

A photograph of an Arctic sea ice landscape. The scene is dominated by large, jagged icebergs and smaller ice floes scattered across a dark blue sea. The sky is a clear, pale blue. The overall atmosphere is cold and desolate.

Ship generated waste in the Arctic Marine Environment: Marine Pollution, MARPOL and the Polar Code

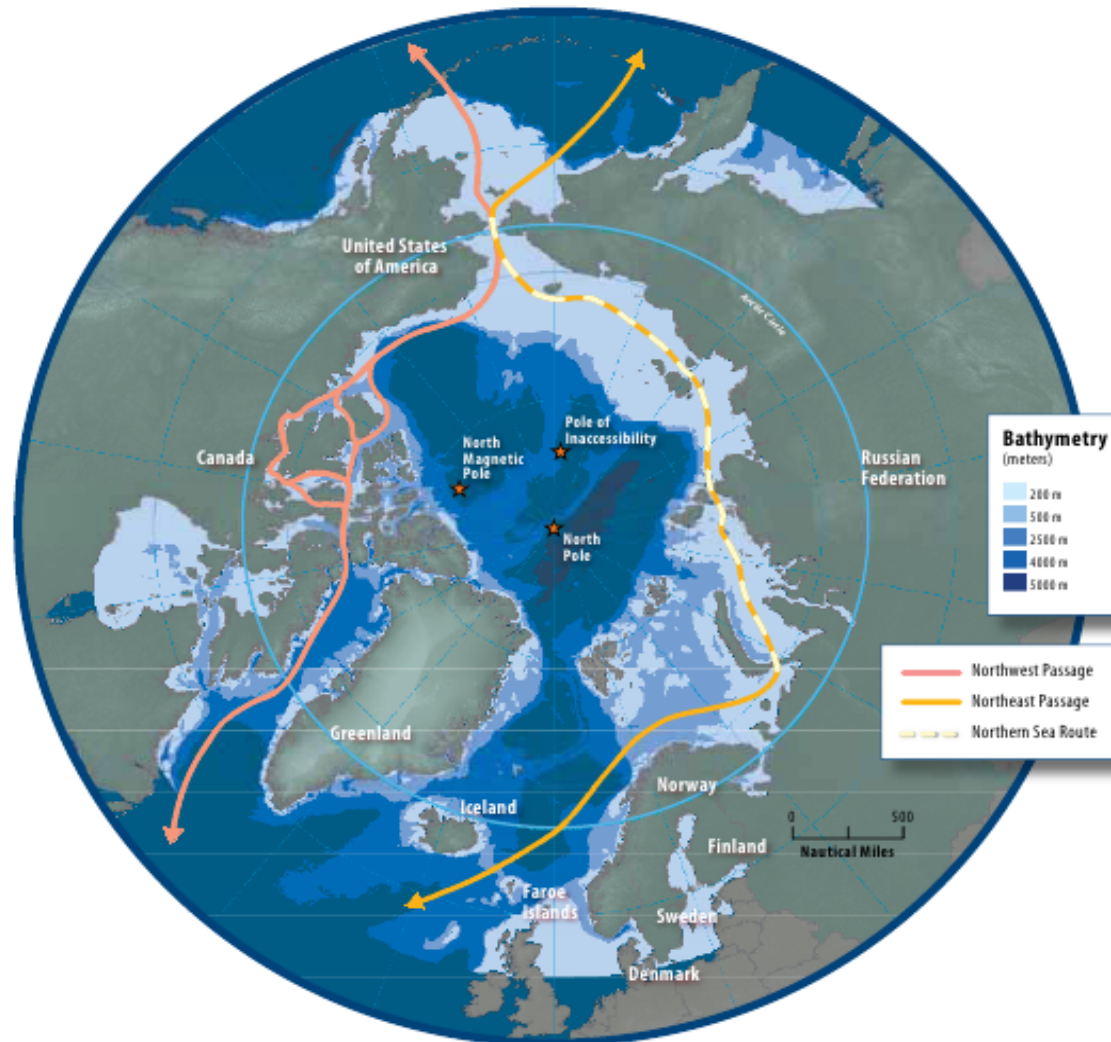
ShipARC 2015

**WMU – IMO – Arctic Council International Conference
Safe and Sustainable Shipping in a Changing Arctic Environment**

**World Maritime University
Malmo, Sweden
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**David Condino, MM, CIV
USCG HQ Office of Facility Compliance**

The Arctic Ocean and shipping routes.



