Oversight and Government Reform*, 110th Cong. (2007) (written testimony of Dr. Joel Schwartz, Professor, Departments of Environmental Health and Epidemiology, Harvard University).

[25] D. Shindell & G. Faluvegi, *Climate Response to Regional Radiative Forcing During the Twentieth Century*, 2 Nature Geoscience 294 (2009).

[26] P. Quinn et al., *Short-Lived Pollutants in the Arctic: Their Climate Impact and Possible Mitigation Strategies*, 9 Atmos. Chem. & Physics 1723, 1725 (2008).

[27] Intergovernmental Panel on Climate Change, *Observations: Surface and Atmospheric Climate Change*, in Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report 237 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter3.pdf.

[28] Arctic Climate Impact Assessment, *Impacts of a Warming Arctic* 10, 12 (2004), *available at* http://amap.no/acia/.

3. Environmental protection recommendations

Recommendation 1: The development of a mandatory Polar Code should comprehensively address all forms of potential impact from vessels operating in polar waters and ensure that the highest possible environmental standards are applied.

Scope of the Code

Recommendation 2: Where appropriate, and particularly in an environmental protection chapter, the Polar Code should refer to "oil and other harmful substances" and include a definition of harmful substances drawn from the definition in the MARPOL Convention.

Recommendation 3: In the development of the Polar Code it should be recognized that the MARPOL Convention is not the sole IMO instrument providing environmental protection provisions, nor is it necessarily limited to only the substances currently regulated. Other instruments include the Ballast Water Management Convention and the Anti-fouling Systems Convention.

Environmental Protection

Recommendation 4: The Polar Code should recognize the value of accident mitigation measures such as traffic routeing and separation schemes, areas to be avoided, speed restrictions, and mandatory ship location reporting.

Recommendation 5: The designation of Particularly Sensitive Sea Areas (PSSAs) should be considered along with associated protective measures tailored to each region that address accident mitigation and environmental protection from routine discharges.

Recommendation 6: The ships' Operating Manual should include procedures tailored to polar waters that address routine vessel discharges.

Infrastructure support and compliance

Recommendation 7: The Polar Code should recognise the value of regional vessel traffic monitoring and information systems to support environmental protection and safety.

Recommendation 8: The Polar Code should address the need for enhanced and coordinated search and rescue response and environmental emergency response in remote Polar Regions and take into account already formulated relevant agreements such as the Arctic Council's SAR instrument.

Recommendation 9: The Polar Code should require that the shipboard oil pollution emergency plan contains tailored provisions for operations in remote and sensitive polar environments.

Recommendation 10: The Polar Code should address the currently inadequate mapping of hydrographic conditions in polar waters.

Recommendation 11: The Polar Code should address the availability and use of waste reception facilities in connection with provisions protecting the polar environment from Annex I, II, IV and V wastes.

Measures focused on MARPOL and MARPOL related wastes

Oils

Recommendation 12: The Polar Code should ban vessel discharges of oil or oily mixtures into Arctic waters, providing equivalent protection to that already in existence for Antarctic waters (MARPOL Annex I, Regulation 15(b)(4)).

Recommendation 13: The Polar Code should introduce a provision eliminating the use of heavy fuel oil (equivalent to MARPOL Annex I, Regulation 43 for the Antarctic Area) and restricting the carriage of heavy fuel oil by vessels in certain ecologically sensitive Arctic waters due to the threat of substantial and irrevocable environmental harm.

Noxious Liquid substances in bulk

Recommendation 14: Vessel discharges of noxious liquid substances or mixtures containing such substances into Arctic waters should be prohibited as they are for Antarctic waters in MARPOL Annex II, Regulation 13 (8).

Packaged dangerous goods and containers

Recommendation 15: The Polar Code should include heightened standards regarding harmful substances in packaged form and all containers to prevent loss and facilitate recovery, if feasible. (See Annex p14/15 for more detail on options to be considered).

Sewage, sewage sludge and grey water

Recommendation 16: Heightened protection and standards for discharges of sewage, sewage sludge and grey water should be included in the Polar code, in combination with testing, monitoring, recordkeeping, reporting, and enforcement requirements.

Garbage

Recommendation 17: All garbage, including food wastes, should be banned from discharge in both Arctic and Antarctic waters.

Air emissions – SOx and NOx

Recommendation 18: Enhanced NOx and SOx emission control measures including identification of potential emission control areas (ECAs) should be established.

Air emissions – incineration

Recommendation 19: There should be a ban on incineration in specially vulnerable areas of the Arctic and Southern Ocean, such as marine protected areas or other ecologically sensitive areas and within a specified distance, e.g. 12 nm, from the ice-face and / or land.

Air emissions – black carbon

Recommendation 20: The Polar Code should include interim measures / guidance on reducing black carbon emissions while the issue is being considered further by the BLG and MEPC. Fifty percent reductions in black carbon emissions should be targeted immediately and seventy percent reductions should be sought in the medium term (i.e., 2018).

Measures focused on Non-MARPOL wastes and other impacts

Underwater noise

Recommendation 21: The Polar Code should seek to reduce vessel disturbance to marine life through ship noise reduction measures, including ship quieting technology identified in the IMO noise reduction guidelines (under development), speed restrictions, routeing options and areas to be avoided (taking into account bathymetric features, endemic marine mammal underwater sound sensitivity and migratory corridors). Particular attention should be given to noise from icebreakers.

Ballast water discharges

Recommendation 22: The Polar Code should require that the provisions of the Ballast Water Management Convention are applied for all vessels operating in polar waters. There should be additional restrictions on ballast discharges due to the great potential for major ecological impacts from species introduced via ballast water as ice cover recedes and the seawater warms in response to climatic change in Polar Regions. Moreover, the IMO Biofouling Guidelines should be followed by all vessels operating in polar waters.

Anti-fouling systems

Recommendation 23: The Polar Code should require that the provisions of the Anti-Fouling Systems Convention are applied to all vessels operating in polar waters. Furthermore, consideration should be given to the need for further restrictions on alternative anti-fouling systems, particularly those which release biocides (which are persistent, bioaccumulative and toxic), due to the potential for major impacts on polar waters and non-biocidal anti-fouling systems should be used when practicable.

Ship strikes

Recommendation 24: The Polar Code should include a provision on the use of advanced voyage planning to avoid interactions, especially collisions, with cetaceans and other marine mammals. Possible courses of action for vessel operators could include avoiding areas that pose a high risk of collision or operating through these areas at a reduced speed (e.g., 10 knots). Efforts also should be made by vessel operators to not interfere with native subsistence hunting of marine wildlife.

ANNEX

Scope of the Code

The mandatory Polar Code should address a broad range of environmental threats including oils and other harmful substances as addressed by MARPOL Annexes I – VI and other forms of marine pollution and environmental threats that are addressed through additional IMO instruments and deliberations, such as underwater noise, the introduction of alien species, and antifouling systems emissions.

The International Convention for the Prevention of Pollution from Ships, 1973, (MARPOL Convention) sets out its intent in the preambular paragraphs, recognizing that Parties desire "to achieve the complete elimination of intentional pollution of the marine environment by oil and other harmful substances and the minimization of accidental discharge of such substances[]". It goes on in Article 2(2) to define harmful substances as "any substance which, if introduced into the sea, is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea, and includes any substance subject to control by the present Convention.". It is widely accepted that the intention of MARPOL today is not only to achieve the complete elimination of intentional pollution of the marine environment but also to address pollution of the atmosphere as evidenced by the provisions of Annex VI.

