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Advancing a Network of Safety Measures in the Bering Strait Region: Now is the Time

Janis Searles Jones

Andrew Hartsig

Becca Robbins Gisclair

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Abstract

Climate change impacts have been particularly acute in the Arctic, where warming has led to the loss of seasonal sea ice, among other impacts. As Arctic waters experience longer ice-free seasons and reduced sea ice extent and thickness, vessel traffic in the maritime Arctic has increased. Experts forecast this growth trend will continue and accelerate. Increasing vessel traffic brings threats to the Arctic region, its people, and its wildlife. These include increased air, water, and subsea noise pollution and the potential for a large oil and/or fuel spill. While authorities have put in place some management measures designed to reduce these threats, more action is needed to safeguard the region. Impacts from increasing shipping in the Arctic region can be further mitigated by both Arctic-specific rules and best practices and broader changes to global-scale shipping practices. More broadly, improvements to governance structures are needed to better address the multiple and overlapping threats to the Arctic region. At the same time, these changes can promote full and meaningful participation by Indigenous residents of the Arctic with respect to the identification, design, and implementation of management measures that may affect their region. On a global scale, reducing greenhouse gas emissions is critically important for the future of the Arctic and its peoples and wildlife—and for the ocean as a whole.

I. INTRODUCTION

Climate change is having dramatic impacts throughout the world, including on the ocean. These impacts are particularly acute in the Arctic, which is warming twice as fast as the rest of the planet.[1] Warming temperatures and diminishing seasonal sea ice—along with increasing interest in commercial exploitation of natural resources—have facilitated and driven growth in vessel traffic in the maritime Arctic.[2] This growth is expected to continue and accelerate.

A 2012 article entitled *Arctic Bottleneck: Protecting the Bering Strait Region from Increased Vessel Traffic* examined risks from increasing levels of vessel traffic in the Bering Strait region of the Arctic.[3] Here, we build upon and update that work. While the focus is once again on the Bering Strait region as the maritime nexus between the Arctic and Pacific oceans, this Article also considers maritime traffic in U.S. Arctic waters more broadly.

The sections below discuss increasing threats, review important advancements in Arctic vessel traffic management, and address some of the key challenges and opportunities that remain. They consider how impacts of increasing Arctic vessel traffic can be mitigated through Arctic-specific rules and best practices

[1] Nat'l Oceanic & Atmospheric Admin., *The Changing Arctic: A greener, warmer and increasingly accessible region* (Dec. 15, 2017), https://www.noaa.gov/explainers/changing-arctic-greener-warmer-and-increasingly-accessible-region [https://perma.cc/NSC3-X7BQ].

[2] For purposes of this Article, Arctic waters include the Bering Sea and waters surrounding the Aleutian Islands. This is consistent with the Arctic Research and Policy Act of 1984 (as amended), which defines Arctic to mean "all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi Seas; and the Aleutian chain." 15 U.S.C. § 4111 (1984).

[3] Hartsig et al., *Arctic Bottleneck: Protecting the Bering Strait Region from Increased Vessel Traffic*, 18 OCEAN & COASTAL L.J. 35, 35-87 (2012).

combined with broader changes that affect shipping practices on a global scale. More broadly, this Article examines how improvements to governance structures could better address the multiple and overlapping threats to the Arctic region and better promote full and meaningful participation by Indigenous residents of the Arctic with respect to the identification, design, and implementation of management measures that may affect their region. Finally, it underscores that reducing greenhouse gas emissions on a global scale is critically important for the Arctic, its peoples and wildlife, and more widely for the ocean and all who depend upon it.

II. AN EXTRAORDINARY REGION UNDERGOING EXTRAORDINARY CHANGE

The U.S. Arctic is home to Indigenous Peoples who have lived there for millennia and wildlife that are exquisitely adapted to a challenging environment. It encompasses vast stretches of marine waters, including U.S. portions of the sea surrounding the Aleutian Islands, Bering Sea, Bering Strait, Chukchi Sea, and Beaufort Sea.

The Bering Strait—a narrow marine passage between the United States and Russia—is a particularly noteworthy part of the Arctic.[4] Only fifty-five miles wide at its narrowest point, it is the sole marine connection between the Pacific and Arctic oceans and is a critical migration corridor. Thousands of marine mammals and millions of seabirds pass through the Bering Strait each year to access the abundant summer Arctic ecosystem.[5] The region provides key habitat for Pacific walrus, beluga, bowhead, gray whales, polar

[4] *See* Appendix 1.
[5] Oceana & Kawerak, Inc., BERING STRAIT MARINE LIFE AND SUBSISTENCE USE DATA SYNTHESIS 33 (July 2014), available at https://oceana.org/sites/default/files/final_pdf_bering_strait_synthesis_july_30_2014_0.pdf [https://perma.cc/Z5PQ-GT2R].

bears, and bearded, ringed, and spotted seals.[6] Millions of birds from all over the world come to the Bering Strait region, including "[a]uklets, gulls, eiders, loons, shearwaters, fulmars, terns, and kittiwakes."[7] Yup'ik, Inupiat, and Saint Lawrence Island Yupik peoples rely on this highly productive ecosystem as a key source of food security and culture. In the Bering Strait region alone, there are twenty federally recognized Tribes.[8] Tribal communities have many concerns with vessel traffic in the region.[9]

The Arctic is particularly vulnerable to climate change.[10] Sea ice, one of the primary drivers for the ecosystem, is reaching record lows year after year.[11] Historically, sea ice has given residents of the Bering Strait a platform upon which they could safely travel, hunt, and fish, and has offered protection from coastal erosion caused by storm surge. Diminishing sea ice removes these benefits and protections, putting residents of Arctic coastal communities and their food security at increasing risk.[12]

6 *Id.*
7 *Id.*
8 Julie Raymond-Yakoubian, *Conceptual and Institutional Frameworks for Protected Areas, and the Status of Indigenous Involvement: Considerations for the Bering Strait Region of Alaska*, *in* INDIGENOUS PEOPLES' GOVERNANCE OF LAND AND PROTECTED TERRITORIES IN THE ARCTIC 84, 84 (Thora Martina Hermann & Thibault Martin eds., 2016).
9 *See* Julie Raymond-Yacoubian, *Arctic Vessel Traffic and Indigenous Communities in the Bering Strait Region of Alaska*, *in* SUSTAINABLE SHIPPING IN A CHANGING ARCTIC, WMU STUDIES IN MARITIME AFFAIRS (L. P. Hildebrand et al. eds. 2018) available at https://kawerak.org/wp-content/uploads/2018/08/Raymond-Yakoubian-2018.pdf, [https://perma.cc/6UHU-S4JC] (hereinafter *Arctic Vessel Traffic and Indigenous Communities*).
10 Nat'l Oceanic & Atmospheric Admin., *The changing Arctic: A greener, warmer and increasingly accessible region* 275, 275 (Dec. 15, 2017), https://www.noaa.gov/explainers/changing-arctic-greener-warmer-and-increasingly-accessible-region, [https://perma.cc/NSC3-X7BQ].
11 *See generally*, Nat'l Snow & Ice Data Ctr., *State of the Cryosphere: Sea Ice* (Nov. 20, 2018), https://nsidc.org/cryosphere/sotc/sea_ice.html, [https://perma.cc/YH9Q-UA6B].
12 Julia O'Malley, *Alaska Relies on Ice. What Happens When It Can't Be Trusted?*, N.Y. TIMES (April 10, 2019),

Loss of sea ice also has profound and widespread impacts on the Arctic marine ecosystem. For instance, in 2017 and 2018, the Bering Sea "cold pool"—a region of cold water that historically acted as a thermal barrier between the southeastern Bering Sea and the northern Bering Sea—shrank significantly.[13] This resulted in large numbers of commercially important fish species such as pollock and cod moving north.[14] Changes in sea ice extent and the cold pool are driving fundamental shifts that ripple through the ecosystem, affecting everything from phytoplankton blooms to fish, birds, and marine mammals.[15] These changes have direct impacts on the region's Indigenous Peoples, who are part of the ecosystem and rely on these animals for sustenance and culture.

Climate change also facilitates commercial and industrial activity by making the region more accessible.[16] Going forward, the Arctic will almost certainly experience increased activity from

https://www.nytimes.com/2019/04/10/us/alaska-ice-melting.html?auth=login-email&login=email, [https://perma.cc/5V9J-WQZM].

[13] Nat'l Oceanic & Atmospheric Admin.**,** *Scientific Teams Set Out to Track Unprecedented Changes in the Eastern Bering Sea* (April 18, 2018), https://www.fisheries.noaa.gov/feature-story/scientific-teams-set-out-track-unprecedented-changes-eastern-bering-sea [https://perma.cc/VDD4-7LZU].

[14] *Id.*

[15] *Id.*

[16] A. Siders et al., *A dynamic ocean management proposal for the Bering Strait region*, 74 MARINE POLICY 177, 178 (2016).

commercial fishing,[17] oil and gas development,[18] and onshore mining operations in Canada and the United States.[19] Vessel traffic is expected to grow in support of these extractive industries.[20] The shipping sector also uses Arctic waters to connect ports in North America and Europe to ports in Asia.[21] Trans-Arctic shipping routes include the Northern Sea Route, which traverses waters north of Russia, and the Northwest Passage, which threads through archipelagic waters north of Canada. As Arctic sea ice continues to diminish, the Transpolar Sea Route—which runs "over the top" via the North Pole—could also become a viable option for trans-Arctic shipping, perhaps, as early as mid-century.[22] Importantly, the

[17] That said, there are precautionary fishing management measures in place in Arctic waters. For instance, the northern Bering Sea is currently closed to bottom trawling. *See* Amendment 89 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (FMP) to Establish Bering Sea Habitat Conservation Measures, Final Rule, 73 Fed. Reg. 43,362 (July 25, 2008). The high seas of the Central Arctic Ocean and the U.S. Arctic fishery management area north of the Bering Strait are currently closed to commercial fishing. *See* Agreement to prevent unregulated high seas fisheries in the Central Arctic Ocean (Oct. 3, 2018); available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.073.01.0003.01.ENG, [https://perma.cc/X2NC-9KPH]; and N. Pac. Fisheries Mgm't Council, FISHERY MANAGEMENT PLAN FOR FISH RESOURCES OF THE ARCTIC MANAGEMENT AREA (2009), available at https://www.npfmc.org/wp-content/PDFdocuments/fmp/Arctic/ArcticFMP.pdf [https://perma.cc/HD2P-RDF5].

[18] While the Bering Strait region and other Arctic waters are not currently open for offshore oil and gas leasing, they have been targeted for future leasing by the Trump Administration's 2019–2024 National Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program. Bureau of Ocean Energy Mgm't, *2019–2024 National Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program* 1 (2018).

[19] U.S. Comm. on the Marine Transp. Sys., *Draft: A Ten-Year Projection of Maritime Activity in the U.S. Arctic Region, 2020-2030* 37–42 (July 2019) [hereinafter CMTS 2019 Draft Projection], available at https://www.cmts.gov/downloads/2019_ArcticVesselProjections_draft.pdf [https://perma.cc/DL9C-ZY6R].

[20] *See generally id.*

[21] *See* Appendix 2.

[22] *See id.* at 70–71 (noting that while the transpolar sea route is not expected to open to most vessels before mid-century, its use could grow quickly when it

Northern Sea Route, the Northwest Passage, and the Transpolar Sea Route all pass through the Bering Strait to connect the Arctic Ocean to the Bering Sea and Pacific Ocean.

The bulk of this Article focuses on managing shipping activities in U.S. Arctic waters. However, impacts from increased vessel traffic are just one strand in a much broader web of changes affecting the region. Given the multiple threats it faces, effective management of the Arctic region will require a comprehensive approach to governance, including full and meaningful involvement in decision-making by Indigenous residents. More broadly, it will require global-scale action to address the fundamental threat of climate change.

III. ARCTIC VESSEL TRAFFIC: OPERATIONS, ROUTES, GROWTH TRENDS, AND ASSOCIATED RISKS

The volume of vessel traffic in the Arctic has already grown substantially and is predicted to continue to grow in the future.[23] As Arctic vessel traffic increases, so do impacts from and risks of conflicts and accidents.

A. Arctic Vessel Operations and Predictions for Growth

Many economic sectors contribute to the overall volume of vessel traffic in Arctic waters. Commercial operators bring supplies and fuel to western Alaska communities using tugs, barges, and tankers.[24] Extractive industries—including oil and gas and mining

becomes seasonally ice-free). *See also* James E. Overland & Muyin Wang, *When will the summer Arctic be nearly sea ice free?* 40 GEOPHYSICAL RES. LETTERS 2097, 2097 (2013) (noting future sea ice loss in the Arctic is very likely in the "first half of the 21st century, with a possibility of major loss within a decade or two").

[23] CMTS 2019 Draft Projection, *supra* note 19, at vi.

[24] Nuka Res. & Planning Group, LLC, OVERVIEW OF TANKER LIGHTERING IN ARCTIC ALASKA 2-3 (2019) [hereinafter OVERVIEW OF TANKER LIGHTERING],

operations—generate significant levels of vessel traffic.[25] Cruise ships of varying sizes take tourists to destinations in the Arctic. A large and economically important commercial fishing fleet operates in southern portions of the Bering Sea,[26] and scientists conduct studies from research vessels.[27] In addition to these commercial operations, subsistence hunters pursue marine mammals from small skiffs, sometimes operating far from shore.[28]

Relative to other global shipping routes, the U.S. Arctic and the Bering Strait currently experience low volumes of commercial vessel traffic.[29] Nonetheless, traffic levels in the region have already

available at https://oceanconservancy.org/wp-content/uploads/2019/03/190306-OC-Lightering-Report-vFINAL.pdf, [https://perma.cc/V5GW-JX7U].

[25] *See, e.g.*, Nuka Res. & Planning Group, LLC, BERING SEA VESSEL TRAFFIC RISK ANALYSIS 49 (2016) (noting that vessel traffic from Shell's offshore oil and gas exploration in 2015 generated a spike in vessel traffic) [hereinafter BERING SEA RISK ANALYSIS], available at https://oceanconservancy.org/wp-content/uploads/2017/01/bering-sea-vessel-traffic-1.pdf, [https://perma.cc/L3QU-652C].