MARPOL and Ship's Waste as it applies to all ships, all oceans, and all IMO members.

- ✓ **The International Convention for the Prevention of Pollution from Ships (MARPOL) imposes numerous operational and technical requirements on ships.**
- ✓ **MARPOL also imposes important obligations on the Government of each Party, which is to ensure the provision for reception of ship-generated wastes that are prohibited from discharge into the sea.**
- ✓ **Reception facilities must be *adequate* to meet the needs of ships, *without causing undue delay to ships*. The requirements for port reception facilities (PRF) create an incentive for ships to comply with MARPOL and to minimize discharges to sea**

Adequacy of PRFs: meeting the needs of the ships normally using a port

- Should Conform with national and local permitting schemes or licensing required by environmental and public health laws concerning waste handling
- Must be arranged so as not to interfere with port or terminal operations
- Must be conveniently located so it can be easily found and use is not discouraged
- Must be situated so that wastes and residues removed from ships cannot readily enter the water



What to do with wastes from Ships and challenges for Arctic shipping

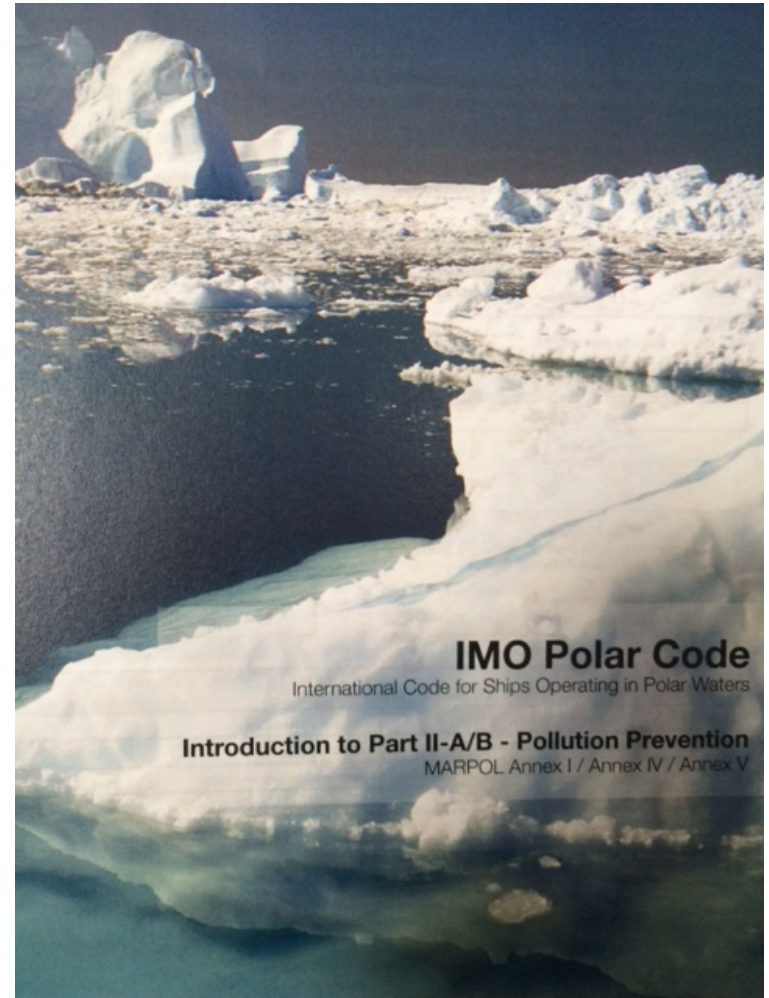
Ships: If it cannot be discharged to the Ocean, then it will have to be stored aboard until it can be discharged at a port reception facility!