The MARPOL Convention does not contain a definition of "pollutant", and the definition of 'harmful substance' in MARPOL is not limited to those substances regulated by MARPOL, but includes all substances controlled by MARPOL.

We support the inclusion in the Polar Code of functional requirements for losses, emissions, discharges or introduction of both potentially harmful substances currently regulated by MARPOL and also potentially harmful substances not currently regulated by MARPOL. For example, harmful substances associated with stern tube bearings, seals and main propulsion components, soot / black carbon, biocides and other harmful substances associated with antifouling systems, and ballast water discharges should be addressed. While these harmful substances are not regulated by MARPOL they are addressed via other IMO instruments or are under consideration within the appropriate IMO committees and sub-committees, but not specifically in relation to losses, emissions and discharges in polar waters.

Recommendation: Where appropriate, and particularly in an environmental protection chapter, the mandatory Polar Code should refer to "oil and other harmful substances" and include a definition of harmful substance drawn from the definition in the MARPOL Convention.

Recommendation: In the development of the Polar Code it should be recognized that the MARPOL Convention is not the sole IMO instrument providing environmental protection provisions, nor is it necessarily limited to only the substances currently regulated. Other instruments include the Ballast Water Convention and the Antifouling Systems Convention.

Environmental protection

A range of proposed measures to provide greater and proportionate protection for polar waters should be included in the mandatory Polar Code addressing both accidental impacts of shipping and also the routine day-to-day operations.

Accident mitigation
The Polar Code should recognize the value of accident mitigation measures such as the identification and establishment of mandatory navigation routes such as traffic routeing and separation schemes, areas to be avoided because of higher associated risks or environmental sensitivity, speed restrictions, where appropriate, to reduce the risk of accidents, and mandatory ship reporting to ensure the safety of passengers, crews and cargoes. Regional vulnerability assessments, including sensitivity analysis would inform the need for establishing routeing measures and areas to be avoided to minimise risks of collision and grounding and to protect polar environments. The appropriate routeing measures for the Arctic and Antarctic would need to be introduced using appropriate IMO mechanisms. Accident mitigation measures should also be introduced to reduce the risk of collisions between vessels and marine mammals. Particularly Sensitive Sea Area (PSSA) designation should be considered for the waters of both poles along with associated protective measures which could include accident mitigation measures.

Vessel Discharges (operational discharges)
Comprehensive provisions, including zero discharge provisions where appropriate, aimed at minimising the impacts of routine vessel operations in sensitive polar environments should be covered in the Polar Code. This should include stringent provisions for oil, noxious liquids, sewage and sewage sludge, grey water, garbage, and air emissions, including nitrogen oxides, sulphur oxides, and black carbon emissions, ballast discharges, and antifouling systems discharges (see subsequent sections for specific recommendations). The Polar Code should require that tailored procedures for the protection of polar environments under normal operations be included in each vessel's operating manual.

Recommendation: The Polar Code should recognize the value of accident mitigation measures such as traffic routeing and separation schemes, areas to be avoided, speed restrictions, and mandatory ship location reporting.

Recommendation: The designation of Particularly Sensitive Sea Areas (PSSAs) should be considered along with associated protective measures tailored to each region that address accident mitigation and environmental protection from routine discharges.

Recommendation: Environmental protection provisions should be comprehensive addressing all forms of potential impact from vessels operating in polar waters.

Recommendation: The ships' Operating Manual should include procedures tailored to polar waters which address routine vessel discharges.

Infrastructure Support and Compliance

In addition to including provisions to provide greater environmental protection, it is important to consider the associated need for supporting infrastructure and also to address compliance.

Polar vessel traffic monitoring and information systems.
Developing polar vessel traffic monitoring and information systems would enhance safety and support environmental protection. Such systems could make use of existing technology including long-range identification and tracking (LRIT), the required mandatory use of automatic identification systems (AIS), mandatory ship reporting and improved communication systems for polar waters, and provision of accurate and timely ice and weather forecasting information - including current conditions and maps, and coordination of ice-breaking assistance.

Search and rescue response and environmental response capacity and coordination
Mechanisms for coordinated Arctic or Antarctic polar responses to remote ship-based emergencies for both search and rescue, and for environmental emergencies such as oil and chemical spill response, including vessel reporting on a regular basis to the relevant regional maritime rescue coordination centres while operating in polar waters, should be addressed in the Polar Code.

Shipboard oil pollution emergency plan.
Tailored procedures for operations under accident conditions, which recognise the remoteness and sensitivity of polar environments, should be included in the shipboard oil pollution emergency plan.

Hydrographic conditions
Current mapping of hydrographic conditions in polar waters is inadequate, and there is an urgent need to generate accurate navigational charts. For example, the Canadian Hydrographic Service says that only 10 percent of the Canadian Arctic has been surveyed to modern standards.[29] Where data are lacking, risk profiles of areas should be established and when a risk profile is too high, no ships should be allowed into the area e.g. through the use of area to be avoided designations.

Waste reception facilities
The provision of adequate waste reception facilities for Annexes I, II, IV and V wastes should be addressed.

Recommendation: The Polar Code should recognise the value of regional vessel traffic monitoring and information systems to support environmental protection (and safety).

Recommendation: The Polar Code should address the need for enhanced and coordinated search and rescue response and environmental emergency response in

[29] AMSA, at 157.

remote Polar Regions and take into account already formulated relevant agreements such as the Arctic Council's SAR instrument.

Recommendation: The Polar Code should require that the shipboard oil pollution emergency plan contains tailored provisions for operations in remote and sensitive polar environments.

Recommendation: The Polar Code should address the currently inadequate mapping of hydrographic conditions in polar waters.

Recommendation: The Polar Code should address the availability and use of waste reception facilities in connection with protecting the polar environment from Annex I, II, IV and V wastes.

Measures focused on *MARPOL and MARPOL related wastes*

Oils

Oil is routinely released into the marine environment from ships through tank washings, deck runoff, and bilge water discharges, and the level of discharges can be substantial. For example, the average cruise ship produces more than 95,000 litres of oily bilge water from engines and machinery each week.[30] The Arctic's sensitive waters and imperiled marine life and ecosystems justify the application of strict oil pollution discharge standards for vessels in the region. Therefore it is proposed that the Polar Code introduces a ban on vessel discharges of oil or oily mixtures into Arctic waters, providing equivalent protection to that already in existence for Antarctic waters (MARPOL Annex I, Regulation 15(b)(4)).

In addition, the accidental release of oil into the Arctic marine environment threatens birds and mammals, such as eiders, polar bears, and seal pups, by compromising their feathers and fur, which can lead to hypothermia and death.[31] Arctic wildlife also can be susceptible to oil spills because it tends to congregate in large numbers to breed, nest, and rear young at certain times and locales each year.[32] Moreover, the impracticability of cleaning up an oil spill in the Arctic could lead to oil persistence in affected areas, consequently causing uptake of oil in marine and coastal food chains.[33] For these reasons, it is proposed that the Polar Code eliminate the use of heavy fuel oil (equivalent to MARPOL Annex I, Regulation 43 for the Antarctic Area) and restrict the carriage of heavy fuel oil by vessels in certain ecologically sensitive Arctic waters due to the threat of substantial and irrevocable environmental harm.

Recommendation: the Polar Code should ban vessel discharges of oil or oily mixtures into Arctic waters, providing equivalent protection to that already in existence for Antarctic waters (MARPOL Annex I, Regulation 15(b)(4)).