[26] N. Pac. Fishery Mgm't Council, BERING SEA FISHERY ECOSYSTEM PLAN 75 (Jan. 2019) available at https://meetings.npfmc.org/CommentReview/DownloadFile?p=c334ad33-4139-4b5a-b205-a8b7c5028562.pdf&fileName=D6%20Final%20BS%20FEP%20Jan%202019.pdf [https://perma.cc/5KQ6-K43S].

[27] B. Konar et al., *Development of best practices for scientific research vessel operations in a changing Arctic: A case study for R/V Sikuliaq*, 86 MARINE POLICY 182, 182-83 (2017) (noting increased use of research vessels in Arctic waters), available at https://www.unols.org/sites/default/files/Sikuliaq%20Marine%20Policy%20paper.pdf [https://perma.cc/MUT4-4YX3].

[28] *See, e.g*, Oceana & Kawerak, Inc., *supra* note 5, at 112 (noting hunters may travel up to 100 miles from their communities).

[29] *See, e.g.*, Benjamin Glick, *Is the Arctic Shipping Route Closer to being a Viable Alternative?*, TRADING THOUGHTS: GRAND VALLEY STATE UNIV. VAN ANDEL GLOBAL TRADE CTR. (undated), https://vagtc.wordpress.com/2017/02/20/is-the-arctic-shipping-route-closer-to-being-a-viable-alternative/ [https://perma.cc/7BW5-DVE6] (noting that while fewer than 20 ships went through the Arctic passages in 2015, almost 14,000 ships transited the Panama Canal and 18,000 transited the Suez Canal).

experienced substantial increases in recent years.[30] As Arctic sea ice continues to diminish[31] and the ice-free season continues to lengthen, vessel traffic in the region is expected to keep growing.[32]

1. Trans-Arctic Shipping

Going forward, shipping companies will likely make greater use of trans-Arctic shipping routes to transport cargo. These routes save significant time and fuel, particularly when transiting from Asia to Europe. In the years ahead, the Northern Sea Route is poised to experience significant growth in transit traffic, which could "dramatically alter the spread of vessel types transiting through the Bering Strait."[33] For instance, in 2018 a Maersk ship became the first to use the Northern Sea Route to transport containerized cargo, a voyage that may herald more widespread use of the route by container ships in the future.[34] In addition, it is not too early to consider potential future use of the Transpolar Sea Route for commercial shipping. Persistent ice makes the route impractical at this time. However, as the Transpolar Sea Route becomes seasonally ice-free, traffic along the route could increase rapidly, in part "because the Transpolar Sea Route does not have the same draft restrictions as other trans-Arctic passages."[35] As noted above, all trans-Arctic shipping routes pass through the Bering Strait, so increased use of any, or all of these routes, will result in increased traffic through the Strait.

30 *See* CMTS 2019 Draft Projection, *supra* note 19, at 15 (noting vessel traffic in the Bering Strait region has "steadily climbed since data collection began in 2008, resulting in a 128% growth in 2018 over 2008 levels").
31 *See, e.g.*, Nat'l Snow & Ice Data Ctr., supra note 11, (describing trends in Arctic sea ice loss).
32 CMTS 2019 Draft Projection, *supra* note 19, at 68 (summarizing scenarios projecting vessel traffic growth in the U.S. Arctic region).
33 *Id.* at 41.
34 *Id.* at 40.
35 *Id.* at 109.

2. Arctic Marine Tourism

Maritime tourism is another growth sector in the Arctic. In 2016, the *Crystal Serenity* became the first large luxury cruise ship to transit the Northwest Passage, a feat it repeated in 2017.[36] The company, Crystal Cruises, plans to return to Alaska in the future using a new, smaller, purpose-built polar-class vessel.[37] Crystal Cruises is far from the only such company to invest in new ships intended for Arctic waters. A 2018 review found that at least twenty-eight new expedition cruise ships capable of operating in Arctic waters would be launched within four years.[38] Many of the new vessels will have robust construction that qualifies them to sail in more challenging and remote waters.[39] As just one example, French operator Ponant intends to launch a specially-constructed vessel called *Le Commandant Charcot*, with plans to sail to the North Pole starting in 2021.[40]

3. Community Resupply and Infrastructure

Vessel traffic that serves the needs of local Arctic communities is also poised to increase. Tug-and-barge and tanker

[36] Maritime Executive, *New Crystal Ship for Northwest Passage* (Oct. 1, 2017), https://www.maritime-executive.com/article/new-crystal-ship-for-northwest-passage [https://perma.cc/J3RL-D938].
[37] *Id*. *See also* Crystal Cruises, *Crystal Expedition Cruises Appoints Captain Thomas Larsen to Helm Crystal Endeavor* (June 18, 2019) (noting plans to sail to Alaska, the Aleutian Islands and the Northeast Passage, among other destinations), available at http://mediacenter.crystalcruises.com/crystal-expedition-cruises-appoints-captain-thomas-larsen-to-helm-crystal-endeavor/ [https://perma.cc/L56U-58G7].
[38] Thomas Nilsen, *Arctic cruise ship boom*, BARENTS OBSERVER, May 22, 2018, https://thebarentsobserver.com/en/travel/2018/05/arctic-cruise-ship-boom [https://perma.cc/HH2S-J8B7].
[39] *See id.* (noting new builds will be a "higher ice-class").
[40] Malte Humpert, *France's Ponant to offer North Pole cruises starting in 2021*, HIGH NORTH NEWS (May 22, 2019), https://www.arctictoday.com/frances-ponant-to-offer-north-pole-cruises-starting-in-2021/ [https://perma.cc/JP4E-QPB5].

traffic delivers supplies and fuel to coastal communities in Arctic Alaska that are not connected to the road system. While community resupply in Alaska has been stable for the past twenty-five or more years,[41] recent reports indicate there may be an increase in the number of transits associated with this sector as operators expand service to northern communities and industrial areas.[42] In addition, community infrastructure projects in western and Arctic Alaska—ranging from port and road construction to airport runway and renewable wind energy projects—will likely generate additional vessel traffic as supplies are brought into the region.[43]

4. Extractive Industries

As noted earlier, development and extraction of natural resources from the Arctic is also expected to contribute to a growth in vessel traffic in the region. Northern Sea Route cargo traffic associated with extractive industries is forecast to grow as Russia continues to bring online Liquefied Natural Gas (LNG)[44] and potential oil and coal development projects.[45] The first shipment of LNG from Russia's Yamal LNG project occurred in 2017.[46] Going forward, Russia plans to ship more than a million tons of LNG from Yamal to markets in Europe and Asia using special icebreaking tankers.[47] Overall, the Russian government has decreed the volume

41 BERING SEA RISK ANALYSIS, *supra* note 23, at 58.
42 CMTS 2019 Draft Projection, *supra* note 19, at 62.
43 *Id.* at 49-57.
44 *Id.* at 34.
45 *See* Ariel Cohen, *Russia Sets Sights On Energy Resources Under Arctic Circle*, FORBES (April 17, 2019), https://www.forbes.com/sites/arielcohen/2019/04/17/russia-sets-sights-on-energy-resources-under-arctic-circle/#13828dd6eea7 (describing potential oil and coal projects in the Russian Arctic and the need for additional vessels to facilitate development of those projects) [https://perma.cc/ZA6S-RD8C].
46 CMTS 2019 Draft Projection, *supra* note 19, at 34.
47 *Id.*

of goods shipped via the Northern Sea Route increase eight-fold from 2017 levels, reaching 80 million tons per year 2024.[48]

In United States waters, any future exploration or development of Arctic oil and gas resources—both onshore and offshore—could also trigger significant increases in vessel traffic in the region.[49] Shell's efforts to explore for oil in the U.S. Arctic Ocean, for instance, generated substantial increases in transits of the Bering Strait.[50] In addition to oil and gas activities, new or expanded onshore mining operations in Alaska could trigger growth in Arctic vessel traffic, which would come on top of vessel traffic that supports ongoing operations at the Red Dog mine.[51] Similarly, expansion of mining operations in Arctic Canada could contribute to continued growth in vessel traffic.[52]

5. Other Sources of Growth in Arctic Vessel Traffic

Other sectors may contribute to growth in vessel traffic in the U.S. Arctic and the Bering Strait region as well. Commercial fishing vessels may move into more northerly waters as they pursue

[48] Charles Digges, *Putin decrees an increase in Arctic traffic*, THE MARITIME EXECUTIVE (May 16, 2019), https://www.maritime-executive.com/article/putin-decrees-an-increase-in-arctic-traffic [https://perma.cc/QYA6-ANNL]. *See also* Vladimir Putin, *O natsionalnykh tselyakh i strategicheskikh zadachakh razbitiya Rossiskoy Federatsii na period do 2024 goda*, (*About national goals and strategic development objectives for the period up to 2024*), DECREE OF THE PRESIDENT OF THE RUSSIAN FED. NO. 204 (May 7, 2018), https://xn--d1aqf.xn--p1ai/media/news/ukaz-o-natsionalnykh-tselyakh-i-strategicheskikh-zadachakh-razvitiya-rossiyskoy-federatsii-na-period/ (calling for development and expanded use of Northern Sea Route) [https://perma.cc/EE3X-M54N].
[49] CMTS 2019 Draft Projection, *supra* note 19, at 30–34.
[50] BERING SEA RISK ANALYSIS, *supra* note 25, at 49. *See also* CMTS 2019 Draft Projection, *supra* note 18, at 12 (noting that Shell's "drill ship, anchor handling vessels, and anti-pollution ships" resulted in a surge of vessel activity in the region).
[51] *See* CMTS 2019 Draft Projection, *supra* note 19.
[52] *See Id*.

valuable fish stocks moving northward.[53] The number of research vessels in the region has already increased, and would likely increase more, if and when commercial fishing expands northward.[54] Overall, the number of vessels conducting research, law enforcement, and search and rescue activities in U.S. Arctic waters has increased, and is likely to continue to grow as "the demand for real-time environmental data in the region increases."[55] Autonomous vessels may also contribute to this pattern of growth.[56]

B. Increasing Shipping Presents Risks to Safety and the Marine Environment

As Arctic shipping traffic increases, so do its attendant risks. This section focuses on accidents that could jeopardize human life; conflicts with other maritime users; water, air, and noise pollution; ship strikes; and introduction of invasive species.

1. Vessel Accidents in the Arctic May Jeopardize Human Lives and Property

[53] *Id.* at 42-43.
[54] *Id.* at 41-43.
[55] *Id.* at 40.
[56] *Id.*

Arctic waters are widely recognized as remote,[57] hazardous,[58] and poorly charted.[59] Although modern vessels are highly capable, they are still vulnerable to accidents including damage caused by grounding, collision, or other sources; fires or explosions; failure of engines or other machinery; and other issues.[60] These accidents can jeopardize the lives of passengers and crew.

Challenging conditions and lack of infrastructure mean that search and rescue operations in the Arctic marine environment are highly demanding.[61] The U.S. Coast Guard "does not currently have the capability or capacity necessary to assure access in the high latitudes," which "limits [its] ability to proactively manage risks"

[57] For example, the Coast Guard Air Station in Kodiak, Alaska—the nearest permanent base to the Arctic Ocean—is roughly 820 nautical miles south of the coastal community of Utqiagvik on Alaska's North Slope. U.S. Dep't of Homeland Security, ARCTIC SEARCH AND RESCUE: FISCAL YEAR 2017 REPORT TO CONGRESS (March 13, 2018), at 5, available at https://www.dhs.gov/sites/default/files/publications/USCG%20-%20Arctic%20Search%20and%20Rescue_1.pdf [https://perma.cc/2835-WWU6].

[58] Arctic waters are susceptible to "ice, dense fog, storms, high winds and waves, and freezing temperatures," among other challenges. Pew Charitable Trusts, ARCTIC STANDARDS: RECOMMENDATIONS ON OIL SPILL PREVENTION, at 6, RESPONSE, AND SAFETY IN THE U.S. ARCTIC OCEAN (Sept. 2013), available at https://www.pewtrusts.org/-/media/assets/2013/09/23/arcticstandardsfinal.pdf [https://perma.cc/MN5K-FXA5].

[59] As of late 2018, it was reported that just 4.1 percent of the Arctic waters off the coast of Alaska were charted to modern standards. Dermot Cole, *Outdated navigational charts are an Arctic maritime disaster in the making*, ARCTIC TODAY (Sept. 10, 2018), at 2, https://www.arctictoday.com/outdated-navigational-charts-arctic-maritime-disaster-making/ [https://perma.cc/B46X-2PVA].

[60] Arctic Council, ARCTIC MARINE SHIPPING ASSESSMENT 87 (2009) [hereinafter AMSA 2009], https://www.pame.is/images/03_Projects/AMSA/AMSA_2009_report/AMSA_2009_Report_2nd_print.pdf [https://perma.cc/SC7U-9MPQ].

[61] Timothy William James Smith, *Search and Rescue in the Arctic: is the U.S. Prepared?* 17 (Pardee RAND Grad. Sch., 2016), https://www.rand.org/pubs/rgs_dissertations/RGSD382.html [https://perma.cc/TJN9-5VNQ].

and "threatens the Nation's ability to respond to crises in the Arctic, ranging from oil spills to contingency operations."[62]

While not in the U.S. Arctic, a recent incident in Norwegian waters highlights the harsh reality of these risks. In late March 2019, a passenger cruise ship traveling approximately 200 miles south of the Arctic Circle lost engine power amid gale-force winds and rough seas.[63] Large waves battered the ship, smashing windows and sweeping passengers off their feet. Over 450 passengers were airlifted from the vessel.[64] The ship eventually made it to a Norwegian port under its own power with nearly 900 passengers and crew still onboard.[65] While no lives were lost, numerous passengers were injured[66] and the rescue operation was a dangerous and costly undertaking. As more ships travel in Arctic waters, the potential for an accident that jeopardizes human life only increases.