ESM: Environmentally sound management of waste once it is discharged to PRF based on principal of Reduce, Reuse, Recycle and energy reclamation.



MARPOL Annexes and the Polar Code

- ✓ No Discharge of Oil (Polar Code Annex I Amendments)
- ✓ No Discharge of NLS (Polar Code Annex II Amendments)
- ✓ No Discharge of Garbage other than food (Already in force under MARPOL and formerly a major source of Non plastic Marine Debris from Ships) (Annex V Amendments - 2013)
- ✓ No Discharge Food near the ice edge (Polar Code - Amendments to Annex V)
- ✓ Restrictions on Incinerators (Annex VI regulations. Source of Particulate matter)
- ✓ Lower Sulfur content fuel use (Annex VI with regulations for ships operating in Arctic waters.)



How Much Waste?: It depends!

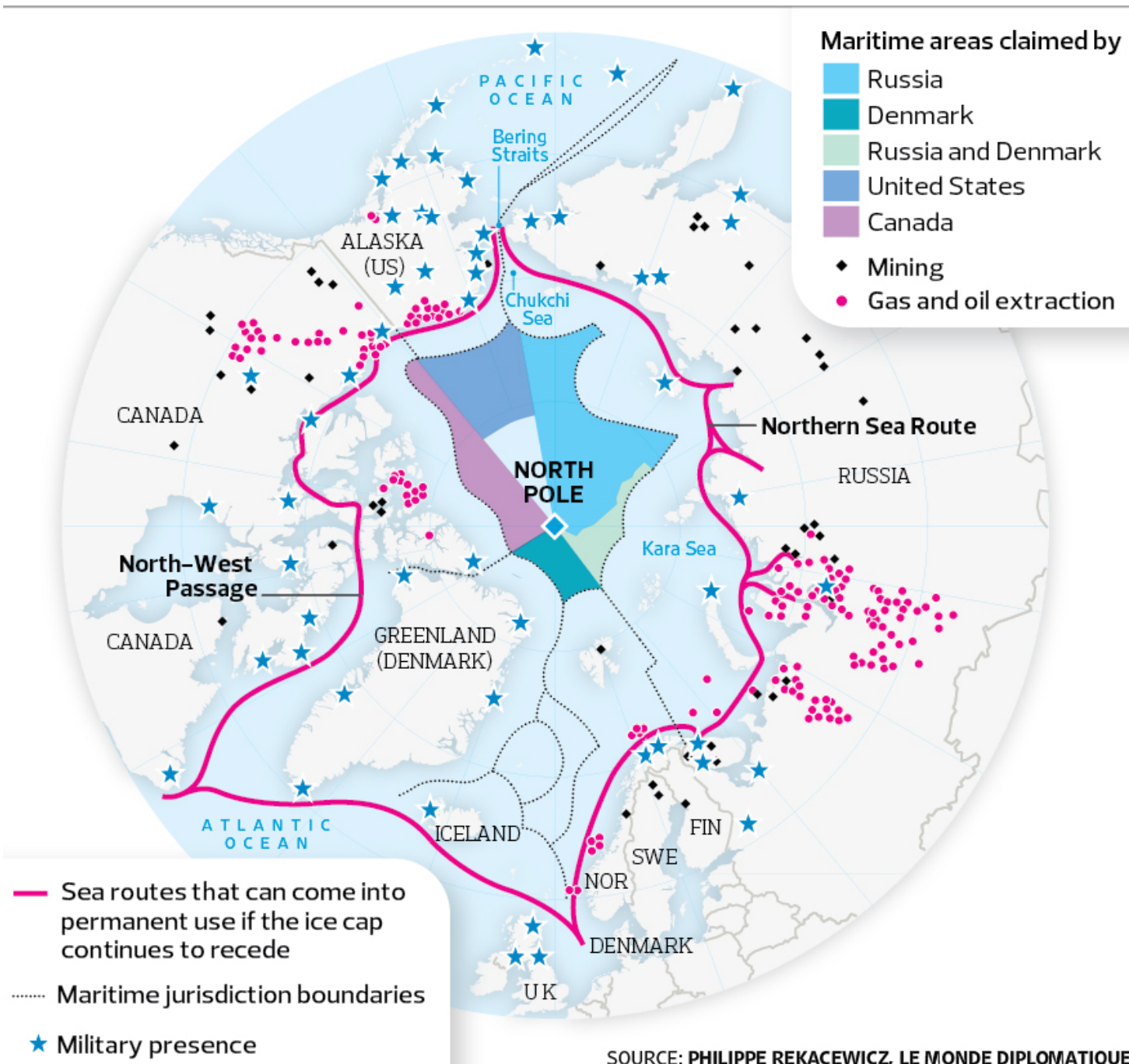
- Oil (size of ship, machinery, cargo, tank cleaning)
- NLS – (does it carry liquid chemicals, tank cleaning)
- Sewage (crew, passenger ship, on board treatment)
- Garbage (crew size, number of Passengers, ISO standard calculations)
- Exhaust Gas Residues (stack scrubbers??)