Recommendation: The Polar Code should introduce a provision eliminating the use of heavy fuel oil (equivalent to MARPOL Annex I, Regulation 43 for the Antarctic Area) and restricting the carriage of heavy fuel oil by vessels in certain ecologically sensitive Arctic waters due to the threat of substantial and irrevocable environmental harm.

Noxious liquid substances in bulk

The discharge of noxious liquid substances into the delicate marine environment of the Arctic presents a significant and unnecessary risk.

Recommendation: Vessel discharges of noxious liquid substances or mixtures containing such substances into Arctic waters should be prohibited as they are for Antarctic waters in MARPOL Annex II, Regulation 13 (8).

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[30] AMSA, at 137.*S*

[31] *Id.* at 136.

[32] *Id.* at 138.

[33] *Id.* at 136-138.

Packaged Dangerous Goods and containers

Several submissions to the DE sub-committee (DE 55/12/3, DE 54/13/7, DE 54/INF.5) have noted the increased potential for loss of harmful substances in packaged form, particularly containerized hazardous and noxious substances (HNS), in polar waters due to severe weather conditions, as well as the elevated risk from these materials to marine life along the sea ice edge and in open waters, such as polynyas.

The number of vessel containers lost at sea every year is growing,[34] likely approximately 10,000 containers per year globally,[35] and represents an environmental threat, particularly in Arctic waters.

The reduction of sea ice extent and thickness in the Arctic Ocean will facilitate the passage of vessel freight in and through the region. Future transits of container ships through the Arctic will pose risks of overboard containers due to severe weather and rough seas. When exposed to strong wave action and winds, containers lose their integrity, and their contents then pose a distinct threat to the environment. Items considered hazardous are, naturally, dangerous to marine life, but even items thought to be non-hazardous, such as plastics and consumer goods, present a threat as flotsam to marine species. Flotsam can cause entanglements and be mistaken as prey and consumed, resulting in injury or death to the animal. Filter-feeders may also mistake tiny floating particles, degraded from original container contents, as zooplankton, leading to the uptake of plastic into the food chain, with negative ecological consequences.

Container contents also may find their way to the three Arctic gyres[36] and remain in the marine environment for extended periods of time, posing a protracted risk.

Possible Measures Regarding Lost Containers-

Potential measures to minimize the occurrence of overboard vessel containers in Arctic waters include more stringent lashing requirements, stack height standards, vertical weight distribution, 'non linear' load consideration, and use of weather and ice forecasts.

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[34] Murdoch, E., and Tozer, D.**,** A Master's Guide to Container Securing, (2006), *available at* http://www.standard-club.com/docs/CTCMG2CSAW_disclaimer.pdf; Interreg III B, Espace Atlantique, Rapport Final, Reponse au Probleme des Conteneurs Perdus par les Navires de Passage dans le Golfe de Gascogne et ses approaches, acronyme LOSCONT, undated, *available at* http://www.interreg-atlantique.org/upload/resultats/RAPPORT_synthese_FINAL_FR_avec_Portugal.pdf.

[35] *See* Club Mutual Insurance Ltd., Containers Overboard! A hazard to shipping? Warning device ideas welcomed (claiming less than 2000 boxes lost per annum, but restricting that figure to the high seas), *available at* http://www.ttclub.com/TTCLUB/PubArc.nsf/D5E4C4B3A805731980256792004C617E/02CE747115C182F780256A6500596BF5?OpenDocument; FOEI, Proposed measures to reduce environmental impacts from containers, July 22, 2004, (submitted to IMO's DSC Subcommittee and reviewed as DSC 9/5/1) (estimating that approximately 10,000 vessel containers are lost each year). *But cf.* Australia, Denmark, and the Netherlands, Proposed measures to prevent loss of containers, Feb. 7, 2011, (submitted to IMO's DSC Subcommittee and reviewed as DSC 89/22/11) (estimating that about 3,000 to 4,000 containers are lost each year).

[36] Curtis Ebbesmeyer and Eric Scigliano, Flosametrics and the Floating World: How One Man's Obsession with Runaway Sneakers and Rubber Ducks Revolutionized Ocean Science, HarpersCollins Publishers, NY, NY, (2009).

Mandatory prompt notification by the vessel operator to the proper authorities of a container loss (as well as the MAR-ICE network or equivalent in the case of an HNS release) and a description of incident coordinates and the nature of contents at issue, including non-hazardous substances, could mitigate harm associated with the event.

Measures to monitor and salvage lost containers could include the use of tracking devices affixed to containers that are most susceptible to falling overboard. This could facilitate locating and recovering – and also avoiding for safety reasons – the container. In addition, containers could be fitted with EPIRB systems. Salvage of overboard containers should be attempted, to the maximum extent feasible, for all containers, even those that do not possess hazardous substances according to the IMDG Code.

Recommendation: the Polar Code should include heightened standards regarding harmful substances in packaged form and all containers to prevent loss and facilitate recovery, if feasible.

Sewage, sewage sludge and grey water

The risks and impacts of sewage, sewage sludge and grey water discharges from ships in Polar Regions are increasing as ship traffic rapidly expands in these areas.[37] For example, visits by cruise ships, which have the potential to generate and discharge as much waste as a small town,[38] are increasing in both Polar Regions.[39,40] Concerns exist over the vulnerability of polar marine ecosystems to sewage-related discharges since these areas are characterized by especially low light and temperature conditions, slowing decomposition.[41] Polar marine environments experience delicate nutrient balances and in some areas they are already under stress due to elevated run-off from rivers caused by increasing temperatures.

Polar marine environments are particularly vulnerable because of the potential to be less tolerant to rapid changes in the nutrient status of the water column or seabed. Polar Regions also have heightened vulnerability due to the presence of sensitive wildlife species in some locations. Moreover, the Arctic has an additional susceptibility: coastal communities including indigenous populations which are dependent on marine ecosystems for their subsistence, health, livelihood and cultural survival. It is well established that people eating fish can contract illnesses (including gastrointestinal illnesses, diarrhoea, ear nose and throat illnesses, vomiting, hepatitis, and respiratory diseases) from contact with faecal-contaminated waters.[42] While most sewage-caused

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[37] FOEI, IUCN, Greenpeace, IFAW and WWF, S*hipping Management Issues to be Addressed* (Nov. 20, 2009), (submitted to IMO's Design and Equipment Sub-Committee and reviewed as DE 53/18/3).

[38] U.S. Environmental Protection Agency, Cruise Ship Discharge Assessment Report 1-1 (2008), *available at* http://www.epa.gov/owow/oceans/cruise_ships/pdf/0812cruiseshipdischargeassess.pdf [hereinafter EPA 2008 Cruise Ship Assessment].

[39] ASOC (2008) A decade of Antarctic tourism: Status, change, and actions needed. XXXI ATCM, ASOC IP041.

[40] AMSA, at 72.

[41] *See e.g.*, Norway, *Environmental Aspects of Polar Shipping*, (Jan. 12, 2010), (submitted to IMO's Marine Environment Protection Committee and reviewed as MEPC 60/21/1).

[42] U.S. Government Accounting Office, Implementation of the Beach Act of 2000: EPA and States Have Made Progress Implementing the Act, but Further Actions Could Increase Public Health Protection 1 (2007), *available at* http://www.gao.gov/new.items/d071073t.pdf [hereinafter Beach Act Report]; Joint Group of Experts on the Scientific Aspects of Marine Environmental Protections, A Sea

illnesses are acute, some are potentially life-threatening.[43] Furthermore, sewage, sludge and grey water are all possible vectors for the introduction of alien species.