2. Oil Spills from Vessels Threaten the Arctic Marine Environment

A 2009 Arctic Council analysis concluded "[r]elease of oil into the Arctic marine environment, either through accidental release, or illegal discharge, is the most significant threat from

62 U.S. Coast Guard, ARCTIC STRATEGIC OUTLOOK 26 (April 2019), at 6,11,24, https://www.uscg.mil/Portals/0/Images/arctic/Arctic_Strategy_Book_APR_2019.pdf [https://perma.cc/6A2K-ARG3].
63 Simon Calder, *Viking Sky: Why Things Went Wrong, What Happened and What's Next?* INDEPENDENT, https://www.independent.co.uk/travel/news-and-advice/viking-sky-what-happened-storm-norway-emergency-evacuation-coast-a8837371.html [https://perma.cc/TKJ5-G8W8].
64 *Id*.
65 David Oliver, *Five Helicopters, 28 rescuers, 464 saved: Inside the Viking Sky Cruise Ship Rescue*, USA TODAY, https://www.usatoday.com/story/travel/cruises/2019/03/28/viking-sky-cruise-ship-norway-inside-rescue-mission/3298517002/ [https://perma.cc/N69E-34H8].
66 Calder, *supra* note 63.

shipping activity."[67] This threat exists wherever vessels use, transport, or store oil or oil products.[68]

Oils may be persistent (such as heavy fuel oil)[69] or non-persistent (such as diesel fuels, gasoline, and jet fuel).[70] When spilled into the marine environment, persistent fuels tend to remain recognizable and may spread as an oil slick or strand on the shore.[71] Non-persistent fuels, on the other hand, tend to evaporate or dissolve when spilled into the water.[72] Both persistent and non-persistent fuels are toxic and negatively impact fish and wildlife via multiple pathways.[73] That said, heavy fuel oil is recognized as particularly dangerous if it is spilled, especially in colder waters.[74]

Ships that carry large volumes of oil and spend longer periods of time in a particular region present the largest oil hazard exposure for that region.[75] In addition, ships using or carrying persistent fuels create more hazard exposure than non-persistent fuels.[76] An analysis of vessel traffic in the Bering Sea concluded that large cargo vessels using persistent oil as a fuel for propulsion and tankers carrying non-persistent fuel as cargo represented the greatest oil spill hazard exposure.[77] On the U.S. side of the Bering Strait,

67 AMSA 2009, *supra* note 60, at 152.
68 BERING SEA RISK ANALYSIS, *supra* note 25, at 17.
69 *Id.* at 35.
70 *Id.* at 19.
71 *Id.* When spilled into the marine environment, persistent fuels tend to remain recognizable and may spread as an oil slick or strand on the shore. *Id.* at 20.
72 *Id.* at 20.
73 *Id.*
74 Det Norske Veritas, REPORT: HEAVY FUEL OIL IN THE ARCTIC (PHASE 1) 42 (2011), https://pame.is/index.php/document-library/shipping-documents/heavy-fuel-oil-documents/359-hfo-in-the-arctic-phase-i/file [https://perma.cc/9DCT-ZK3K].
75 *See generally* BERING SEA RISK ANALYSIS, *supra* note 25, at 51-54.
76 *See id.* at 37 (noting that persistent oil remains in the environment for a longer period of time "and thus has the potential to impact biological receptors over a longer time than non-persistent oil").
77 *Id.* at 53.

these include vessels serving Red Dog mine near Kivalina and tankers delivering fuel products to the region.[78]

Some of the tankers delivering fuel to the region represent a particular threat because they transfer their fuel at sea. These large tankers sit so deep in the water that they cannot deliver their cargo directly to communities. Instead, fuels from these deep-draft tankers must be transferred, on open water, into smaller barges that can access shallow ports and beaches in Arctic communities.[79] This process of at-sea fuel transfer is known as "lightering" or "ship-to-ship transfer."[80] Due to the presence of large volumes of oil in one place at one time,[81] as well as the inherent risk of transferring oil at sea, lightering represents a significant oil spill risk in the region. There have been no reported lightering spills off the coast of Alaska,[82] but oil spills related to lightering have been documented in other regions, and the impacts were significant.[83]

3. Discharges from Vessels Pollute Arctic Waters

In addition to the risk of accidental oil spills, more vessel traffic will likely lead to the discharge of additional pollutants into Arctic waters. Vessel discharge is governed by rules at the state, national, and international level.[84] These laws prevent or

78 *Id.* at 54.
79 OVERVIEW OF TANKER LIGHTERING, *supra* note 24, at 2-3.
80 *Id.* at 1.
81 *See id.* at 3 (noting the use of large tankers "means that larger volumes of fuel may be transported in one place at one time," even if the overall volume of fuel delivered to the region remains relatively stable).
82 *Id.* at 19.
83 *See id.* (describing spill of heavy fuel oil during a fuel transfer operation in San Francisco Bay that impacted ten miles of shoreline, closed fisheries and beaches, and resulted in an $850,000 natural resources damage assessment).
84 *See, e.g.*, Melissa Parks et al., *Quantifying and mitigating three major vessel waste streams in the northern Bering Sea*, 106 MARINE POLICY 1, 8 (2019) (noting international, national, and state level options for area-based mitigation measures to reduce discharge), available at https://reader.elsevier.com/reader/sd/pii/S0308597X18308315?token=B5CFC92

significantly restrict ships from discharging many types of pollutants, such as oil and oil mixtures and noxious liquids and chemicals.[85] However, there are more lenient restrictions on the intentional discharge of sewage,[86] and even fewer restrictions on the intentional discharge of graywater (i.e., drainage water from showers, dishwashers, sinks, laundry machines, and similar facilities).[87]

Discharge of untreated sewage and graywater can spread bacteria or viruses,[88] which can lead to illness in people who consume marine-based foods.[89] This is particularly problematic in the Arctic, where fish and marine mammals often constitute a significant part of the diet for many people.[90] Importantly, graywater is not necessarily "cleaner" than sewage; concentrations of fecal coliform in untreated vessel graywater can be up to several orders

70945ED9C4A5B69B5574668940272C1B29B40795062BFC7620C622917253856A6C164E694F2DD317D7F9BC404 [https://perma.cc/M73H-RS8U].

[85] *See, e.g.*, Int'l Convention for the Prevention of Pollution from Ships, as amended by Protocol of 1978, Annexes I, II, & III (Feb. 16, 1978) [hereinafter MARPOL].

[86] Int'l Maritime Org., *Prevention of Pollution by Sewage from Ships* (undated), http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Sewage/Pages/Default.aspx, [https://perma.cc/ZNW7-2DMY] (describing international standard that allows ships to discharge raw sewage so long as the discharge occurs at a distance of at least twelve nautical miles from shore and traveling at least four knots).

[87] *See, e.g.*, Parks et al., *supra* note 84, at 4–6 (noting that IMO instruments such as MARPOL and the Polar Code do not "specifically address grey water or restrict its discharge").

[88] *See, id*. at 4 (noting fecal coliform from discharged sewage presents an ecosystem risk; also noting that graywater contains fecal coliform concentrations similar to those found in raw sewage)*; see also* Envtl. Prot. Agency, CRUISE SHIP DISCHARGE ASSESSMENT REPORT SECTION 3: GRAYWATER 3-6 (2008) (noting presence of pathogens in untreated graywater samples) (hereinafter CRUISE SHIP DISCHARGE REPORT).

[89] *See*, Parks et al., *supra* note 84, at 4 (noting that "[s]hellfish can concentrate fecal coliform and associated pathogens from the water around them, which can be passed to humans").

[90] *See, e.g.*, Oceana & Kawerak, Inc., *supra* note 5, at 18–22 (describing the importance of subsistence foods to Indigenous people of the Bering Strait region).

of magnitude higher than untreated domestic wastewater.[91] Discharges of sewage and graywater can also lead to oxygen depletion and can increase nutrient levels, possibly contributing to toxic algal blooms and eutrophication, the effects of which can ripple through marine food webs.[92]

Discharge of sewage and graywater from large passenger vessels is a special concern.[93] Large passenger ships, such as cruise ships, discharge significant volumes of sewage and graywater, averaging nearly 8.5 gallons per day per person for sewage and between forty-five and sixty-five gallons per day per person for graywater.[94] With cruise vessel tourism expected to increase significantly in polar waters, discharges from cruise ships and other large passenger vessels are a significant threat to the Arctic marine environment.[95] Even if stronger restrictions on discharge are imposed, enforcement will be critical: some cruise companies have a well-documented record of noncompliance with anti-pollution regulations.[96]

91 CRUISE SHIP DISCHARGE REPORT, *supra* note 88, at 3-6.
92 *Id*. at 2-33, 3-27.
93 *See* Parks et al., *supra* note 84, at 4 (noting that "passenger vessels carry significantly more people and generate more sewage and grey water than . . . other vessel types").
94CRUISE SHIP DISCHARGE REPORT, *supra* note 88, at 2-2, Figure 2.1 and 3-3.
95 *See, e.g.*, Ahmasuk, Austin, *Local Concerns of Opening the Arctic and the Crystal Serenity*, OCEAN CURRENTS: OCEAN CONSERVANCY BLOG (Sept. 8, 2016), https://oceanconservancy.org/blog/2016/09/08/local-concerns-of-opening-the-arctic-and-the-crystal-serenity/ [https://perma.cc/N8G3-HAJ4].
96 *See, e.g.*, U.S. Dep't of Justice Office of Pub. Affairs, *Princess Cruise Lines to Pay Largest-Ever Criminal Penalty for Deliberate Vessel Pollution: Company to Pay $40 Million and Implement Remedial Measures on All Carnival Companies Visiting U.S. Ports* (Dec. 1, 2016), https://www.justice.gov/opa/pr/princess-cruise-lines-pay-largest-ever-criminal-penalty-deliberate-vessel-pollution, [https://perma.cc/MKH6-TLH8] (noting that the "Carnival family of companies has a documented history of environmental violations"); *see also*, U.S. Dep't of Justice Office of Pub. Affairs, *Princess Cruise Lines and its Parent Company Plead Guilty to Environmental Probation Violations, Ordered to Pay $20 Million Criminal Penalty* (June 3, 2019), https://www.justice.gov/opa/pr/princess-cruise-lines-and-its-parent-company-

4. Emissions from Vessels Adversely Affect Arctic Air Quality and Contribute to Global Warming

Increased vessel traffic also presents risks from emissions into the air. Most vessels are powered by engines that run on fossil fuels including heavy fuel oil, distillates, or fuel blends. Combustion of these fuels emits pollutants that contribute to climate change. In addition to emitting carbon dioxide, ships' engines produce particulate matter including black carbon. Black carbon has significant climate forcing impacts.[97] In the Arctic, black carbon is deposited on ice and snow where it decreases reflectivity, increases heat absorption, and accelerates melting.[98] Although black carbon does not persist in the atmosphere as long as carbon dioxide, it is the second-biggest contributor to anthropogenic climate change after carbon dioxide.[99] Ships also emit sulfur and nitrogen oxides, which

plead-guilty-environmental-probation-violations, [https://perma.cc/5F58-6GMS] (noting violations of probation); Taylor Dolven, *Federal judge threatens to temporarily block Carnival ships from docking at U.S. ports*, MIAMI HERALD (Apr. 10, 2019), https://www.miamiherald.com/news/business/tourism-cruises/article229069589.html (noting that one of Carnival Cruise lines' ships illegally dumped graywater in Glacier Bay National Park in Alaska).

[97] *See, e.g.*, *Climate risks from CO2 and short-lived climate pollutants*, WORLD HEALTH ORG., (undated), https://www.who.int/sustainable-development/housing/health-risks/climate-pollutants/en/, [https://perma.cc/PA8N-D68K] (noting that black carbon, while short-lived in the atmosphere, "has hundreds to thousands of times more warming potential than carbon dioxide.").

[98] *See, e.g.*, P.K. Quinn et al., *The Impact of Black Carbon on Arctic Climate*, ARCTIC MONITORING & ASSESSMENT PROGRAMME, 45–49 (2011), https://www.amap.no/documents/download/977/inline.

[99] *See* T.C. Bond et al., *Bounding the role of black carbon in the climate system: A scientific assessment*, 118 J. of Geophysical Res.: Atmospheres, 5380, 5381 (2013) ("We estimate that black carbon . . . is the second most important human emission in terms of its climate forcing in the present-day atmosphere; only carbon
dioxide is estimated to have a greater forcing."), https://www.researchgate.net/publication/312193003_Bounding_the_role_of_black_carbon_in_the_climate_system_-_A_scientific_assessment [https://perma.cc/6ZXL-CEPU].

can have adverse impacts on human health.[100] Ships that burn heavy fuel oil tend to produce even "dirtier" exhaust because contaminants in the fuel—such as ash, sulfur, vanadium, aluminum, silicon, sodium, sediment, and asphaltenes—negatively affect the composition of exhaust.[101]

Arctic shipping emissions have direct consequences on human health and the environment in the Arctic and contribute significantly to global emissions and climate change. Global shipping traffic is responsible for roughly 2.2% of global carbon dioxide emissions.[102] If the shipping industry were a country, its worldwide emissions would rank approximately sixth, falling between Germany and Japan.[103] Experts predict that on a business-as-usual pathway, total shipping emissions could reach 17% of worldwide greenhouse gas emissions by 2050.[104]

[100] Airclim et al., AIR POLLUTION FROM SHIPS 3 (2011), http://www.cleanshipping.org/download/111128_Air%20pollution%20from%20ships_New_Nov-11(3).pdf [https://perma.cc/5546-6UKQ]
[101] Vard Marine, FUEL ALTERNATIVES FOR ARCTIC SHIPPING 10-11 (2015), http://awsassets.wwf.ca/downloads/vard_313_000_01_fuel_alternatives_letter_final.pdf
[102] Int'l Maritime Org., THIRD IMO GREENHOUSE GAS STUDY 2014, EXECUTIVE SUMMARY 1 (2014), http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf [https://perma.cc/HFE6-3A96].
[103] Zoe Schlanger, *Smoggy Seas: If shipping were a country, it would be the world's sixth-biggest greenhouse gas emitter*, QUARTZ (April 17, 2018), https://qz.com/1253874/if-shipping-were-a-country-it-would-the-worlds-sixth-biggest-greenhouse-gas-emitter/, [https://perma.cc/NRB2-WKT9]
[104] *See* European Parliament Directorate-Gen. for Internal Policies, *Emission Reduction Targets for International Aviation and Shipping* 28 (2015), http://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU(2015)569964_EN.pdf, [https://perma.cc/42BF-LHKT] (explaining that "if action to combat climate change is further postponed," the maritime transport sector's contribution to global carbon dioxide emissions may reach 17% by 2050).