Challenge for Ships: Waste Management in the Arctic

Ships will have to be designed to store all wastes on-board and will need greater capacity to store and manage MARPOL wastes generated on board because of:

- ✓ Longer passages between ports of call
- ✓ Delays in passage making due to weather, ice, fog, precipitation
- ✓ Restrictions on discharging to the ocean for all or nearly all wastes generated aboard ship
- ✓ Inability to enter some ports due to insufficient or uncharted depths in channels from sea to ports
- ✓ inadequate piers/terminals within a port or no port infrastructure to receive ships or wastes from ships at anchor

OPENING UP THE FAR NORTH



Existing Sources of Pollution Offshore Oil and Mineral Operations



Other sources: Derelict Fishing Vessels and Derelict Fishing Gear (DFG)



Japan Tsunami washed up on in the Aleutian Islands



A Case Study: “Microplastics found in in the Far North”

- A 2014 study in the Arctic showed that microbeads have traveled into the farthest reaches of the Polar regions.
- The authors, from Dartmouth College and the University of Plymouth (England): “Our findings indicate that microplastics have accumulated far from population centers and that Polar sea ice represents a major historic global sink of man-made particulates. The potential for substantial quantities of legacy microplastic contamination to be released to the ocean as the ice melts therefore needs to be evaluated.”

Benthic Debris in the Arctic

“even higher than those found in a deep-sea canyon near the Portugal..”