MARPOL Annex IV measures for sewage discharge were not established with polar waters in mind, but more generally for discharges in temperate and tropical waters with faster decomposition rates. Further, MARPOL IV restrictions prescribe distances from shore and rates at which discharges may occur, since shorelines are appropriately viewed as vulnerable resources that these measures aim to protect. Polar shorelines and communities are equally if not more vulnerable, but important ecological features can be found far offshore, such as ice floes, ice lines, and sensitive wildlife species (e.g., marine mammals), which are equally in need of protection. Therefore, restrictions based purely on proximity to shorelines are inadequate. These risks are heightened by the fact that cruise ships, with hundreds or thousands of people on board, travel to polar waters specifically to view wildlife and biodiversity hotspots.[44,45]

Discharges of grey water, the wastewater from galleys, showers, laundries, as well as food pulp, represent an environmental concern for polar waters. The U.S. Commission on Ocean Policy reported in 2004 that an average cruise ship produces 3.8 million liters of grey water each week.[46] Substances found in grey water include faecal coliform bacteria, oil and grease, detergents, nutrients, metals, food waste, and medical waste.[47] Analyses by U.S. EPA and the Alaska Department of Environmental Conservation indicated fecal coliform levels of 36,000,000 CFU/100mL and 2,950,000 MPN/100mL, respectively, for untreated cruise ship grey water, which is higher than, by orders of magnitude, bacteria levels identified in untreated domestic wastewater.[48] Grey water also has potential to cause harmful environmental effects due to concentrations of nutrients and other oxygen-demanding materials.[49]

Further consideration should be given to the necessary controls on sewage and sewage-related discharges, which account for the unique environmental polar conditions, risks and vulnerabilities, in order to provide adequate protection for sensitive polar ecosystems.

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of Troubles 5-6 (2001), *available at* http://unesdoc.unesco.org/images/0012/001229/122986e.pdf [hereinafter GESAMP].

[43] Beach Act Report, at 1; GESAMP, at 5-8.

[44] *Id.*

[45] Conservation International, Cruises, http://www.biodiversityscience.org/xp/CELB/programs/travel-leisure/cruises.xml.

[46] AMSA, at 137.

[47] Claudia Copeland, Congressional Research Service, Cruise Ship Pollution: Background, Laws and Regulations, and Key Issues 4 (last updated July 1, 2008) [hereinafter CRS Cruise Ship].

[48] EPA 2008 Cruise Ship Assessment, at 3-6.

[49] CRS Cruise Ship, at 4; US Navy Naval Sea Systems Command and US EPA Office of Water. Technical Development Document: Phase I, Uniform National Discharge Standards for Vessels of the Armed Forces 5.0 (1999).

Possible options include:

- banning all discharges of treated or untreated sewage and grey water from vessels operating in Polar Regions and certified to carry more than a specified number of people;

- creating sewage / sewage sludge / grey water "no discharge zones" in the most sensitive and biologically rich areas such as marine protected areas or areas where wildlife congregate to feed and / or breed;

- requiring advanced waste water treatment systems on board all vessels in Polar Regions;

- preventing discharges within a specified distance from land and / or ice-covered water;

- designating Polar Regions as special areas under MARPOL Annex IV (in a similar manner to that proposed for the Baltic Sea) and require stricter discharge limits within the proposed Special Areas. In considering strengthening standards on sewage and sewage-related waste (grey water and sewage sludge) discharges, it will also be important to consider provision of adequate waste reception facilities.

One possible scenario could include these options used in combination. For example, wastewater effluent discharge could be banned within 12 nm of an ice-face and/or land in the Arctic and Antarctic and "no discharge zones" could be established in certain ecologically important polar waters. Elsewhere, in areas where discharge would be allowed, advanced wastewater treatment systems would be required to treat sewage and grey water discharges. Untreated sewage and sewage sludge discharges would be prohibited in all polar waters.

At a bare minimum, we believe that the Arctic should be afforded the same sewage standard currently provided to the Antarctic in Annex IV (Art. 6) to the Protocol on Environmental Protocol to the Antarctic Treaty.

Recommendation: Heightened protection and standards for discharges of sewage, sewage sludge and grey water should be included in the mandatory Polar code, in combination with testing, monitoring, recordkeeping, reporting, and enforcement requirements.

Garbage

Garbage[50] from vessels that enters the ocean becomes marine litter and hence a threat to ecosystems, wildlife, and coastal communities.[51] While the percentage of vessel-originated litter varies regionally, in 2003, environmental group Stichting De Noordzee found that 40 percent of marine litter in the Netherlands came from the sea – which included sources such as merchant shipping, fisheries, recreational vessels, and offshore facilities. Revisions to MARPOL Annex V will reduce the number of items allowed to be jettisoned overboard, however some types of garbage will still be permitted to be discharged at sea.

Potentially the most environmentally harmful category for permitted discharges is food waste, which is often the largest garbage waste stream component on ships.[52,53] A 2008

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[50] Cruise ships generate the most garbage of any ship type. A large cruise ship can create about 7 tons of solid waste during a one-week voyage. EPA 2008 Cruise Ship Assessment, at 5-3,

[51] CRS Cruise Ship, at 4.

[52] EPA 2008 Cruise Ship Assessment, at 5-11.

U.S. EPA report indicates that if discharged in sufficient quantities, food waste can contribute to increases in biological oxygen demand, chemical oxygen demand, and total organic carbon, reduce water and sediment quality, adversely impact marine biota, increase turbidity, and raise nutrient levels.[54] Citing Polglaze (2003), the EPA report further states that food waste elements may be harmful to fish digestion and health. Moreover, continued disposal of food wastes in confined environments can cause nutrient pollution in areas of limited water exchange.[55] In addition, "regular and sufficiently large inoculations of food waste to an area may cause ecological changes such as perturbations to species behavioural patterns and alternation to community species composition and diversity (Polglaze, 2003)."[56] A further potential environmental impact of discharged victuals may be the unintentional introduction of food associated plastics. The EPA report recommends that, in order to avoid the introduction of plastics with food wastes into the marine environment, it is essential to separate all food associated plastics before food wastes are ground up prior to being discharged at sea or incinerated to then be discharged at sea.[57]

Article 4(8) of the revised Annex II to the Antarctic Treaty System Environmental Protocol stipulates that "...any poultry or avian products not consumed shall be removed from the Antarctic Treaty area or disposed of by incineration or equivalent means that eliminates the risk of introduction of micro-organisms (e.g., viruses, bacteria, yeasts, fungi) to native flora and fauna." This requires that any poultry or avian products should not be released into the Antarctic Treaty Area (south of 60 degrees South) even after it has been through a grinder.

Arguments for a complete ban on garbage discharges, including ground-up food wastes, in polar waters include:

- the eradication of poor practices which result in plastics being unintentionally mixed with food wastes;
- simpler enforcement of discharge provisions, since all discharges would be banned and no discharges of any form of garbage would be permissible;
- the potential for the introduction of invasive micro-organisms via food wastes would be eliminated;
- the risk to local water quality – because of the acidic nature of the waste, its significant volume (e.g., cruise ships), and the demand for oxygen as the food degrades -- would be eliminated. A cruise ship carrying 500 people will generate food wastes from 1,500 or more meals daily; for the larger cruise ships with about 5,000 passengers and crew, the figure would clearly be much higher, perhaps closer to 25,000 meals a day.[58]

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[53] Holland America Lines and Royal Caribbean Cruises, based on 2002 and 1999 figures, respectively, generated 12 cubic meters of food waste per vessel per week. *Id.* at 5-2.