5. Additional Subsea Noise from Vessels May Adversely Affect Marine Animals and Subsistence Hunting

Increasing vessel traffic generally leads to more noise in the ocean, which can have serious impacts on marine mammals and fish. In the water, low-frequency sound energy—like that used by baleen whales—travels faster and further than light energy[105] and can easily travel long distances and cross maritime jurisdictional borders.[106] Researchers documented changes to humpback whale vocalizations in response to anthropogenic sound sources roughly 200 kilometers away.[107] In the past, Arctic waters have been relatively free of anthropogenic noise. In recent years, however, the Arctic is experiencing more underwater noise caused by vessel traffic as well as military sonar, seismic exploration for oil and gas, and resource extraction.[108] With respect to vessel traffic, icebreakers tend to produce louder and more varied sounds than other vessels.[109]

Increased noise in the subsea environment may adversely affect marine mammals, which use sound to communicate, avoid predators, and navigate their environment.[110] Anthropogenic noise can disturb important behaviors like feeding, breeding, resting, or migration.[111] Exposure to low-frequency sound "may be associated

105 ROBERT J. URICK, PRINCIPLES OF UNDERWATER SOUND 1 (3rd ed. 1983).
106 *See, e.g.*, Sue E. Moore et al., *A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing Arctic*, 62 Bioscience 289, 290 (2012) (noting sound from seismic surveys has been detected thousands of kilometers from its source).
107 Denise Risch et al., *Changes in Humpback Whale Song Occurrence in Response to an Acoustic Source 200km Away*, 7 PLoSONE e29741, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3256173/pdf/pone.0029741.pdf [https://perma.cc/CT44-95QT].
108 Sue E. Moore et al., *supra* note 106, at 289-292.
109 AMSA 2009, *supra* note 60, at 146.
110 Moore et al., *supra* note 106, at 290.
111 *Id.*

with chronic stress in whales,"[112] and human-caused noise may reduce the availability of prey species.[113] Emerging evidence suggests that subsea noise may adversely affect fish, squid, and other marine animals.[114] To the extent that marine mammals are adversely affected by underwater noise, opportunities for subsistence hunting may also be adversely affected. For instance, sound from vessels may cause marine mammals to divert from their usual migration pathways, which could make hunting those animals more difficult or dangerous.[115]

6. Increased Ship Traffic May Increase Ship Strikes

In the Arctic, ships share the water with marine mammals including large whales, creating the potential for ship strikes that can injure or kill these whales.[116] The Bering Strait region could be an especially important region in this regard, because the strait is relatively narrow and the fall migration of whales overlaps with periods of higher vessel traffic in this narrow passage.[117] Many

[112] Rosalind M. Rolland et al., *Evidence that ship noise increases stress in right whales*, 279 PROCEEDINGS OF THE ROYAL SOCIETY B 2363, 2365–67 (2012), https://royalsocietypublishing.org/doi/pdf/10.1098/rspb.2011.2429 [https://perma.cc/KMS7-GPZP].
[113] Moore et al., *supra* note 106, at 290.
[114] J. Gedamke et al., *Ocean Noise Strategy Roadmap,* NOAA 99–102 (2016), https://cetsound.noaa.gov/Assets/cetsound/documents/Roadmap/ONS_Roadmap_Final_Complete.pdf [https://perma.cc/5C3Y-LC2G].
[115] Huntington et al., *Vessels, risks and rules: planning for safe shipping in the Bering Strait*, 51 MARINE POLICY 119, 122 (2015). *See also* Hannah Hoag, *Inuit concerns stall seismic testing: Research in Canadian waters halted over fears it could harm wildlife*, NATURE (Aug. 12, 2010) (describing how Inuit group concerns that seismic testing could "disturb narwhals, beluga, walrus, seals and polar bears in Lancaster Sound"), https://www.nature.com/news/2010/100812/full/news.2010.403.html [https://perma.cc/X265-FGAV].
[116] Huntington et al., *supra* note 115, at 121.
[117] *Id.*

species of large whales are susceptible to ship strikes[118] and in this region, bowhead whales may be most vulnerable.[119] In addition to whale mortality from ship strikes, some observers have raised the concern that a large vessel could strike subsistence hunters in small skiffs.[120]

7. Additional Vessel Traffic Creates More Pathways for Marine Invasive Species

Ship traffic is a major contributor to the spread of invasive species—organisms introduced by human activity into an environment outside of their natural range and that spread to have negative impacts on the local ecosystem.[121] Ships may spread non-native species when they take on ballast water containing marine organisms in one location and discharge that ballast water and its associated marine organisms in another location.[122] Ships may also spread non-native species when those species attach themselves to

118 *See, e.g.*, David W. Laist et al., *Collisions Between Ships and Whales*, 17 MARINE MAMMAL SCI. 35, 39 (2001) (finding evidence of ship strikes among eleven species of great whales).

119 Huntington et al., *supra* note 115, at 121. *See also* AMSA 2009, *supra* note 57, at 108 (listing ship strikes as a potential conflict between increasing vessel traffic and indigenous marine resource use in the Bering Strait region).

120 *See id.* at 122 (noting that Indigenous hunters travel as much as 100 miles from shore in small open boats that "could be struck by a large vessel or swamped by a large vessel's wake," and that "[g]iven the cold water and distance from land and assistance in the Bering Strait region, such incidents would likely be fatal to those on the small boat, if the large vessel were unaware of the accident.").

121 *Biofouling*, INT'L MARITIME ORG., http://www.imo.org/en/OurWork/Environment/Biofouling/Pages/default.aspx, [https://perma.cc/B226-QRZQ] ("The problem of invasive species carried by ships has intensified over the last few decades due to the expanded trade and traffic volume and, since the volumes of seaborne trade continue to increase, the problem may not yet have reached its peak."). *See also Invasive Species*, IUCN, https://www.iucn.org/theme/species/our-work/invasive-species/, [https://perma.cc/HS66-LRN6] (defining invasive species).

122 *Ballast Water Management*, INT'L MARITIME ORG., http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx, [https://perma.cc/6AGV-DKXX].

the outside of a vessel in one location and are carried by the ship to another location ("hull-fouling" or "biofouling").[123] Invasive species can transform marine habitats and cause significant economic impacts, including diminishing fisheries.[124] Once invasive species are established in marine habitats, "it can be nearly impossible to eliminate them."[125] Modelers predict Arctic waters will have the largest rate of species invasion, with a modeled invasion intensity of nearly five and a half times the global marine average.[126] Researchers posited that relatively "low initial species richness" in the Arctic led to "high biodiversity impact" in polar regions.[127] With respect to invasive species transmitted by vessels, risk is highest where ships travel routes that join seas with similar environments, such as the Northern Sea Route, which connects the North Pacific and the North Atlantic.[128]

IV. STEPS FORWARD: ADVANCES IN THE MANAGEMENT OF ARCTIC VESSEL TRAFFIC SINCE 2012

Stakeholders and regulators have already taken important steps to mitigate threats posed by increasing vessel traffic in the

123 Int'l Maritime Org., *Biofouling*, http://www.imo.org/en/OurWork/Environment/Biofouling/Pages/default.aspx (last visited Nov. 1, 2019) [https://perma.cc/B226-QRZQ].
124 Jennifer L. Molnar, Rebecca Gamboa, Carmen Revenga & Mark Spaulding, *Assessing the global threat of invasive species to marine biodiversity*, 6 FRONTIERS IN ECOLOGY & THE ENV'T, 485, 485 (2008), https://pdfs.semanticscholar.org/d0be/4fa91c637e06175f158251f11837e4a40cfa.pdf [https://perma.cc/VNL3-ZVVM].
125 *Id*. at 485.
126 William W.L. Cheung, Vicky W. Y. Lam, Jorge L. Sarmiento, Kelly Kearney, Reg Watson & Daniel Pauly, *Projecting global marine biodiversity impacts under climate change scenarios*, 10 FISH & FISHERIES 235, 243 (2009).
127 *Id.* at 243.
128 Chris Ware Jørgen Berge, Anders Jelmert, Steffen M. Olsen, Loïc Pelliser, Mary Wisz, Darren Kriticos, Georgy Semenov, Slowomir Kwashieski & Inger G. Alsos, *Biological introduction risks from shipping in a warming Arctic*, 53 J. OF APPLIED ECOLOGY 340, 347 (2015), https://besjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/1365-2664.12566 [https://perma.cc/LX8R-T5HG].

Arctic. The following section summarizes measures, implemented since 2012, intended to increase safety and reduce environmental impacts associated with vessel traffic in Arctic waters. It also discusses additional mitigation measures under active consideration and in one case, a suite of measures that was rescinded before it could be implemented.

A. The International Maritime Organization Adopted a New Polar Code

One of the biggest developments in Arctic shipping regulation since 2012 has been implementation of the International Maritime Organization's (IMO) International Code for Ships Operating in Polar Waters (Polar Code), which began in January 2017.[129] The Polar Code establishes provisions designed to increase safety and reduce environmental impacts of ship traffic in high-latitude waters, including Arctic waters. Like other IMO conventions, the Polar Code is enforced by individual nations, including the nation under which a vessel is registered (i.e., the "flag state") and nations where the vessel makes port calls (via "port-state control"). Various parts of the shipping industry itself—including insurance providers and classification societies—also help enforce the Polar Code and other IMO mitigation measures.

The Polar Code's environmental provisions include pollution restrictions above and beyond those that apply in non-polar waters. These include additional restrictions on the discharge of oil, noxious liquid substances, harmful substances, sewage, and garbage.[130] Likewise, the Polar Code's safety provisions include

[129] Int'l Maritime Org., *Shipping in polar waters—Adoption of an international code for safety for ships operating in polar waters (Polar Code)*, http://www.imo.org/en/MediaCentre/HotTopics/polar/Pages/default.aspx, [https://perma.cc/UYF7-3NNG] (last visited Nov. 1 2019) (noting Polar Code entered into force January 1, 2017).

[130] Int'l Maritime Org., International Code for Ships Operating in Polar Waters, part II-A, ch. 1–5, MEPC 68/21/Add.1 (Nov. 21, 2014)

special requirements related to ship design and construction, equipment, operating and training requirements, communications, voyage planning, and other elements designed to improve safety of vessels in high-latitude waters.[131] Sometimes safety and environmental protection measures blend together. For example, voyage planning provisions are categorized under safety, but require mariners to consider information that could help minimize impacts to marine mammals, such as location of marine mammal aggregation and seasonal migration areas.[132] Mariners and other stakeholders are working to determine how best to apply these mandatory marine mammal voyage planning provisions in U.S. Arctic waters.

Adoption of the Polar Code was a significant step forward, but it did not resolve all challenges related to vessel traffic in high-latitude waters. The Polar Code's safety provisions, for example, do not apply to fishing vessels, smaller cargo ships, pleasure yachts, military vessels and other less common vessel types.[133] Its environmental provisions do not regulate discharge of graywater and do not prohibit use or carriage for use of heavy fuel oil in Arctic

http://www.imo.org/en/MediaCentre/HotTopics/polar/Documents/POLAR%20CODE%20TEXT%20AS%20ADOPTED.pdf, [https://perma.cc/57Z4-WFD6](hereinafter Polar Code).

131 Id. at part I-A; ch. 1–12, http://www.imo.org/en/MediaCentre/HotTopics/polar/Documents/POLAR%20CODE%20TEXT%20AS%20ADOPTED.pdf.[https://perma.cc/57Z4-WFD6],\.

132 *Id.* at part I-A, ch. 11.3.6.

133 The Polar Code's safety provisions apply only to vessels subject to the International Convention for the Safety of Life at Sea (SOLAS). *See* DNV-GL, *The IMO Polar Code in force, beginning 1 January 2017: How to comply* (Dec. 21, 2016), https://www.dnvgl.com/news/the-imo-polar-code-in-force-beginning-1-january-2017-how-to-comply-83230, [https://perma.cc/D3Y2-J7V5]. SOLAS does not apply to certain types of smaller vessels. International Martime Organization, *Int'l Convention for the Safety of Life at Sea* (as amended) *(SOLAS)*, Nov. 1, 1974, 32 U.S.T. 47, 1226, Ch. 1 Part A, Reg. 3 (listing vessels to which SOLAS does not apply).

waters.[134] The Polar Code does little to address impacts from vessel-related noise or the threat of invasive species in Arctic waters. While it sets forth broad management measures for polar waters, it does not impose granular area-based management measures such as specific vessel routing measures or specific areas where discharges or emissions should be subject to more stringent regulations. In short, while adoption of the Polar Code was a positive development, it is not the final word on management of vessel traffic in Arctic waters.

B. IMO Approved New Areas to be Avoided and Traffic Routes Around the Aleutian Islands and in the Bering Strait, and Additional Measures are Under Consideration

In U.S. Arctic waters, several routing measures have been implemented since 2012 and others are underway. Routing measures include, among other things, different types of formal vessel traffic lanes as well as "Areas to be Avoided" (ATBAs). As the name implies, ATBA designation encourages vessels to steer clear of defined areas to avoid navigational hazards or to safeguard environmentally sensitive areas.[135]

[134] The Polar Code encourages mariners to discontinue use of heavy fuel oil in the Arctic but does not require them to do so. *See* Polar Code, Part II-B, Ch. 1.1.

[135] Int'l Maritime Org., *General Provisions on Ships' Routeing*, § 2.1.12 (defining "area to be avoided" as "a routeing measure comprising an area within defined limits in which either navigation is particularly hazardous or it is exceptionally important to avoid casualties and which should be avoided by all ships, or certain classes of ship"). *See also* Int'l Maritime Org., *Guidance Note on the Preparation of Proposals on Ships' Routeing Systems and Ship Reporting Systems for Submission to the Sub-Committee on Safety of Navigation*, § 1.2 (2003) (noting that ships routeing measures may be used to "increase the protection of the marine environment"), http://www.imo.org/en/OurWork/Safety/Navigation/Documents/Ships'%20routeing/MSC.1-Circ.1060-asAmended-consolidated-Guidance%20Note%20on%20the%20Preparation%20of%20Proposals%20onShipsRouteingReporting.pdf, [https://perma.cc/363R-W8JF].

Waters surrounding the Aleutian Islands—in the southern Bering Sea and North Pacific—were the first in the U.S. Arctic to benefit from routing measures. The IMO approved five ATBAs in the region, which took effect at the beginning of 2016.[136] After establishment of the five ATBAs in waters surrounding the Aleutian Islands, attention turned to the Bering Strait region.