Bergmann, Melanie Marine Pollution Bulletin

Pathways for Introduction and Transport of Marine Pollution in the Arctic Ocean

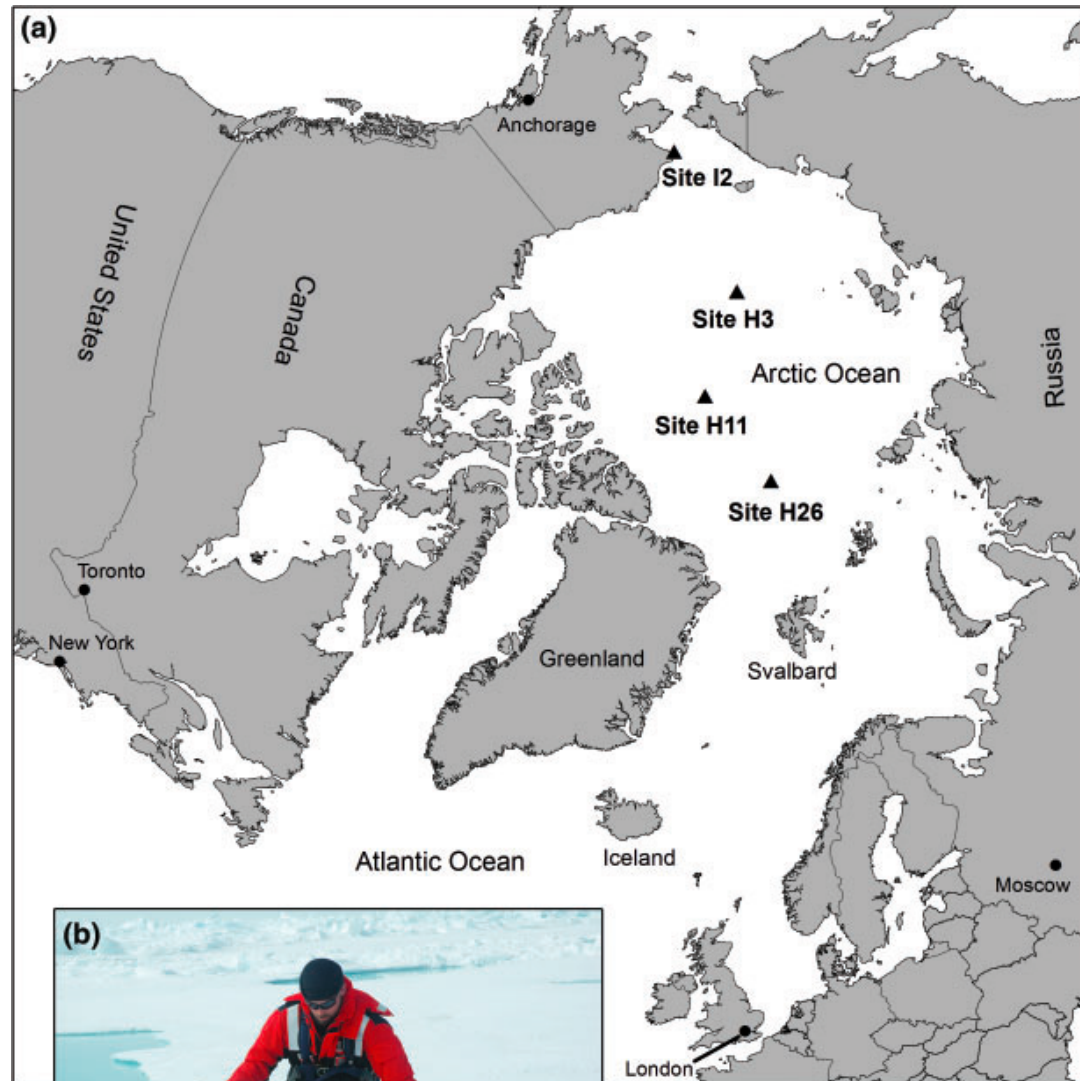


Bower, A.S., M.S. Lozier, S. F. Gary, and C.W. Böning. 