[54] *Id*. at 5-11.

[55] *Id.* at 5-12.

[56] *Id.*

[57] *Id.*

[58] David Rosenfeld, *Dirty Waters: Cashing in on Ocean Pollution*C, DC Bureau (Jan. 18, 2010), *available at* http://dcbureau.org/20100104305/Natural-Resources-News-Service/dirty-waters-cashing-in-on-ocean-pollution.html.

Alternatively, another approach would be to identify a mandatory discharge distance, such as 12 nm, from more sensitive sites such as the nearest land, ice face and protected areas.

Recommendation: All garbage, including food wastes, should be banned from discharge in both Arctic and Antarctic waters.

Air Emissions –nitrogen oxides (NOx), sulphur oxides (SOx) and incineration

NOx and SOx emissions are associated with serious public health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, changes in lung function, and chronic bronchitis. NOx and SOx emissions also contribute to ocean acidification. Approximately one-third of all NOx and SOx emissions end up in the oceans and the impact of these emissions on acidification is particularly severe in specific, vulnerable areas such as Arctic and Antarctic waters.[59] The most impacted ocean areas are those directly around the emission release site and emission reduction policies would be especially important in these fragile ocean ecosystems. Stronger measures would slow ocean acidification in sensitive polar waters and also result in significant reductions in harmful air pollutant emissions, with important health benefits for indigenous Arctic communities and other local populations.

Publically available data on emission levels from shipboard incineration and where it is occurring in Polar Regions are limited. Items incinerated onboard vessels include hazardous wastes, oil, oily sludge, sewage sludge, medical waste, pharmaceuticals, paper, food, and plastics.[60] Incineration of hazardous materials and certain types of plastics may have environmental and health effects from the combustion of by-products. Heavy metals and hydrochloric acid are likely emitted from shipboard incineration.[61] Additionally, the Parliamentary Commission for the Environment found that small amounts of PCBs (polychlorinated biphenyls) and PAHs (polycyclic aromatic hydrocarbons) may be generated by cruise ships' solid waste incinerator.[62] PCBs are covered under the Stockholm Convention on Persistent Organic Pollutants and are recognized as a serious concern in the Arctic. The Stockholm Convention acknowledges that "Arctic ecosystems and indigenous communities are particularly at risk because of

[59] Scott C. Doney et al., *Impact of Anthropogenic Atmospheric Nitrogen and Sulfur Deposition on Ocean Acidification and the Inorganic Carbon System*, 104 PNAS 14580, 14581, 14583.

[60] California Cruise Ship Environmental Task Force, Report to the Legislature: Regulation of Large Passenger Vessels in California 54-66 (2003), *available at* http://montereybay.noaa.gov/resourcepro/resmanissues/pdf/CA_cruise%20_ship_rept.pdf.

[61] California Air Resources Board (CARB), Appendix H to Staff Report, Risk Assessment Methodology for Emissions from Cruise Ship Onboard Incineration H-1 (2005), *available at* http://www.arb.ca.gov/regact/csoi/apph.pdf.

[62] Parliamentary Commissioner for the Environment (New Zealand), Just cruising? Environmental effects of cruise ships (2003), *available at* http://www.pce.parliament.nz/assets/Uploads/Reports/pdf/just_cruising.pdf.

the biomagnification of persistent organic pollutants and that contamination of their traditional foods is a public health issue".[63]

Recommendation: Enhanced NOx and SOx emission control measures including identification of potential emission control areas (ECAs) should be established.

Recommendation: There should be a ban on incineration in specially vulnerable areas of the Arctic and Southern Ocean, such as marine protected areas or other ecologically sensitive areas and within a specified distance e.g. 12nm, from the ice-face and / or land.

Air emissions - black carbon

Black carbon is a component of particulate matter (PM) and is produced by ships through the incomplete combustion of diesel fuel. Controlling the emissions of black carbon will result in significant health benefits as well as climate benefits, especially in sensitive regions such as the Arctic. While the magnitude of the effects of black carbon on the global climate is subject to some uncertainty, there is emerging consensus regarding the regional influence of black carbon on areas of snow and ice (e.g., Qian et al. 2009, Hadley et al. 2010; Asia Xu et al. 2009, Flanner et al. 2009). Black carbon, together with tropospheric ozone, and methane, may contribute to Arctic warming to a degree comparable to the impacts of carbon dioxide, though there remains considerable uncertainty regarding the magnitude of their effects. Emissions of black carbon have been identified by some researchers as the second strongest contribution to current global warming, after carbon dioxide emissions.

Climate processes unique to the Arctic have significant effects on global and regional climate. The Arctic continues to warm more rapidly than any other part of the globe. Furthermore, the IPCC noted nearly 10 years ago that changes in the Arctic have already taken place. These changes are not modeled future scenarios, but rather real changes happening in real time. These changes include unusual melting of glaciers, sea ice, and permafrost, and shifts in patterns of rain and snow fall, freshwater runoff, and forest/tundra growth. The consequences include disrupted wildlife migration patterns, altered fish stocks, modified agricultural zones, and increased forest fires.

In addition, many scientific studies have linked levels of PM2.5 to a series of significant health problems, including: premature death in adults with heart and lung disease; heart attacks; low birth weight; childhood pneumonia; chronic respiratory disease (e.g., bronchitis); aggravated asthma and other respiratory symptoms (e.g., coughing, wheezing).

In view of the regional climate impacts and the known health benefits of reducing particulate matter, it is proposed that black carbon emission reduction requirements for vessels in polar waters are included in the Code.[64]

[63] Stockholm Convention on Persistent Organic Pollutants, *available at* http://chm.pops.int/default.aspx.

[64] For additional information and discussion regarding shipping emissions of black carbon and their climate impact, see MEPC 60/4/24 ("Reduction of emissions of black carbon from shipping in the Arctic," submitted by Norway, Sweden and the United States) and MEPC 60/INF.20 ("New Inventory

Potential Control Measures-

Vessels operating in fragile Polar Regions should be leading the field and setting precedents with respect to reducing air emissions that impact health, the environment and climate. A range of measures should be considered for reducing emissions from ships in polar waters, including: (i) increased energy efficiency through improvements to both the design and the operation of ships; (ii) increased use of renewable energy sources, such as wind and solar; (iii) and voyage optimisation and vessel speeds.

Recent IMO submissions regarding black carbon emissions from vessels-

There have been a multitude of recent IMO papers that refer to black carbon emissions from vessels and their impacts on the environment and public health (e.g., MEPC 59/INF.15, MEPC 60/21/1, MEPC 60/INF.20, MEPC 61/5/10, MEPC 62/4/16, DE 54/13/7, DE 54/13/8, DE 54/INF.5). Of particular note, submission MEPC 60/4/24 from Norway, Sweden, and the United States discusses the impacts of BC emissions from shipping on the Arctic climate, its significance, and several approaches to reduce those emissions. The paper maintains that BC emissions can be reduced by lowering fuel consumption and through specific pollution control measures.

Fuel consumption strategies include slow steaming, modifications to vessel and propeller design, maximum use of alternative power technologies, and measures to improve ship routeing and logistics. Examples of specific pollution control measures are in-engine adjustments, diesel particulate filters, water-in-fuel emulsification on demand, and slide valves. The paper emphasizes that BC emissions have serious impacts on the Arctic, that shipping contributes to BC production, and that greater BC emission contributions from vessels are expected in the Arctic as sea ice diminishes and sea lanes open up. Importantly, the paper concludes that “reductions of black carbon now, can provide short-term climate responses that are absolutely necessary to forestall a climate “tipping point”, thereby providing the climate “breathing time” for the needed reductions in CO_2 to take hold over the longer term[.]”