In 2010, the U.S. Coast Guard embarked on a maritime planning process, called a Port Access Route Study (PARS), to determine whether the Bering Strait region might benefit from formal vessel traffic lanes.[137] Toward the conclusion of that process in 2016, the Coast Guard recommended designating formal vessel traffic lanes and specific ATBAs in the region.[138] In 2018, those recommendations bore fruit when the IMO approved a joint proposal from the United States and Russia to designate recommendatory two-way vessel routes that extend well south, and slightly north, of the Bering Strait itself.[139] The routes are safe for

[136] North of England P&I Assn., Ltd., *USA: IMO Adopt the Establishment of five 'Areas to Be Avoided' (ATBA) in the Aleutian Islands* (June 25, 2015), http://www.nepia.com/insights/industry-news/usa-imo-adopt-the-establishment-of-five-%E2%80%98areas-to-be-avoided%E2%80%99-(atba)-in-the-aleutian-islands/, [https://perma.cc/F5XG-Y6Y3]. *See also* Int'l Maritime Org., Sub-committee on Navigation, Communication and Search and Rescue, *Routeing Measures and Mandatory Ship Reporting Systems: Establishment of five areas to be avoided in the region of the Aleutian Islands, Submitted by the United States* (Dec. 5, 2014) (describing U.S. proposal for Aleutian Island areas to be avoided), http://www.nepia.com/media/258601/IMO-NCSR-2-3-5-Adopt-the-Establishment-of-Five-Areas-to-be-Avoided.pdf, [https://perma.cc/K3M8-KFNB].

[137] *See generally*, U.S. Coast Guard, *Port Access Route Study: In the Bering Strait*, 75 Fed. Reg. 68, 568 (Nov. 8, 2010) (announcing vessel routing study for the Bering Strait region and requesting public comment).

[138] U.S. Coast Guard, *Preliminary Findings: Port Access Route Study: In the Chukchi Sea, Bering Strait, and Bering Sea, 22-36* (Dec. 23, 2017), https://www.navcen.uscg.gov/pdf/PARS/Bering_Strait_PARS_General.pdf, [https://perma.cc/MD6B-89BY] (hereinafter *Preliminary Findings*).

[139] The Maritime Executive, *IMO Authorizes New Bering Sea Routing* (May 26, 2018), https://www.maritime-executive.com/article/imo-authorizes-new-bering-

all types of vessels and are designed to keep ships away from potentially hazardous coastlines and shoaling waters.[140] Encouraging ships to follow these routes improves predictability and safety and enhances environmental protection.[141] In addition to the establishment of these two-way routes, the IMO also designated three ATBAs in the Bering Strait region in 2018; one each around St. Lawrence, Nunavik, and King islands.[142] The United States proposed these Bering Strait-region ATBAs to help improve shipping safety, protect the marine environment, and safeguard subsistence activities.[143]

Beyond the ATBAs designated in 2018, officials from the United States and Russia have discussed the potential for the two countries to jointly propose a transboundary ATBA designed to improve safety and protect waters around Big and Little Diomede

sea-routing, [https://perma.cc/76YE-QKHQ]. *See also* Int'l Maritime Org. Sub-committee on Navigation, Communication and Search and Rescue, *Routeing Measures and Mandatory Ship Reporting Systems: Establishment of two-way routes and precautionary areas in the Bering Sea and Bering Strait, Submitted by the Russian Federation and the United States* §§ 3.5 & 8.5 (Nov. 17, 2017) (describing joint U.S. and Russian proposal for vessel traffic lanes), https://www.navcen.uscg.gov/pdf/IMO/NCSR_5_3_7.pdf, [https://perma.cc/Q6WJ-EC7X].

140 *Id.*

141 *Id.* at § 3.

142 *See* Int'l Maritime Org., *Sub-Committee on Navigation, Communications and Search and Rescue (NCSR), 5th session, February 19-23, 2018*, (Feb. 23, 2018), http://www.imo.org/en/MediaCentre/MeetingSummaries/NCSR/Pages/NCSR5.aspx, [https://perma.cc/D6GA-VQ3Q] (noting subcommittee's agreement to "establish three areas to be avoided in the Bering Sea, proposed by the United States, to improve safety of navigation and protect the fragile and unique environment"). The United States originally proposed a substantially bigger ATBA that would have encompassed a large area south of St. Lawrence Island. The IMO subcommittee that evaluated the proposal opted not to include these southern waters when it approved the St. Lawrence Island ATBA because some subcommittee members felt that it was inappropriate to designate such a large area in the absence of more direct concerns about navigation and ship safety.

143 Henry Huntington et al., *The role of areas to be avoided in the governance of shipping in the greater Bering Strait region*, MARINE POLICY § 4.3 (May 2019), https://doi.org/10.1016/j.marpol.2019.103564, [https://perma.cc/VR35-WLZ6].

Islands, which are located in the middle of the Bering Strait.[144] Big Diomede Island is part of Russia and Little Diomede Island is part of the United States. The United States Coast Guard went as far as recommending designation of an ATBA around Little Diomede Island in 2016.[145] However, instead of moving forward with a unilateral proposal at the IMO, the United States opted to explore the potential of a joint Russian/U.S. ATBA that would surround both Diomede Islands. As of this writing, discussions between the U.S. and Russia are still ongoing.

In late 2018, the U.S. Coast Guard announced the start of a new PARS for the Alaskan Arctic Coast, covering U.S. portions of the Chukchi and Beaufort seas.[146] In undertaking the study, the Coast Guard plans to "analyze current vessel patterns, predict future vessel needs and balance the needs of all waterway users by developing and recommending vessel routing measures for the Arctic coast."[147] While the Coast Guard expects to take more than four years to complete the Alaskan Arctic Coast PARS,[148] the process could eventually lead to the creation of ATBAs adjacent to the Chukchi and Beaufort Sea coasts, designated traffic lanes to guide large vessels as they pass through the region, and/or additional mitigation measures designed to increase safety and minimize impacts to the marine ecosystem and subsistence hunting.[149] The PARS process gives Indigenous residents of Arctic communities and other stakeholders an opportunity to contribute input that may help shape the study and any recommended outcomes.[150]

144 *Id.* at 6.
145 Preliminary Findings, *supra* note 138, at 22, 30-31.
146 Port Access Route Study: *Alaskan Arctic Coast*, 83 Fed. Reg. 65,701, 65,701 (Dec. 21, 2018).
147 *Id.* at 65,702.
148 *Id.*
149 *See id.* (noting that the Coast Guard is undertaking the study in part to develop and recommend vessel routing measures for the Arctic coast).
150 *See id.* at 65,701 (requesting public comment) and 65,702 (noting that the study may take more than four years in part because of challenges related to

C. Stakeholders Formed New Non-Regulatory Bodies, Including the Best Practices Information Forum and Two Waterways Safety Councils

Over the past five years, maritime stakeholders established new voluntary, non-regulatory bodies to gather and disseminate information related to shipping in Arctic waters which have relevance to the Bering Strait. These new bodies include the Arctic Shipping Best Practices Information Forum, the Arctic Waterways Safety Committee, and the Aleutian Island Waterways Safety Committee.

The Arctic Shipping Best Practices Information Forum was formed in 2017 in an effort to help implement the Polar Code.[151] The Forum is designed to heighten awareness of Polar Code provisions among those mariners who operate in Arctic waters, as well as others who may be affected by maritime operations in the Arctic.[152] The Forum also works to promote "the exchange of information and best practices between the Forum participants on specific shipping topics, including but not limited to; hydrography, search and rescue logistics, industry guidelines and ship equipment, systems and structure."[153] The Best Practices Information Forum developed as a project of the Arctic Council's Protection of the Arctic Marine Environment (PAME) working group. Participation in the Forum "is open to Arctic States, Permanent Participants and Arctic Council Observers," as well as other professional organizations that have

"accessing and communicating with regional stakeholders at times when discussions will be most productive.").

[151] Prot. of the Arctic Marine Env't Working Grp., *The Arctic Shipping Best Practice Information Forum* (undated), https://www.pame.is/index.php/projects/arctic-marine-shipping/the-arctic-shipping-best-practices-information-forum (last visited Aug. 27, 2019), [https://perma.cc/NP6A-HH7X].

[152] *Id.*

[153] *Id.*

relevant expertise and experience and that work to promote shipping safety and protection of the marine environment in the Arctic.[154] To date, the Forum has served primarily as a venue for information sharing; in the future, it may evolve to serve additional functions.

In addition to the Arctic Shipping Best Practices Information Forum, which covers the global Arctic, maritime users have established two voluntary, multi-stakeholder groups that focus on waters off the coast of Alaska. The Arctic Waterway Safety Committee was established in 2014 and covers U.S. portions of the Beaufort and Chukchi seas, as well as the Bering Strait and northern Bering Sea.[155] The Aleutian Islands Waterways Safety Committee was established in 2017 and covers U.S. waters around the Aleutian Islands chain and the southern portion of the Bering Sea, including waters around the Pribilof Islands.[156] The two committees are modeled after Harbor Safety Committees that operate in various marine areas in the lower 48 states.[157] They facilitate exchange of information and establishment and dissemination of best practices and standards of care relevant to their regions. This is in an effort to promote safety, protect the marine environment, and reduce conflicts among maritime users.[158] While the two committees are

154 *Id.*
155 *Our Work*, ARCTIC WATERWAYS SAFETY COMM., http://www.arcticwaterways.org/attorneys-1.html [https://perma.cc/FX9L-PTLR].
156 *About*, ALEUTIAN ISLANDS WATERWAYS SAFETY COMM.
157 *See generally* U.S. Coast Guard, NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 1-00: GUIDANCE FOR THE ESTABLISHMENT AND DEVELOPMENT OF HARBOR SAFETY COMMITTEES UNDER THE MARINE TRANSPORTATION SYSTEM (MTS) INITIATIVE (undated), (describing Harbor Safety Committees).
158 *See Our Work*, ARCTIC WATERWAYS SAFETY COMM., http://www.arcticwaterways.org/attorneys-1.html, [https://perma.cc/FX9L-PTLR]. (describing mission of Arctic Waterways Safety Committee); *see also* Aleutian Islands Waterways Safety Comm., ALEUTIAN ISLANDS WATERWAYS SAFETY PLAN 5 (May 2019), https://docs.wixstatic.com/ugd/cd25fe_0f4f7dff15fb429c8b26dd4456d3f05b.pdf [https://perma.cc/SXW7-A7UH] (describing purpose and mission of Aleutian Islands Waterways Safety Committee).

structured somewhat differently, both include members representing a wide range of maritime sectors and stakeholders, including various commercial shipping operators and subsistence or Alaska Native interests.[159] Representatives from federal, state and local agencies participate in and support the work of both Committees.[160]

The two Alaskan waterways safety committees are forums in which waterway users can identify concerns and work toward collaborative, non-regulatory solutions. For instance, the Arctic Waterways Safety Committee focused on reducing conflicts between Indigenous hunters and researchers operating in Arctic waters, eventually developing and adopting a standard of care for research vessels.[161] While the research vessel standard of care is non-binding, it has been adopted by at least some Arctic researchers.[162] The Aleutian Islands Waterways Safety Committee recently developed and adopted a "Waterways Safety Plan" with standards of care and protocols which "are intended to complement and supplement federal, state and local law, regulations and guidelines."[163]

159 *Membership*, ARCTIC WATERWAYS SAFETY COMM., http://www.arcticwaterways.org/membership.html, [https://perma.cc/GC9Z-DR7R]; *see also Organization Framework & Biographies*, ALEUTIAN ISLANDS WATERWAYS SAFETY COMM., https://www.aleutianislandswsc.org/membership-framework, [https://perma.cc/KH7M-5MYU] (describing membership structure of committees). Co-author Andrew Hartsig is a member of the Aleutian Island Waterways Safety Committee representing conservation organizations.
160 *Id*.
161 *See generally* Arctic Waterways Safety Comm., WATERWAYS SAFETY PLAN PART 3 (Dec. 5, 2018), http://www.arcticwaterways.org/safety-plan.html, [https://perma.cc/R73M-T3YS].
162 Ian Evans, *Avoiding Clashes Between Ocean Researchers and Indigenous Communities*, OCEANS DEEPLY (Oct. 12, 2017), https://www.newsdeeply.com/oceans/community/2017/10/12/avoiding-clashes-between-ocean-researchers-and-indigenous-communities, [https://perma.cc/737Z-5YF6].
163 ALEUTIAN ISLANDS WATERWAYS SAFETY PLAN, *supra* note 155, at 5.

While development of these two safety committees represents a step forward, opportunities for improvements remain. The structure of the Arctic Waterways Safety Committee, for example, has been criticized for not adequately including Tribes, and an important regional tribal organization recently withdrew from participating in the Committee for this reason.[164] As the Committee continues to evolve, it should consider changing its membership structure to ensure relevant Tribes are properly represented.

D. The Northern Bering Sea Climate Resilience Area Was Established – And Then Revoked

In 2016, after years of work by Indigenous communities, President Obama signed an Executive Order creating the Northern Bering Sea Climate Resilience Area (NBSCRA).[165] The Executive Order set aside the Northern Bering Sea region as a unique place, home to rich peoples and cultures, and in need of a special governance structure and protections. It created a mandate for federal agencies working in the region to coordinate with one another and to give attention to the "rights, needs and knowledge" of Alaska Native Tribes in the region as well as the "delicate and unique" ecosystem.[166] It also created a Federal Bering Task Force to facilitate coordination between federal agencies and a Bering Sea Intergovernmental Tribal Advisory Council to provide input to the Task Force on behalf of Alaska Native Tribes.[167]

The Executive Order contained specific directives aimed at various industries that could adversely affect ecological values or

[164] *See* Letter from Kawerak, Inc. to Willie Goodwin, Chairman, Arctic Waterways Safety Committee (Jan. 23, 2019) (on file with author).
[165] *See generally* Northern Bering Sea Climate Resilience, Exec. Order No. 13754 of Dec. 9, 2016, 81 Fed. Reg. 90,669, 90,669–74 (Dec. 14, 2016).
[166] *Id.* at 90,669.
[167] *Id.* at 90,670–71.

opportunities for subsistence hunting and fishing in the region. These included a permanent withdrawal of the region from oil and gas development[168] and reinforcement of an existing fishing measure that closes the region to bottom trawling.[169] The Executive Order also required all federal agencies to consider traditional knowledge in decision-making, and directed additional work to address pollution from vessels, consider routing measures for ships, and bolster oil spill preparedness.[170]

President Trump revoked the Executive Order soon after he took into office,[171] so the Northern Bering Sea Climate Resilience Area no longer exists as such. It could, however, be reinstated and still serves as a potential model for coordinated management that includes a substantial role for Indigenous People.