2009. Interior pathways of the North Atlantic meridional overturning. *Nature* 459: 243-247.

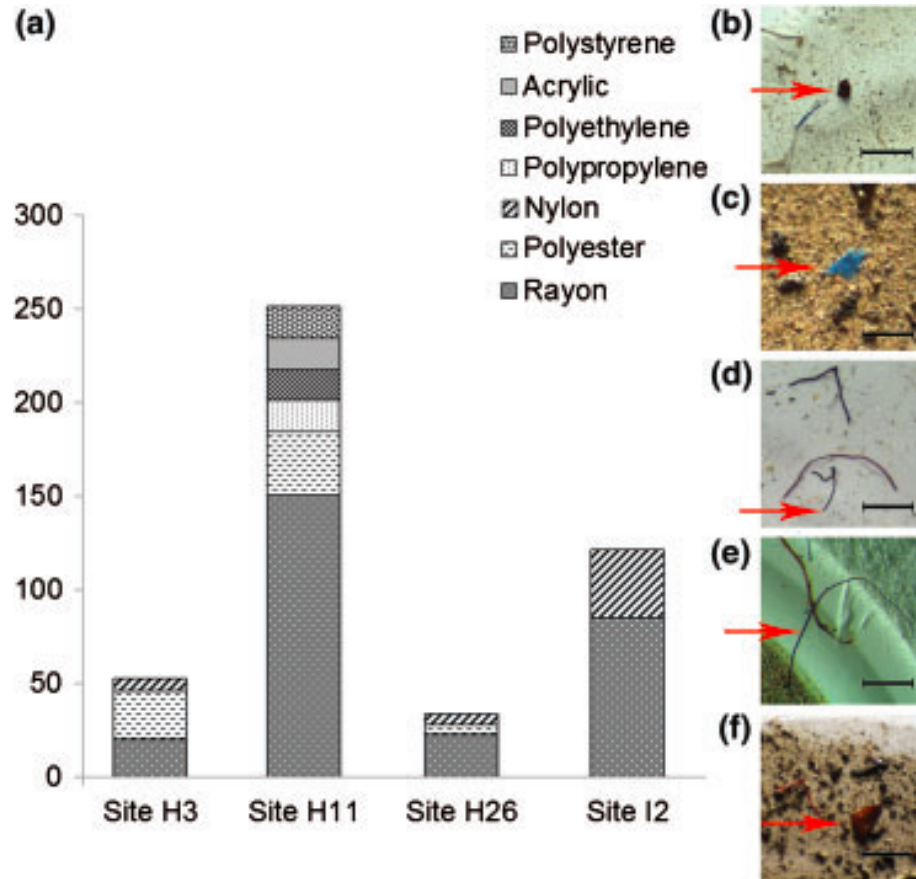
Lozier, M.S. 2010. Deconstructing the Conveyor Belt. *Science* 328(5985): 1507-1511. / Lozier,