Submissions to the DE sub-committee from Norway, DE 55/12/5, and New Zealand, DE 55/12/3, address the topic as well. Norway’s paper recognizes that the deposition of black carbon, or soot, on ice is an environmental problem. Although no particular requirements for black carbon emissions have so far been put forward by Norway, the paper recommends that mitigation efforts continue as much as feasible through operational or other measures. New Zealand’s most recent Polar Code submission, DE 55/12/3, cites the environmental and health concerns associated with black carbon emissions from the ships, and “supports the introduction of controls for this type of pollutant from vessels entering the Polar Regions”. The paper goes on to cite operational and technical measures to further this goal that can be cost effective, and specifically references the use of emulsified fuels, which it asserts reduce particulate emissions by up to 60 percent without the need for engine modifications. Lastly, the paper points out that measures to reduce black carbon and particulate matter may also offer co-benefits by reducing nitrogen and sulfur oxides as well.

Convention on Long-range Transport of Air Pollution report on black carbon-

The Executive Body (EB) for the Convention on Long-range Transboundary Air

of short-lived climate forcing aerosols from international shipping activity in the Arctic,” submitted by FOEI).

Pollution (CLRTAP) recently formed an Ad Hoc Expert Group on Black Carbon and commissioned the group to prepare a report to assess available information on black carbon to, *inter alia*, articulate the rationale for addressing near-term and regional/Arctic climate change impacts of air pollution along with impacts on human health and ecosystems under the Convention. On September 30, 2010, the Co-Chairs of the Expert Group released their report, which assesses available information on black carbon and outlines reasons for addressing the impacts of black carbon pollution. The Report has been submitted to BLG 15 as BLG 15/INF.8. In response to the Report, the EB adopted at its December 2010 meeting the following resolution in which it: "Decided to request the Chairman of the EB to inform the IMO of its concern about the climate and health impacts of BC emissions and to urge the IMO to adopt requirements to reduce emissions of BC from international shipping, especially emissions in areas that impact the Arctic climate."[65]

European Parliament resolution on black carbon emissions from polar shipping-

In addition, the European Parliament passed a resolution on January 20, 2011 stating "that the rapid warming of the Arctic makes it necessary, in addition, to work on possible further short-term measures to limit Arctic warming." In part to achieve that objective, the resolution "[r]equests the EU and its Member States to propose, as part of the ongoing IMO work on a mandatory Polar Code for shipping, that soot emissions and heavy fuel oil be regulated specifically; in the event that such negotiations do not bear fruits, requests the [European] Commission to put forward proposals on rules for vessels calling at EU ports subsequent to, or prior to, journeys through Arctic waters, with a view to imposing a strict regime limiting soot emissions and the use and carriage of heavy fuel oil."[66]

New research on present and future black carbon emissions from vessels in the Arctic and existing, cost-effective technologies to reduce those emissions

Three recently published reports provide further data pertinent to the Sub-Committee's consideration of measures to reduce black carbon emissions from vessels in the Polar Regions.

In *Arctic shipping emissions inventories and future scenarios*, Corbett et al. (2010), BLG 15/INF.5 (Annex 1),[67] the authors analyze Arctic emissions inventories of black carbon, greenhouse gases and other pollutants from shipping under existing and future scenarios. The inventories take into account the predicted growth of regional shipping due to the decline of sea ice coverage, potential diversion of global shipping traffic to the Arctic using emerging routes, and available emissions reductions though implementation of emissions control measures. The report concludes that without control measures, black carbon will increase in all future scenarios. Black carbon emissions in the Arctic are predicted to increase from 0.88 kilo tonnes (kt) per year in 2004 to between 2.7 kt per year (under a business as usual scenario) to 4.7 kt per year (under a high-growth scenario) by 2050.

[65] Executive Body for the Convention on the Long-range Transboundary Air Pollution, Draft Decision on the Implications of the Reports of the TFHTAP for the Convention and Ad-hoc Expert Group on Black Carbon, Dec. 16, 2010 (Final).

[66] The resolution also states that a bunker fuel use and carriage ban "might be appropriate in Arctic waters to reduce risks to the environment in case of accidents." European Union: European Parliament, *European Parliament resolution on a sustainable EU policy for the High North*, July 20, 2011, A7-0377/2010.

[67] J. J. Corbett, D. A. Lack, J. J. Winebrake, S. Harder, J. A. Silberman and M. Gold, *Arctic shipping emissions inventories and future scenarios*, 10 Atmos. Chem. and Phys. 9689 (2010).

The inventories were created using empirical data of shipping activity reported by Arctic Council member states using current estimates of particulate emission factors, and an activity-based approach used in the Arctic Marine Shipping Assessment 2009 report of the Arctic Council. Future seasonal emissions projections were created using high growth and business as usual assumptions, with a projected 1%, 2% and 5% diversion of global shipping for 2020, 2030 and 2050 due to the decline of Arctic sea ice and accessibility of new trade routes.

Maximum feasible reductions (MFR) in emissions were calculated using technologies employed individually or in combinations, including seawater scrubbing, slide valves, water-in-fuel emulsions, diesel particulate filters and emissions scrubbing technologies. The percentage of emissions due to transit vessels (as compared to fishing vessels) is predicted to rise in all future scenarios, from a 2004 level of 71%, to a 2050 level as high as 93%.

Though quantitative data on Arctic shipping's contributions to global climate change remain uncertain, Corbett et al. estimate that in a high-growth shipping scenario, by 2030 the short-term climate forcing of black carbon could range from 17% to 78% of the global warming potential of CO_2 depending on growth, diversion of global ship traffic to the Arctic, and use of emissions reducing technologies. The MFR for black carbon, using a combination of technologies, was assessed at 70%. In a high-growth scenario the use of control measures to achieve MFR would reduce black carbon in the Arctic from 17 kt per year to 5 kt per year. In the business as usual scenario, MFR would reduce emissions to less than 2 kt per year. Without emission control technologies, black carbon emissions are predicted to increase by 2.44% to 3.69% per year by 2050.

Growth in global shipping (2.1% per year) and diversion of vessel traffic to the Arctic (ranging from 1% to 5%) may result in increased black carbon emissions despite implementation of MFR. Diversion traffic is predicted to add between 2.4 and 12 kt of black carbon per year by 2050. However, with MFR, Arctic black carbon emission from global shipping can be reduced in the near term and held nearly constant through 2050.

In *An assessment of technologies for reducing regional short-lived climate forcers emitted by ships with implications for Arctic shipping*, Corbett et al. (2010),[68] the authors develop a cost-effectiveness decision framework to evaluate five black carbon abatement technologies for marine engines. The report concludes that emissions control targets for black carbon are most cost-effective (i.e., least US$/mt CO2eq reduced) at 60% reductions in emissions levels achieved using a combination of control technologies.

The technologies analyzed are slide valves, water-in-fuel emulsion, diesel particulate filters, emulsified fuel, and sea water scrubbing. The framework considers the effect of the technologies, implemented alone or in combination, on a set of short-lived climate forcers emitted by marine diesel combustion.

All technologies produced benefits for global warming potential with the exception of sea water scrubbers, which selectively control particles that contribute to regional cooling. Combination technologies performed better than single technologies in the analysis, even the combination of the lowest-cost technologies.