V. LOOKING AHEAD: ADDITIONAL MANAGEMENT MEASURES ARE NEEDED TO SAFEGUARD THE ARCTIC FROM THE IMPACTS OF INCREASING VESSEL TRAFFIC AND RAPID CLIMATE CHANGE

As the foregoing sections show, there has been progress in implementing regulations, adopting recommendatory measures, and establishing forums designed to promote better vessel traffic practices, both in Arctic waters broadly and in the U.S. Arctic and Bering Strait region in particular. Although short-lived, the Northern Bering Sea Climate Resilience Area was a notable attempt to develop an entirely new governance structure that would address concerns related to growing vessel traffic and impacts from other

168 *Id.* at 90,670.
169 *Id.* at 90,672
170 *Id.* at 90,671–72.
171 Implementing an America-First Offshore Energy Strategy, Exec. Order 13795, 82 Fed. Reg. 20,816, 20,816–18 (May 3, 2017). President Trump's reversal of the Northern Bering Sea Climate Resilience Area underscores the vulnerability of executive orders, which are easily reversed by future Presidents. The use of an Executive Order to create the Northern Bering Sea Climate Resilience Area also highlights the lack of other mechanisms that could accommodate the formation of this unique governance structure.

sectors while amplifying the role Indigenous Peoples play in the management of the Bering Strait region.

These have been significant steps forward, and we do not intend to minimize their importance. At the same time, more must be done to implement shipping measures that promote safety, minimize conflicts with subsistence users, and reduce risk to the marine environment. These necessary actions must occur in the context of broader improvements in the management of Arctic resources.

The following sections emphasize the need for holistic management in the face of a rapidly changing climate; describe more granular shipping-focused mitigation actions designed to improve safety, reduce the threat of oil spills, decrease harmful discharges, and reduce other vessel-related impacts to the Arctic marine ecosystem; and examine opportunities to curb vessel emissions in Arctic waters and beyond—for the benefit of the Arctic marine ecosystem and the entire ocean.

A. The Need for Holistic and Inclusive Governance in the Arctic – and the Need to Look Beyond Arctic Shipping to Address Global Climate Change

Thus far, this Article has focused on managing the risks of increasing vessel traffic in U.S. Arctic waters. While the risks associated with increasing vessel traffic are substantial on their own, they exist in conjunction with profound and rapid climate change and hazards associated with the expansion of other commercial activities. These activities and changes necessitate holistic, inclusive management for the region's natural resources.

It is impossible to consider measures intended to address threats posed by shipping in the Arctic without acknowledging the broader context of climate change. As explained earlier, climate change is having substantial and disproportionate impacts on Arctic ecosystems and communities. Simply addressing emissions from

shipping, while necessary, will be insufficient to address the global problem. Rather, global action to reduce emissions is urgently needed. The recent U.S. Climate Assessment[172] and the IPCC 1.5° report[173] make clear that each sector that contributes to climate change must do its part to drive systemic change. At a global scale, all nations must work together to reduce greenhouse gas emissions. Reducing or eliminating emissions from shipping must be part of that action.

Moreover, changing climate and the growth in vessel traffic will likely be accompanied by commercial fishing and offshore oil and gas exploration expanding to new areas in the Arctic. Successful management will require a comprehensive approach that coordinates across a full range of uses, agencies, and stakeholders. Currently, more than twenty federal agencies have management responsibilities in the Arctic.[174] Sovereign tribal governments, state and municipal governments and other tribal organizations, including co-management bodies, have governance responsibilities, and many other commercial, recreational, and conservation stakeholders have a stake in the region as well.[175]

This siloed management is ineffective and often results in analyses that fail to consider potential cumulative impacts of commercial and industrial uses—together with climate change—in a comprehensive way.[176] An integrated approach is needed to

[172] *See generally* U.S. Global Change Res. Program, FOURTH NATIONAL CLIMATE ASSESSMENT VOLS. I & II (NCA4) (2018).
[173] *See generally* Intergovernmental Panel on Climate Change, SPECIAL REPORT: GLOBAL WARMING OF 1.5°C. (2018).
[174] Joel Clement et. al., MANAGING FOR THE FUTURE IN A RAPIDLY CHANGING ARCTIC: A REPORT TO THE PRESIDENT, 32 (2013), https://www.afsc.noaa.gov/publications/misc_pdf/iamreport.pdf, [https://perma.cc/S7C9-DUTV].
[175] *Id.* at 1.
[176] *Id.* at 38 (noting the "largely balkanized management system for the Arctic" is straining to cope with a rapidly changing region and growing "economic, environmental, cultural, and social expectations.").

improve efficiencies, work across jurisdictional boundaries, and consider and manage for cumulative impacts across uses.[177]

In developing comprehensive management for the region, Tribes must have meaningful involvement in decision-making.[178] Bering Strait region "[T]ribes have a strong desire to be direct participants in the design, justification and implementation of protections."[179] However, there is currently no formal role in management, either domestically or at the IMO, for Tribes.[180] Utilizing Traditional Knowledge in management decisions is also key, and provides a wealth of information. According to Julie Raymond-Yakoubian, a social scientist with Kawerak, Inc. and a leading scholar on the co-production of knowledge:

> If indigenous communities are consulted and included in decision-making this vast body of Traditional Knowledge will be accessible and can be used to formulate effective monitoring and management of vessel traffic and other activities in the region. Indigenous communities must be meaningfully and equitably involved in order for this to be successful.[181]

As noted above, the NBSCRA offered one potential model for an inclusive and coordinated governance structure for the region that includes a meaningful role for Tribes. While the Executive Order did not do everything the Tribes requested, it was a significant

177 *Id.* at 2-3.
178 *Arctic Vessel Traffic and Indigenous Communities*, *supra* note 9, at 290–91.
179 *Conceptual and institutional Frameworks*, *supra* note 8, at 97–98.
180 *See* Levon Sevunts, *World maritime body presents Polar Code to Arctic Council meeting in Alaska*, RADIO CANADA INTERNATIONAL (March 10, 2017), http://www.rcinet.ca/eye-on-the-arctic/2017/03/10/world-maritime-body-presents-polar-code-to-arctic-council-meeting-in-alaska/, [https://perma.cc/6L9J-ZJ7X].
181 *Arctic Vessel Traffic and Indigenous Communities*, *supra* note 9, at 292.

step forward for coordinated management with a role for Tribes and serves as an example of what a coordinated, inclusive management structure might look like in the Bering Strait region.

Canada's Indigenous Protected Areas offer another example of a coordinated, inclusive governance structure with Indigenous management at its core. "Indigenous Protected Areas [IPAs] are based on the idea of a protected area explicitly designed to accommodate and support an Indigenous vision of a working landscape."[182] They provide for conservation measures while also prioritizing hiring of Indigenous People via monitoring and guardian programs. They also provide a means for healing and reconciliation by supporting communities and individuals in regaining land-based life skills, reconnecting youth with their cultural traditions and language, collecting and documenting Indigenous knowledge, and guaranteeing that there will always be 'places that are theirs.'[183] Canada's first Indigenous Protected Area, the Edéhzhíe Protected Area in Fort Providence, NWT, was established by the Dehcho First Nations and the Canadian Government in 2018.[184] Inuit are leading development of several potential marine Indigenous Protected

[182] Mary Simon, *A New Shared Arctic Leadership Model*, INDIGENOUS AND NORTHERN AFFAIRS CANADA 19 (March 2017), http://publications.gc.ca/collections/collection_2017/aanc-inac/R74-38-2017-eng.pdf, [https://perma.cc/24TJ-P7BH].
[183] *Id.*
[184] Mieke Coppes, *For the first time in Canadian history, there is an official Indigenous protected area*, HIGH NORTH NEWS (Oct. 22, 2018), https://www.highnorthnews.com/en/first-indigenous-protected-area-designated-canada, [https://perma.cc/7NWY-5JFR].

Areas in the Arctic, including Imappivut in northern Labrador[185] and Pikialasorsuaq in northern Baffin Bay.[186]

Canadian law provides several other mechanisms for creating marine protected areas, including Marine Protected Areas, National Marine Conservation Areas, and National Wildlife Areas.[187] These mechanisms require federal agencies to negotiate with both Indigenous land claims organizations and Inuit communities to establish a protected area.[188] Under these provisions, the Government of Canada (Parks Canada), the Nunavut Government and the Qikiqtani Inuit Association agreed to establish Tallurutiup Imanga National Marine Conservation Area at the eastern entrance of the Northwest Passage.[189] Once formally established, Tallurutiup Imanga will be the largest marine protected area in Canada.[190] To date, a boundary has been negotiated, and the Canadian government and Qikiqtani Inuit Association have announced a package of conservation jobs and infrastructure benefits for the conservation area.[191] Collaborative management

185 Levon Sevunts, *Inuit traditional knowledge to guide marine management plan off Labrador coast*, RADIO CANADA INTERNATIONAL, (Sept. 29, 2017, 16:45) https://www.rcinet.ca/en/2017/09/29/inuit-traditional-knowledge-to-guide-marine-management-plan-off-labrador-coast/, [https://perma.cc/KMU9-3PDJ].

186 Dept. of Fisheries & Oceans Canada, *Pikialasorsuaq (North Water Polynya)* (Aug. 1, 2019), http://www.dfo-mpo.gc.ca/oceans/management-gestion/pikialasorsuaq-eng.html, [https://perma.cc/7ZFN-ATD5].

187 *Indigenous Protected Areas and Marine Conservation*, OCEANS NORTH, https://oceansnorth.org/en/what-we-do/indigenous-protected-areas-marine-conservation/, [https://perma.cc/5PE5-Y8Q6] (last visited August 27, 2019).

188 *Id.*

189 *Canada's newest and largest Marine Protected Area: Tallurutiup Imanga–Lancaster Sound*, IUCN (Aug. 31, 2017), https://www.iucn.org/news/protected-areas/201708/canada%E2%80%99s-newest-and-largest-marine-protected-area-tallurutiup-imanga-%E2%80%93-lancaster-sound, [https://perma.cc/89LZ-NHZY].

190 *Id*.

191 *National Marine Conservation Areas: Inuit Impact and Benefit Agreement*, PARKS CANADA (Aug. 1, 2019) https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga/entente-agreement, [https://perma.cc/J2S5-B982].

between Inuit and Canada, and ensuring benefits to Inuit in the region from the designation, are at the heart of the agreement.[192]

Canada's recognition of underlying rights for Indigenous Peoples is notably different than that of the Unites States.[193] While the underlying legal frameworks are different, the Canadian approaches serve as important examples that can inform efforts in the U.S., and these concepts could be applied with the appropriate enabling legislation.

B. Managing for Increasing Vessel Traffic in the U.S. Arctic: Improving Safety and Reducing Risks to the Marine Environment

Beyond comprehensive governance changes, regulators and stakeholders could act to put in place specific vessel traffic management measures that would go further to help prevent accidents, reduce the risks from oil spills, reduce air, water, and noise pollution, and protect marine mammals. This section outlines some of those measures.

See also Tallurutiup Imanga National Marine Conservation Area, PARKS CANADA (undated), https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga, [https://perma.cc/8Q7C-T97J].

[192] *Id*. *See also Tallurutiup Imanga National Marine Conservation Area*, PARKS CANADA (undated), https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga, [https://perma.cc/8Q7C-T97J].

[193] *See* Melanie Zurba et al., *Indigenous Protected and Conserved Areas (IPCAs), Aichi Target 11 and Canada's Pathway to Target 1: Focusing Conservation on Reconciliation* 8 Land 1, 4–6 (2019), https://doi.org/10.3390/land8010010, [https://perma.cc/7UC2-QKFV]. *Cf.* DAVID S. CASE & DAVID A. VOLUCK, ALASKA NATIVES AND AMERICAN LAWS 265–324 (3d ed. 2012).

1. Adopt Preventative Measures to Further Reduce the Risk of Vessel Accidents in the Arctic

Traveling by boat in the Arctic will always involve some degree of risk, both to mariners and passengers. Nonetheless, it is possible to implement additional measures designed to reduce the risk of maritime accidents that jeopardize human safety and—if such accidents do occur—improve the efficacy of response efforts. Measures could include designating additional formal vessel traffic routes, applying Polar Code safety provisions to a broader range of vessels, updating navigational charts, and supplementing vessel traffic monitoring systems.

As noted above, the IMO adopted ATBAs in the Aleutian Islands and the Bering Strait region and two-way vessel traffic lanes for the Bering Strait region. Additional routing measures could further enhance safety in the region. To that end, the United States and Russia should move forward with a joint proposal to designate a transboundary ATBA around the Diomede Islands in the middle of the Bering Strait. Such an ATBA could provide important safeguards to ships transiting the Strait by helping to ensure they keep a safe distance from the shores of these islands.

Stakeholders in the Beaufort and Chukchi seas should also take advantage of the U.S Coast Guard's PARS for the Alaskan Arctic Coast to consider whether designation of ATBAs and traffic lanes would improve safety in those waters. Among other things, designating formal traffic lanes could encourage more predictable vessel movement and could help ensure that designated routes are charted to modern standards and free from navigational hazards. Designation of ATBAs could encourage vessels to steer clear of potentially dangerous areas, or areas where large vessels may encounter Indigenous hunters in small craft. As stakeholders and regulators explore the potential for additional ATBAs, they should

consider the possibility of seasonal or dynamic ATBAs that adjust to changing conditions—either in real time or on a seasonal basis.[194] These options—particularly dynamic ATBAs—would require good data and communication among regulators, mariners and other affected stakeholders.[195] In all cases, identification of potential vessel traffic lanes and ATBAs should involve meaningful collaboration with Indigenous residents of the region to ensure their perspectives guide the process, along with other factors including safety and freedom of navigation.