M.S. 2012. Overturning in the North Atlantic. *Annual Review of Marine Science* 4: 291-315.

Ice Cores
(2005 and 2010)
R. Obbard, et.al.
Dartmouth College
and
R. Thompson
University of Plymouth

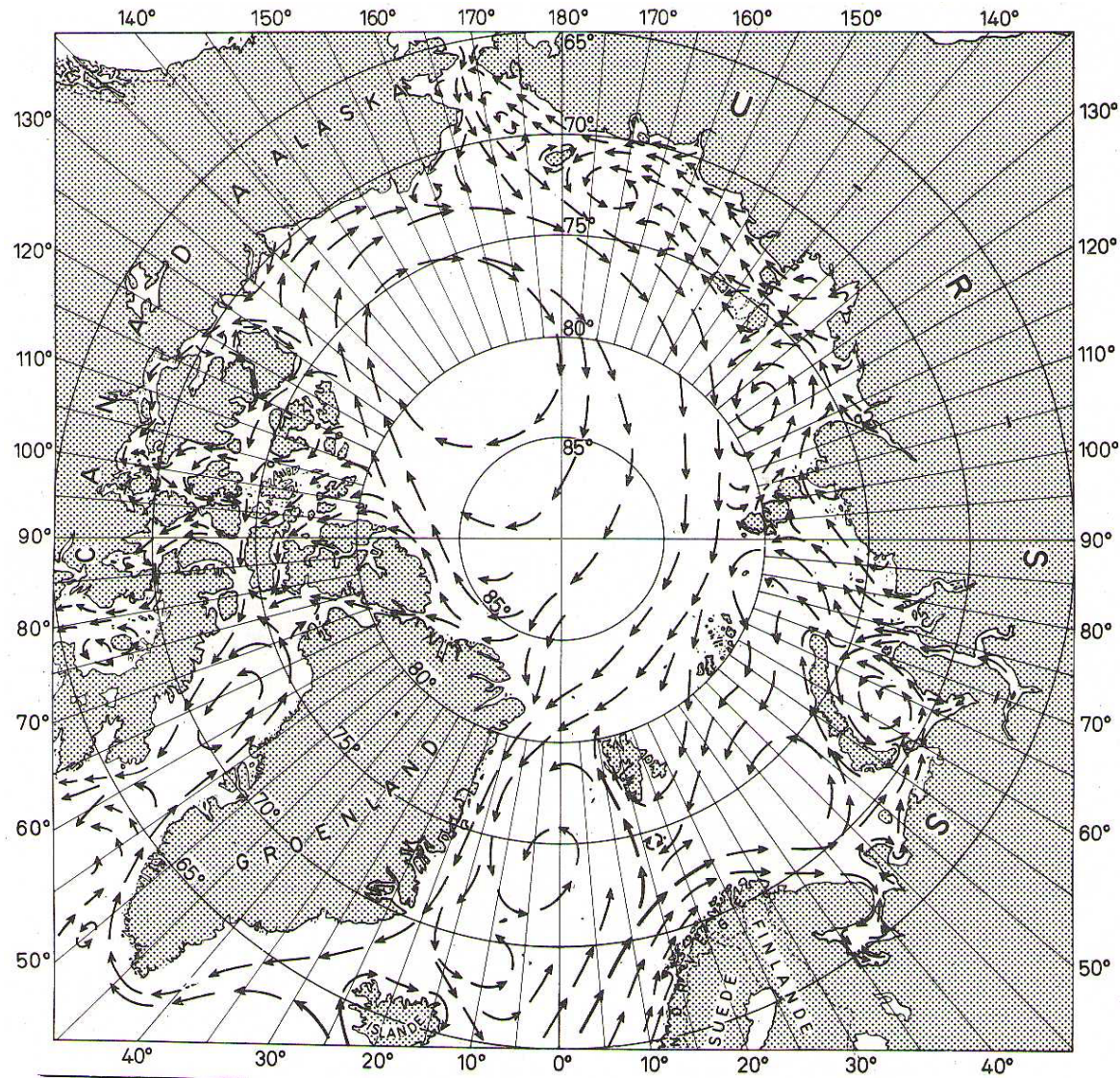


ICE Core Analysis (Microplastics)



Source: Obbard, R.W., et. Al. (2014), Global warming releases microplastic legacy frozen in Arctic Sea ice, *Earth's Future*, 2, 315–320, doi:10.1002/2014EF000240, p. 317

Arctic Ocean Currents and What could happen to Ice Bound Pollution



Source: US National Oceanic and Atmospheric Administration

Arctic Ice Then and Now



Impacts of Marine Pollution/Debris in the Arctic Marine Environment

- Habitat degradation (super sensitive and for the present relatively pristine)
- Accumulation in Ice and transport and re-release into the ocean upon melt
- Ingestion by marine animals and marine mammals (e.g. filter feeders, baleen whales)
- Leaching of toxins from micro-plastics to benthic and pelagic ocean, seasonal ice and multi-year ice in the Arctic
- All the usual impacts seem to be magnified in the Arctic (studies show orders of magnitude greater amounts of Micro-plastics in sea ice over surface water samples from the ocean at lower latitudes)

Arctic and Near Arctic Ports

Arctic Regions showing the Arctic Circle, Geo-Political boundaries, and some Arctic Ports north of 60 degrees latitude. Ports will be challenged to provide both municipal waste management and ability to accept waste from ships.



Waste Management Challenges in the Arctic

- difficulty in constructing new infrastructure due to remoteness or geological characteristics of the port;
- changing ice conditions which would prevent practical use or siting of reception facilities;
- landside environmental concerns regarding waste processing and disposal facilities sited in Arctic ports located adjacent to environmentally sensitive areas, and protected habitats, designated refuges, or culturally sensitive areas; and
- PRFs in logistically challenging remote areas (seasonally or year round) or complete inability to operate at some PRFs during winter months due to seasonal ice conditions.

Port of NOME Alaska (64.5 Degrees North Latitude)



Nome Alaska in Early Spring (2013)



A possible solution to the MARPOL Reception Facility Challenges for Ship's in the Arctic

- 2006-2011 - Arctic Council, through it's Protection of the Arctic Marine Environment (PAME) Work Group studies port reception facilities at Arctic Ports (1st Arctic Marine Shipping Assessment)
- 2012 - PAME considers the applicability of the Concept of Regional Waste Management strategies for port reception facilities to Arctic Regions.
- 2013 - PAME invites US and Others to develop an outline for a draft regional reception facilities waste management approach for the Arctic, based on existing IMO and other best practice guidance.

Thank You

Questions????



Contact Information

David Condino, MM CIV

USCG HQ Office of Port and Facility Compliance CG-FAC-2

2703 Martin Luther King Jr Ave SE

Washington DC 20593-7501

David.A.Condino@USCG.MIL