The total annual cost to achieve such a 60% reduction in black carbon emissions in the Arctic is estimated at US$8 to 50 million, avoiding roughly 9 to 70 million metric tons of CO_2eq per year at an average annual cost of US$1200 to $8400 per vessel.

[68] J.J. Corbett, J.J. Winebrake and E.H. Green, *An assessment of technologies for reducing regional short-lived climate forcers emitted by ships with implications for Arctic shipping*, 1 Carbon Management 207 (2010) at 223.

Furthermore, a 70% reduction in black carbon emissions can be realized at about US$15 to 30 per mt$CO_2$eq (20 year), under conditions where the vessel spends 25-100% of the time in a sensitive region.

The paper also suggests that operational measures (such as slow steaming) to reduce BC emissions should be evaluated for their cost-effectiveness.

In *Impact of Fuel Quality Regulation and Speed Reductions on Shipping Emissions: Implications for Climate and Air Quality*, Lack et al. (2011) analyze the emissions of a container vessel as it switches from high-sulphur to low-sulphur fuel and slows down off the California coast. The study finds that 75 percent reductions in black carbon were achieved on a per kilometer basis. The study also posits that "use of higher quality fuels by ships in the Arctic may result in less BC deposition to snow and ice (compared to the use of low quality fuels) resulting in positive climate benefits."[69]

Recommendation: The Polar Code should include interim measures / guidance on reducing black carbon emissions while the issue is being considered further by the BLG and MEPC. We propose that 50 percent reductions in black carbon emissions be targeted immediately and that 70 percent reductions be sought in the medium term (i.e., 2018).

[69] D. Lack et al., *Impact of Fuel Quality Regulation and Speed Reductions on Shipping Emissions: Implications for Climate and Air Quality*, XX Enviro. Sci & Tech. YY (2011) (need proper cite).

Measures focused on Non-MARPOL wastes and other impacts

Underwater noise

Noise pollution, including that from ships, can have profound effects on marine wildlife by interfering with the ability to communicate, navigate, and detect prey and predators.[70] Other adverse impacts on marine animals from noise can include temporary and permanent hearing loss, displacement from preferred habitat, and even death.[71] The seriousness of the issue has attracted the attention of IMO, which through an MEPC Correspondence Group has undertaken considerable work on the issue of incidental ship noise, particularly from propeller cavitation, and has recently submitted a status report on the subject to MEPC 61 (see MEPC 61/19). Moreover, MEPC 62 agreed to establish underwater noise on the work agenda of the DE Sub-committee.

However, the work so far has not focused on Polar Regions specifically, where major populations of marine mammals are located. Based on the anticipated growth in Arctic shipping activity, a significant amount of ocean background noise from commercial shipping will likely occur in the region. Strong measures are needed to protect polar marine wildlife, especially cetaceans, for the following reasons:

- In the Arctic "the ambient noise environment . . . is more complex and variable than in many other ocean areas due to the seasonal variability in ice cover."[72]

- Many areas of the Arctic have not yet been subject to high levels of shipping noise. Incidental ship noise could harm or displace marine mammal populations from their preferred habitat or feeding grounds. Concurrently, marine mammals are also increasingly threatened as a result of other activities such as oil and gas exploitation made possible by retreating sea ice and climate change.

- Ice breakers generate intense sounds when moving through ice, but often produce louder and more variable sound in the open sea than most large commercial vessels. This is due to the propulsion systems required for their intended function (repeated ramming of ice, backing up, and ramming). Analysis has shown that the more homogenous the wake field surrounding propeller blades, the quieter the propeller will be.[73] In contrast, the forward and backward thrust of icebreakers creates a more turbulent and less homogenous wake field. Research indicates varying responses by whales to ice breakers. In one study, avoidance behavior was exhibited by beluga whales 35 to 50 kilometers away from an icebreaker; and another predicted that bowhead whales would engage in avoidance behavior when approximately 10 to 50 kilometers from an icebreaker, with biologically significant implications, especially for

[70] Christopher W. Clark et al., *Acoustic Masking in Marine Ecosystems: Intuitions, Analysis and Implication*, 395 Mar. Ecol. Prog. Ser. 201, 202 – 203 (2009).

[71] United States, *Shipping Noise and Marine Mammals* (Dec. 17, 2007) (submitted to IMO's Marine Environment Protection Committee and reviewed as MEPC 57/INF.4).

[72] United States, *Minimizing the Introduction of Incidental Noise from Commercial Shipping Operations into the Marine Environment to Reduce Potential Adverse Impacts on Marine Life* 3 (June 25, 2008) (submitted to IMO's Marine Environment Protection Committee and reviewed as MEPC 58/19).

[73] Brandon L. Southall & Amy Scholik-Schlomer, Final Report of the NOAA International Conference Potential Application of Vessel-QuietingTechnology on Large Commercial Vessels, (1-2 May, 2007).

mothers and calves. Special equipment such as bubbler systems that aid in breaking up ice can create still further negative impacts.[74]

- Noise-reducing features can be likely integrated into new ships built for polar conditions in a cost-effective and efficient manner.[75]

In light of the particular environmental features of Polar Regions, measures must be adopted which will lessen the risk of harm posed to marine life by incidental shipping noise. Certain unique aspects of the Polar Regions, including sea ice, the presence of icebreakers, special bathymetric features, endemic marine mammal underwater sound sensitivity, and relevant migratory corridors, should be taken into account when considering measures to reduce harmful impacts caused by ship noise pollution.

To this end, the Arctic Council's Arctic Marine Shipping Assessment 2009 report (AMSA) provides helpful guidance, suggesting that "[m]any environmental effects resulting from ship disturbances can be effectively mitigated through the use of best practices and the implementation of management measures. With regard to noise disturbances, such measures could include rerouting to avoid some areas in sensitive periods, lower speed, and alternative engine and hull designs to make ships less noisy. There is a need to plan potential future shipping lanes in the Polar Regions so as to avoid large seabird colonies, marine mammal haul-outs and other areas where animals are aggregated."[76]

Recommendation: The Polar Code should seek to reduce vessel disturbance to marine life through ship noise reduction measures, including ship quieting technology identified in the IMO noise reduction guidelines (under development), speed restrictions, routeing options and areas to be avoided (taking into account bathymetric features, endemic marine mammal underwater sound sensitivity and migratory corridors). Particular attention should be given to noise from icebreakers.

Ballast water discharges

Recognising the very great potential for major ecological consequences of introduced species in Antarctic waters, the Antarctic Treaty Parties (ATPs) and Members of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) have adopted resolutions adopting Practical Guidelines for Ballast Water Exchange in the Antarctic Treaty Area[77] and Guidelines for Ballast Water Exchange[78] in the CAMLR

[74] Hein Rune Skjoldal et al., Arctic Marine Shipping Assessment: Background Research Report on Potential Environmental Impacts of Shipping in the Arctic 93 (2009) (Draft Version), *available at* http://arcticportal.org/uploads/IR/vt/IRvt-EnpP5nmlg36Xt-sVw/6-1-Environmental-Impacts-from-Current-and-Future.pdf.

[75] United States, *Noise from Commercial Shipping and Its Adverse Impacts on Marine Life* (Apr. 9, 2009) (Report of the Correspondence Group, submitted to IMO's Marine Environment Protection Committee and reviewed as MEPC 59/19).

[76] AMSA, at 146.

[77] Antarctic Treaty Consultative Meeting, Resolution 3 (2006). Ballast Water Exchange in the Antarctic Treaty Area. *See also* IMO Resolution MEPC.163(56) from 13 July 2007.