In addition to improving safety through the identification and designation of additional vessel traffic lanes and ATBAs, the IMO should broaden key provisions of the Polar Code so that they apply to additional categories of vessels. As noted above, existing Polar Code safety provisions do not apply to fishing vessels, even though there are more fishing vessels operating in Arctic waters than any other category of vessel.[196] Some officials contemplated expanding the scope of the Polar Code to cover additional vessel types even before the current version of the Code took effect.[197] More recently, the IMO started to actively consider such an expansion. In a late-2018 meeting, the IMO's Maritime Safety Committee agreed on a "roadmap" that could result in adoption of

194 Siders et al., *supra* note 16, at 181–83.
195 *Id*.
196 Hendrik Schopmans, *Revisiting the Polar Code: Where Do We Stand? Arctic Institute*, CTR. FOR CIRCUMPOLAR SECURITY STUDIES (June 11, 2019). https://www.thearcticinstitute.org/revisiting-polar-code/, [https://perma.cc/C3GW-DEGX].
197 *See, e.g.*, Craig H. Allen, *Polar Code rings in the New Year for Arctic shipping*, PAC. MARITIME MAG. (Dec. 1, 2016) https://www.pacmar.com/story/2016/12/01/features/polar-code-rings-in-the-new-year-for-arctic-shipping/474.html, [https://perma.cc/AE83-A8YM] (noting that in 2015, a U.S. State Department official "suggested that the IMO member-states may review whether to extend the Code's safety measures to non-SOLAS vessels" including fishing vessels and other smaller vessels).

revisions to the Polar Code and/or SOLAS by 2022.[198] In 2019, the Committee tasked a subcommittee with considering "the consequences and feasibility" of applying key chapters of the Polar Code to additional categories of vessel.[199] At the same meeting, the Committee approved a draft resolution urging IMO Member States to voluntarily implement "safety measures of the Polar Code on ships not certified under the SOLAS Convention."[200] The IMO Assembly will consider adopting the draft resolution in late 2019.[201]

Improvements to information infrastructure could also bolster maritime safety in the Arctic. Less than two percent of U.S. Arctic waters have been charted using modern survey methods.[202] Updates to nautical charts in the U.S. Arctic should be prioritized and accelerated. Recent years have witnessed significant advances in the use of automatic identification system (AIS) technologies, which use VHF and satellites to transmit information about a vessel's location and other information from the vessel to shore and to other vessels, in real-time or near real-time. At present, AIS is used to avoid collisions between vessels, monitor vessel traffic in U.S. Arctic waters, and encourage regulatory compliance.[203] AIS

198 Int'l Maritime Org., Maritime Safety Comm. (MSC), 100th session, 3–7 Dec. 2018. http://www.imo.org/en/MediaCentre/MeetingSummaries/MSC/Pages/MSC-100th-session.aspx, [https://perma.cc/B9EY-USAR].

199 Int'l Maritime Org., Maritime Safety Comm. (MSC), 101st session, 5–14 June 2019. http://www.imo.org/en/MediaCentre/MeetingSummaries/MSC/Pages/MSC-101st-session.aspx, [https://perma.cc/UBX9-J47Y].

200 *Id*.

201 *Id*.

202 Comm. on the Marine Transp. Sys., A TEN-YEAR PRIORITIZATION OF INFRASTRUCTURE NEEDS IN THE U.S. ARCTIC 12 (Apr. 15, 2016), https://www.cmts.gov/downloads/NSAR_1.1.2_10-Year_MTS_Investment_Framework_Final_5_4_16.pdf, [https://perma.cc/HYY8-8KYQ].

203 *See, e.g.*, *Monitoring Center*, ALASKA MARITIME PREVENTION & RESPONSE NETWORK, https://www.alaskaseas.org/vessel-monitoring/monitoring-center/, [https://perma.cc/654X-AZ7D] (describing use of AIS to monitor vessel traffic

systems, however, are capable of much more. A Coast Guard research and development program explored the viability of using AIS to transmit relevant safety and navigation information to ships in real-time, on an as-needed basis.[204] This could include information about the presence of subsistence hunters or dangerous weather conditions, among other things.[205] The Coast Guard should facilitate these advances in navigation technologies to improve communication and safety in Arctic waters.

2. Reducing the Risk from Oil Spills in Arctic Waters

As noted above, the vast majority of vessels operating in Arctic waters use some form of oil to power their engines. Some of these vessels run on heavy fuel oil, which poses a particular threat when spilled.[206] Some of these vessels carry large volumes—up to 100,000 barrels—of oil-based fuel as cargo,[207] and some engage in lightering operations that transfer fuel from one ship to another. All of these vessels and operations contribute to the risk of a potentially catastrophic oil spill in Arctic waters, and all point to the need to adopt additional measures to minimize that risk.

If implemented, many of the recommendations from the previous section would decrease the likelihood of oil spills. Designation of additional vessel traffic lanes and ATBAs can reduce

to aid compliance and identify deviations and emergencies); *see also Superior vessel tracking with state of the art vessel monitoring*, 1-CALL ALASKA: A RESOLVE COMPANY, https://1callalaska.com/services/vessel-tracking/, [https://perma.cc/2Z44-4WGJ] (describing vessel monitoring system).

[204] Irene Gonin & Gregory Johnson, *Alaska AIS Transmit Prototype Test, Evaluation, and Transition Summary Report*, U.S. COAST GUARD ACQUISITION DIRECTORATE: RES. & DEV. CTR. (Oct. 2018).

[205] *See id.*, at 27, 30.

[206] Bryan Comer & Naya Olmer, *Heavy fuel oil is considered the most significant threat to the Arctic. So why isn't it banned yet?,* INT'L COUNCIL ON CLEAN TRANSP. (Sept. 15, 2016), https://theicct.org/blogs/staff/heavy-fuel-oil-considered-most-significant-threat-to-arctic, [https://perma.cc/H6L7-53B6].

[207] BERING SEA RISK ANALYSIS, *supra* note 25, at 52.

the chance of accidents by making traffic patterns more predictable, keeping ships away from dangerous areas, and helping ships stay in waters that have been charted to modern standards.[208] Moreover, to the extent that additional ATBAs and vessel traffic routes encourage vessels to stay away from ecologically sensitive areas, these measures could help minimize impacts from any oil spills that do occur. Although oil spilled in the marine environment will move with wind and currents, thoughtfully-designed vessel traffic lanes and ATBAs could help keep oil from reaching environmentally sensitive areas.

Beyond the measures discussed in the previous section, there are other ways to reduce the risk from oil spills in the Arctic. Eliminating the use of heavy fuel oil is one such measure.[209] Vessels are already prohibited from using heavy fuel oil in Antarctic waters[210] and the Polar Code recommends—but does not require—that mariners avoid using heavy fuel oil in the Arctic.[211] In 2017, the IMO's Marine Environment Protection Committee agreed to develop measures designed to reduce the risks of the use of heavy fuel oil as fuel by ships in Arctic waters.[212] The following year, a group of member countries, led by Finland, proposed banning heavy fuel oil as a shipping fuel in Arctic waters. The proposal noted that a single heavy fuel oil spill "could have devastating and lasting effects on fragile Arctic marine and coastal environments," and that

[208] *See supra* Part V.B.I (discussing benefits of ATBAs).
[209] Det Norske Veritas, REPORT: HEAVY FUEL IN THE ARCTIC (PHASE 1) 2 (2011), https://www.pame.is/images/03_Projects/HFO/HFO_in_the_Artic_Phase_I.pdf, [https://perma.cc/6TW3-EFTW] (noting that due to the particular properties of heavy fuel oil, "significant risk reduction will be achieved" by switching from heavy fuel oil to distillate fuel-types in the Arctic).
[210] MARPOL, *supra* note 85, at Annex 1, Reg. 43, Ch. 9, "Special Requirements for the Use or Carriage of Oils in the Antarctic Area."
[211] POLAR CODE, *supra* note 130, at Part II-B, Ch. 1.1.
[212] *See, e.g.*, Int'l Maritime Org, Marine Env't Prot. Comm. (MEPC), 71st session, 3–7 July 2017, http://www.imo.org/en/MediaCentre/MeetingSummaries/MEPC/Pages/MEPC-71.aspx, [https://perma.cc/DHR2-NNFW].

a ban on heavy fuel oil "should be implemented as soon as possible."[213] In its October 2018 meeting, the Marine Environment Protection Committee tasked a subcommittee with developing "a ban on heavy fuel oil for use and carriage as fuel by ships in Arctic waters, based on an assessment of the impacts of such a ban."[214] The IMO should finalize, adopt, and implement a ban on heavy fuel oil in Arctic waters as quickly as possible. This could be accomplished via an amendment to MARPOL Annex 1 or by another legally binding instrument.

A ban on heavy fuel oil in the Arctic would be a significant step in reducing the threat posed by oil spills there. Ultimately, however, switching from distillates to alternative, non-fossil fuels would offer even greater protection against oil spills. In the near term, use of LNG as a marine fuel would virtually eliminate the impacts of a fuel spill, because LNG will "immediately start to vaporize after a release" and will "disperse rapidly depending on the local wind conditions."[215] In general, an LNG spill would be "far more benign than either [heavy fuel oil] or diesel oil spills."[216] Even so, LNG is still a fossil fuel, and its combustion contributes to global warming.[217] For that and other reasons, other fuel alternatives—including battery-power—are preferred options.

[213] Int'l Maritime Org., Marine Env't Prot. Comm. (MEPC), 72d session, agenda item 11, *Development of Measures to Reduce Risks of Use and Carriage of Heavy Fuel Oil as Fuel by Ships in Arctic Waters: Proposal to ban heavy fuel oil use and carriage as fuel by ships in Arctic waters*, submitted by Finland, Germany, Iceland, the Netherlands, New Zealand, Norway, Sweden and the United States (Feb. 2, 2018), https://www.transportstyrelsen.se/contentassets/57f800efae134fe0af0808d2773a14f2/72-11-1.pdf, [https://perma.cc/Z6CL-SAWH].

[214] Int'l Maritime Org., Marine Env't Prot. Comm. (MEPC), 73rd session, 22–26 Oct. 2018, http://www.imo.org/en/MediaCentre/MeetingSummaries/MEPC/Pages/MEPC-73rd-session.aspx, [https://perma.cc/HA4Q-URHP].

[215] Vard Marine, *supra* note 101, at 36.

[216] *Id.*

[217] *See, e.g.*, *id.* at 33 (concluding that while using LNG as a marine fuel will emit less CO2 and CO2 equivalent than conventional fuels, reduction of

Another opportunity to reduce the risk of oil spills in Arctic waters involves improving the safety of lightering operations. Businesses engaged in lightering in western and Arctic Alaska, with the support of the Coast Guard, are already beginning to discuss ways to bolster safety and reduce risks in the region.[218] As those discussions continue, operators should consider identifying areas best suited for lightering operations or areas where lightering should not occur.[219] In selecting these areas, operators should seek out and incorporate input from residents of local communities.[220] Identification of specific lightering areas may identify regions or corridors where updated hydrographic surveys would most benefit lightering operations, which could help avoid accidents caused by outdated or inaccurate charting.[221] Lightering operators could also develop a shared suite of best practices designed to help ensure ship-to-ship transfers take place only when weather, wind, and sea conditions are safe and when available spill response equipment can be deployed effectively.[222] They could also consider whether existing oil spill response equipment is best suited to the conditions where lightering operations take place.[223] Use of onboard cameras could be a cost-effective way to improve safety via remote monitoring of lightering operations.[224] Other risk mitigation tools may include drills and exercises to practice rapid deployment of spill response equipment as well as table-top or field exercises to test

greenhouse gas emissions will not be as dramatic as reductions in NOx, Sox and particulate matter emissions).

218 Personal communication, Cap't Patrick Hilbert, Chief of Prevention, U.S. Coast Guard Dist. 17 (Juneau, AK).

219 OVERVIEW OF TANKER LIGHTERING, *supra* note 24, at 35.

220 *Id*.

221 *Id*. at 34; *see also id*. at 19–20 (describing the soft grounding of tanker involved in lightering operations in western Alaska in an area where water depth shown on nautical chart was inaccurate).

222 *Id.* at 35.

223 *Id.* at 36.

224 *Id.* at 34.

preparedness for incidents including grounding or loss-of-propulsion events.[225]

Finally, impacts from oil spills could be reduced if local communities had additional spill response equipment and training. With response assets located thousands of miles away from the Bering Strait, "Indigenous communities are likely to be first responders to any accident in the Bering Strait."[226] While locating appropriate response equipment in communities and training community members to use it would not lower the risk of a spill, it could reduce the severity of its consequences.

3. Implement Measures to Mitigate Impacts Related to the Discharge of Sewage and Graywater

Residents of the Bering Strait region have expressed concern about the impacts of discharge from vessels into the marine environment.[227] As noted above, IMO regulations impose no restrictions on the discharge of graywater from vessels and allow discharge of even raw sewage so long as a vessel is moving at least four knots and is positioned at least twelve nautical miles from land or ice.[228]

International standards governing the discharge should be strengthened. At a minimum, the IMO should require ships to treat discharge graywater in the same way they are required to treat discharge of sewage. This could be done via an amendment to

225 *Id.* at 36–37.
226 *Arctic Vessel Traffic and Indigenous Communities*, *supra* note 9, at 291.
227 *See, e.g.*, Kawerak, Inc., BERING STRAIT VOICES ON ARCTIC SHIPPING: MOVING FORWARD TO PROTECT ALASKA NATIVE WAYS OF LIFE AND THE NATURAL RESOURCES WE RELY ON 12 (2016), [https://perma.cc/8ZNL-E859] (describing resident of Elim voice concern over ships dumping wastes in the water).
228 *See supra* Part III.B.3.

MARPOL and/or the Polar Code. IMO could also go further and require ships to be even farther from shore or ice—more than twelve nautical miles—before discharging untreated sewage or graywater.[229] Similarly, IMO could amend MARPOL and/or the Polar Code to require more additional testing, sampling, monitoring and record-keeping with respect to wastewater treatment plants and discharge of sewage and graywater in Arctic waters.[230]

In addition to ship-based discharge limits, discharge can be regulated by area-based protections. In the United States, individual states may apply to the Environmental Protection Agency to establish no-discharge zones for sewage in state waters,[231] but this type of no-discharge zone would apply only within three nautical miles of the shore and therefore would have limited benefit.[232] No-discharge zones can also be created in international waters by designating a "special area" that limits discharge of sewage pursuant to Annex IV of MARPOL.[233] At present, the Baltic Sea is the only Annex IV special area,[234] and its protections are just beginning to be phased in.[235] Nonetheless, it may be useful to explore the possibility of proposing one or more additional Annex IV special areas in

229 *See* Parks et al., *supra* note 84, at 7 (suggesting IMO impose more stringent regulations on discharges of sewage and graywater).
230 *Id.* at 7.
231 33 U.S.C. § 1322(f)(3); *see also* 40 C.F.R. § 140.4.
232 Parks et al., *supra* note 84, at 8.
233 Under MARPOL, special areas are defined as areas where "for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required." Int'l Maritime Org., *Special Areas Under MARPOL* (undated), http://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx, [https://perma.cc/P2A7-YRB4] (last visited Aug. 28, 2019).
234 Int'l Maritime Org., *Special Areas under MARPOL* (undated), http://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx, [https://perma.cc/P2A7-YRB4].
235 *See* DNG-VL, *Baltic Sea – First Marpol special area for sewage* (Sept. 18, 2017), https://www.dnvgl.com/news/baltic-sea-first-marpol-special-area-for-sewage-100367, [https://perma.cc/44A8-Q48A] (listing dates that Baltic Sea special area will take effect for certain vessel types).