[78] CCAMLR Resolution 28/XXVII Ballast water exchange in the Convention Area.

Convention Area north of 60°S, respectively, ahead of the BWM Convention coming into force globally. Article 13 of the BWM Convention encourages regional cooperation including the conclusion of regional agreements which are consistent with the BWM Convention.

Recommendation: The Polar Code should require that the provisions of the BWM Convention are applied for all vessels operating in polar waters. There should be additional restrictions on ballast discharges due to the great potential for major ecological impacts from species introduced via ballast water as ice cover recedes and the seawater warms in response to climatic change in Polar Regions. Moreover, the IMO Biofouling Guidelines should be followed by all vessels operating in polar waters.

Antifouling systems

The International Convention on the Control of Harmful Anti-fouling Systems (AFS) on Ships prohibits the use of harmful organotins in anti-fouling paints and it is the intention that it will, in the future, develop a mechanism to prevent the potential future use of other harmful chemicals in anti-fouling systems. The AFS Convention entered into force in September 2008, however a significant number of Arctic and Antarctic States have yet to ratify the Convention.

Recommendation: The Polar Code should require that the provisions of the AFS Convention are applied to all vessels operating in polar waters. Furthermore, consideration should be given to the need for further restrictions on alternative anti-fouling systems, particularly those which release biocides (which are persistent, bioaccumulative and toxic), due to the potential for major impacts on polar waters, and non-biocidal anti-fouling systems should be used when practicable.

Ship strikes

Records demonstrate that nearly all cetacean species are susceptible to ship strikes, and collisions with large whales may also result in considerable damage to vessels. In addition to mortality, collisions with vessels may inflict injuries including broken bones and propeller lacerations on cetaceans (MEPC.1/Circ.674). The threat posed by ship strikes to marine mammals, particularly cetaceans, is well documented, and a number of measures have been enacted to address this problem.[79] In addition, the IMO has recently issued voluntary guidelines on the subject of ship strikes[80]. Many species of large whale reside or frequent polar waters including endangered bowhead whales (*Balaena mysticetus*), North Pacific right whales (*Eubalaena japonica*), and Antarctic blue whales (*Balaenoptera musculus* ssp. *intermedia*). Smaller narwhals and beluga whales also inhabit the Arctic region.

[79] *E.g.*, Canada's shifting of a Traffic Separation Scheme in the Bay of Fundy (MSC 76/23, para 11.3 (Dec. 16, 2002) and NAV 48/3/5 (Apr. 5, 2002)); United States' North Atlantic right whale rule (63 Fed. Reg. 60173, Oct. 10. 2008).

[80] IMO Guidance Document for Minimizing the Risk of Ship Strikes with Cetaceans, MEPC.1/Circ.674, July 31, 2009.

Marine mammal activities that should be taken into account by ship operators in voyage plans and through operations:

Migratory Patterns

Co-occurrence between whales and ships in the Arctic will tend to increase as vessel traffic grows. However, particular areas within the Arctic pose a higher risk level for interactions, including ship strikes. For example, the Bering Strait functions as a bottleneck wherein both migrating whales (see Figure 1) and transiting vessels will overlap in tight confines, thereby elevating risk of harm to whales (see IWC 2010[81]). Spring migration routes for bowhead and beluga whales into Hudson Bay, Foxe Basin, and Lancaster Sound are also vulnerable to impacts from increased commercial activity, such as oil and gas development and shipping (AMSA 2009). In addition, as shipping traffic intensifies in the Canadian Arctic Archipelago "there will be increased potential for conflict between ships and marine mammals in narrow and geographically restrictive areas." (AMSA 2009). MEPC.1/Circ.674 describes information gathering on shipping and cetacean distribution patterns in order to assess risk, and such information should be taken into account prior to new shipping routes being developed.

Feeding Grounds

In addition to migratory patterns through restricted island passages or straits, whales may congregate on feeding grounds, such as those that exist north of the St. Lawrence Islands in the Chirikov Basin (Perryman et al. 2002). Areas just north of the Unimak Pass in the Aleutian Islands also function as feeding grounds for some whales, likely due to the localized upwellings that occur there (Friday et al. 2009). Areas of concentrated feeding may change with the season. This has been found for gray and North Pacific right whales in the Bering Sea (e.g., Zerbini et al. 2009). The AMSA report specifically finds that "[s]hip strikes of whales and other marine mammals are of concern in areas where shipping routes coincide with seasonal migration and areas of aggregation[,]" such as feeding grounds. (AMSA 2009).

The Ice Edge and Polynyas

In polar waters, certain types of cetaceans may aggregate at the seasonal ice edge or within ice of a particular degree of coverage or thickness, such as the substantial ice cover preferred by bowhead whales (e.g. Stafford et al. 2009). Whales may also aggregate in polynyas – typically coastal areas of open water surrounded by ice-covered waters – where they may reside until seasonal ice recedes (McGillivary et al. 2009). An increasing understanding of cetacean distribution patterns in relation to ice conditions and other remotely measurable habitat variables may help in identifying areas with high collision risk (IWC 2010).

Additional considerations by ship operators related to voyage planning and operations:

Hunting

Several whale species are subject to direct hunting in polar waters and shipping-related mortalities will have implications for the impacts of hunting on population status. For example, AMSA has suggested that information on where shipping will co-occur with hunting and with crucial stages of the beluga migration "can be used to develop specific management and mitigation plans, perhaps including limitations on shipping to protect belugas and those who hunt them." (AMSA 2009). AMSA also notes that "[a]ny disruption of the spring and fall hunts [of bowheads], or any injury or mortality to bowheads would be considered a major issue to Alaskan and Siberian communities." (AMSA 2009).

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[81] IWC, 2010. Report of the Joint IWC-ACCOBAMS Workshop on Reducing Risk of Collisions between Vessels and Cetaceans. Available from http://www.iwcoffice.org/meetings/shipstrikes10.htm.

Voyage planning and operations intended to avoid or minimize contact with marine mammals

The AMSA report states that "[a]s vessel traffic increases in the Arctic, modifications to customary vessel operation in key cetacean aggregation areas or vessel speed restrictions can be an effective measure to mitigate potential impacts on vulnerable species such as bowhead whales and, to a lesser extent, narwhals, beluga whales and other Arctic marine organisms." (AMSA 2009). These measures are consistent with those outlined in MEPC.1/Circ.674 and also recent international workshops on minimising risks of collisions with cetaceans (e.g., IWC 2010). Several studies have shown that reducing speed decreases the risk of fatal or serious injuries to large whales (AMSA 2009). Speed restrictions have been imposed in some areas to reduce collision risk, and ship speed should be an integral feature in voyage planning designed to better protect cetaceans.

Where feasible, vessel routeing measures may also be applied in order for ships to avoid known cetacean aggregation areas. The points raised in the AMSA also have some relevance in the Antarctic, and in order to ensure adequate levels of marine mammal protection in polar waters other measures or tools must be considered for inclusion in the Polar Code.

Recommendation: The Polar Code should include a provision on the use of advanced voyage planning to avoid interactions, especially collisions, with cetaceans and other marine mammals. Possible courses of action for vessel operators could include avoiding areas that pose a high risk of collision or operating through these areas at a reduced speed (e.g., 10 knots). Efforts also should be made by vessel operators to not interfere with native subsistence hunting of marine wildlife.

Figure 1 - Bowhead whale migration in the Bering, Chukchi, and Beaufort Seas (Audubon Alaska and Oceana, 2010)