Arctic waters. Indigenous residents have called for a no discharge zone in the Bering Strait for many years, due to its importance to marine mammals and the communities who depend on them.[236]

To the extent that vessels traveling in the Arctic are prohibited from discharging or elect not to discharge sewage and graywater, they will need to store those wastes onboard. Polar Code regulations could be strengthened to call for increased storage capacity for vessels traveling in Arctic waters.[237] In addition, it would be beneficial to increase the availability of port facilities where vessels can safely offload these and other wastes. If these "port reception facilities" were more widely available in Arctic waters, it could facilitate designation of an Annex IV special area.[238] Establishing adequate port reception facilities in the U.S. Arctic could be costly[239] and would require close collaboration with residents of the Arctic to ensure their communities were not unduly burdened by accepting wastes from ships.[240] Nonetheless, if done

[236] *Arctic Vessel Traffic and Indigenous Communities*, *supra* note 9, at 291.
[237] *See* Parks et al., *supra* note 84, at 7.
[238] *See, e.g.*, Int'l Maritime Org., *Amendments to the Annex of the Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973: Special Area Provisions and the Designation of the Baltic Sea as a Special Area under MARPOL Annex IV*, MARINE ENV'T PROT. COMM. RES. 200(62) § 4 (July 15 2011) (adding new regulation requiring availability of adequate port reception facilities before special area designation takes effect), http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Sewage/Documents/200(62).pdf, [https://perma.cc/8QVV-V4EM]. *See also* Alex Kemp & Gudmund Bernitz, *Port reception facilities for waste water in the Baltic Sea: fit for purpose?* HFW BRIEFINGS (October 2017), http://www.hfw.com/Port-reception-facilities-for-waste-water-in-the-Baltic-Sea-fit-for-purpose-October-2017, [https://perma.cc/6E5P-CAV7] (observing that implementation of the Baltic Sea special area was "initially subject to sufficient notifications to the IMO on the availability of adequate [Port Reception Facilities] from states bordering the Baltic Sea").
[239] Parks et al., *supra* note 84, at 7.
[240] *See, e.g.*, Alex Kemp & Gudmund Bernitz, *supra* note 238 (noting that local wastewater management systems may not be well-suited to accept sewage from ships, "which may contain heavy fuel oil and other contaminants").

properly, build-out of these facilities would be a critical investment for a clean, healthy Arctic marine environment in the future.

4. Curb Subsea Noise in Arctic Waters

In 2014, the IMO adopted voluntary Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life.[241] Among other things, the Guidelines provide guidance on designing quieter ships and reducing noise from existing ships.[242] Ship designers and operators should use these guidelines to help reduce noise in Arctic waters. The IMO guidance recommends operational measures like slowing down to reduce propeller cavitation—the main source of noise from ships[243]—and using routing measures to keep vessels away from areas that may be particularly sensitive to undersea noise from ships.[244] Another alternative is to employ measures designed to maintain the relative quiet of areas that are not yet subject to significant amounts of undersea noise.[245]

Port-based incentives are another way to encourage quieter vessels. The Vancouver Fraser Port Authority instituted an "EcoAction Program" that allows vessels that use technologies to reduce underwater noise (and other environmental impacts) to apply

241 Int'l Maritime Org., *Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life*, MEPC.1/Circ.833 (April 7, 2014), http://www.imo.org/en/MediaCentre/HotTopics/Documents/833%20Guidance%20on%20reducing%20underwater%20noise%20from%20commercial%20shipping%2C.pdf, [https://perma.cc/2G79-FUBH].
242 *Id.* §§ 7–10.
243 *Id.* § 3.2; § 10.4.
244 *Id.* § 10.5.
245 R. Williams et al., *Impacts of Anthropogenic Noise on Marine Life: Publication Patterns, New Discoveries, and Future Directions in Research and Management*, 115 OCEAN & COASTAL MGMT. 17, 23 (2015).

for up to a 47% reduction in harbor fees.[246] The program recognizes four "quiet ship notations" from organizations that establish industry standards, as well as five propeller designs that help reduce underwater noise from ships.[247] Ships with one or more of these quiet ship notations, performance indicator level, or technologies are eligible to apply for the reduced fees.[248] Regulators, port authorities and other stakeholders should consider how routing measures and port-based incentives might be used to encourage quieter shipping in Arctic waters.

More work is needed to understand and address impacts of underwater noise from vessel traffic. Recognizing this, a number of delegations to the IMO's Marine Environment Protection Committee continue to express interest in more research to better understand the impacts of underwater noise from shipping.[249] In addition, the Arctic Council's Protection of the Arctic Marine Environment's work plan for 2019-2021 includes a project designed to estimate and map vessel noise levels in the Arctic, identify areas of special ecological or cultural concern, and develop possible mitigation measures.[250]

246 *Vancouver Fraser Port Authority expands noise reduction criteria to encourage quieter waters for endangered whales*, PORT OF VANCOUVER (Feb. 11, 2019), https://www.portvancouver.com/news-and-media/news/vancouver-fraser-port-authority-expands-noise-reduction-criteria-to-encourage-quieter-waters-for-endangered-whales/, [https://perma.cc/TKQ7-G5CJ].
247 *Id*.
248 *Id*.
249 *Ship Noise: Ship noise can have negative impacts—on both humans and marine life*, INT'L MARITIME ORG., http://www.imo.org/en/MediaCentre/HotTopics/Pages/Noise.aspx, [.https://perma.cc/WYK4-SG4R].
250 *Arctic Council*, PAME WORK PLAN 2019-2021 31, https://pame.is/index.php/document-library/pame-reports-new/pame-ministerial-deliverables/2019-11th-arctic-council-ministerial-meeting-rovaniemi-finland/426-pame-2019-2021-work-plan/file, [https://perma.cc/2XAT-KHUZ].

5. Reduce the Risk of Ship Strikes

It is possible to take steps to minimize the risk of ship strikes on large, slow-moving whales in Arctic waters. Scientists, indigenous experts, mariners, and other stakeholders could work together to identify areas where there is a high risk of ship strikes. Regulators could designate vessel traffic lanes and ATBAs that are, to the extent possible, designed to keep large or fast-moving vessels away from areas where large whales are known to aggregate. Regulators could also consider the potential for seasonal or dynamic routing measures to better account for seasonal migration.[251] In cases where it is impractical to keep vessels away from large whales, regulators should encourage or mandate speeds of less than ten knots when large whales are known to be in the vicinity.[252] As noted above, new technologies that integrate with ships' AIS and navigation equipment could allow mariners to be notified automatically when they are entering areas of known marine mammal aggregations.[253] In addition to reducing the risk of ship strikes on whales, improved communication between residents of Arctic communities and vessels could also reduce the potential for conflicts or accidents between commercial vessels and subsistence hunters operating small craft.

6. Prevent the Spread of Invasive Species in Arctic Waters

Because marine invasive species are nearly impossible to remove once they have taken hold,[254] prevention is the best

[251] Siders et al., *supra* note 16, at 181–83. *See also* Huntington et al., *supra* note 140, at §§ 4–6.
[252] *See, e.g.*, *Reducing Ship Strikes to North Atlantic Right Whales*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-ship-strikes-north-atlantic-right-whales, [https://perma.cc/7MVC-KS5E].
[253] *See supra* Part V.B.I.
[254] Molnar et al., *supra* note 124, at 485.

approach. The IMO has adopted a mandatory convention to address the spread of invasive species from one region to another via ballast water,[255] and has approved voluntary guidelines to address the spread of invasive species via biofouling.[256] Outside the IMO, the Arctic Council's working groups on Conservation of Arctic Flora and Fauna and Protection of the Arctic Marine Environment published an Action Plan on Arctic invasive alien species.[257] While the Action Plan recognizes ballast water and hull fouling as a vector for invasive species in Arctic waters,[258] it does not offer specific suggestions beyond encouraging nations to collaborate "to implement effective programs for preventing the introduction and controlling the spread of invasive alien species,"[259] and assess whether the IMO should develop Arctic-specific guidance for minimizing the spread of invasive species from shipping.[260] Development of an Arctic-specific plan to address the spread of marine invasive species from shipping may be the most appropriate next step. Such a plan could trigger more stringent treatment or enforcement standards for ballast water, and more robust or effective hull-cleaning requirements to minimize hull fouling. In addition, scientific monitoring and assessment of invasion risk related to vessel traffic in the Arctic should continue.

255 *See, e.g., International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM),* INT'L MARITIME ORG., http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx, [https://perma.cc/H4VJ-MT4K].
256 Int'l Maritime Org., 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species, MPEC 62/24/Add. 1 (July 15, 2011), http://www.imo.org/en/OurWork/Environment/Biofouling/Documents/RESOLUTION%20MEPC.207%5b62%5d.pdf, [https://perma.cc/W74D-L4LN].
257 Arctic Council, Arctic Invasive Alien Species: Strategy and Action Plan (2017), https://www.caff.is/strategies-series/415-arctic-invasive-alien-species-strategy-and-action-plan, [https://perma.cc/X2NQ-NF6V].
258 *Id.*, at 9.
259 *Id.*, at 12.
260 *Id.*, at 13.

7. Consider Designation of One of More Particularly Sensitive Sea Areas

As defined by the IMO, a Particularly Sensitive Sea Area (PSSA) "is an area that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic, or scientific attributes where such attributes may be vulnerable to damage by international shipping activities."[261] PSSAs provide a way to package together multiple IMO mitigation measures. In the PSSA context, these mitigation measures are called "associated protective measures," and they are adopted along with the PSSA.[262]

Associated protective measures can include Special Area or Emissions Control Area designation, application of special discharge restrictions, routing and reporting measures (including ATBAs) and "development and adoption of other measures aimed at protecting specific sea areas against environmental damage from ships, provided that they have an identified legal basis."[263] There are a variety of criteria for designation as a PSSA, and specific parameters for its application.[264] While PSSAs only provide for regulation of shipping impacts, their designation provides an opportunity for associated protective measures which cover a range of impacts, and therefore provide an opportunity for broad protections from shipping threats. Designation of a PSSA in the Bering Strait region—and perhaps elsewhere in the U.S. Arctic—may be an efficient way to bundle multiple protections against impacts from increasing vessel traffic in the region.

261 Int'l Maritime Org. Res. A.982(24), U.N. Doc. A 24/Res.982, at 3 (Dec. 1, 2005), available at http://www.imo.org/en/OurWork/Environment/PSSAs/Documents/A24-Res.982.pdf, [https://perma.cc/NG6H-MCLU].
262 *Id.*
263 *Id.*, at 8.
264 *See generally id.*

C. Curb Harmful Emissions from Vessels in the Arctic and Reduce and Eventually Decarbonize the Global Shipping Fleet

The measures discussed in the sections above are important to increase shipping safety, reduce the risk of oil spills, minimize impacts from discharge of sewage and graywater, quiet ship-related noise, avoid ship strikes, and prevent the spread of invasive species in Arctic waters. As important as those measures are, the rapid and profound impacts of climate change in the Arctic make it absolutely critical to act now to reduce emissions from vessels that operate in the Arctic, and to reduce and eventually eliminate carbon emissions from the global shipping sector.

There are ways to reduce emissions from vessels operating in the Arctic, including area-based measures and switching to cleaner fuels. For instance, it is possible to design and implement Arctic-specific, area-based limits on emissions from vessels. This could be done through designation of an IMO Emissions Control Area (ECA) for some or all Arctic waters. ECAs are areas within which vessels are subject to emissions limits that are more stringent than normal; they are designated under MARPOL Annex VI and designed to reduce harmful emissions from shipping.[265] At present, a North American ECA reaches as far north as Southeast Alaska but does not extend to the Arctic.[266] If IMO designated an Arctic ECA that required the use of 0.1% sulfur fuel (consistent with the existing

[265] *Prevention of Air Pollution from Ships*, INT'L MARITIME ORG. (undated), http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Air-Pollution.aspx, [https://perma.cc/8RXK-ZHCW].
[266] *See generally* Information on North American Emission Control Area (ECA), U.N. Doc. MPEC.1/Circ.723 (2010) https://www.epa.gov/sites/production/files/2016-09/documents/mepc1-circ-re-na-eca.pdf, [https://perma.cc/EDJ2-TYPW].

North American ECA), it would result in a 50% drop in black carbon emissions in the Arctic.[267]

Phasing out the use of heavy fuel oil in Arctic waters is another way to reduce emissions in the Arctic region. As noted above, contaminants in heavy fuel oil create exhaust emissions that are particularly dirty.[268] Even so, heavy fuel oil is—for now at least—still used by some vessels transiting Arctic waters.[269] If these vessels switched from heavy fuel oil to higher-quality, low-sulfur fuels, it would result in a substantial reduction in emissions including a 5–8% reduction in CO2 emissions, a 95% decrease in SO2, a 93% decrease in particulate SO4 emissions, and a 75% decrease in organic particulate emissions. Studies suggest it would also reduce black carbon emissions by 50% or more.[270] Switching to LNG would result in still greater reductions in emissions,[271] and switching to electric propulsion could eliminate emissions altogether, depending on the source of the electricity.

While reducing emissions from vessels operating in the Arctic will yield important benefits, regional-scale action is insufficient to address the challenge of global climate change. Instead, it is necessary to reduce, and eventually eliminate, vessel emissions on a global scale. In 2018, the IMO adopted an initial strategy on the reduction of greenhouse gases from ships.[272]

267 Daniel Lack, *The Impacts of an Arctic Shipping HFO Ban on Emissions of Black Carbon* 12 (Sept. 2016), https://www.hfofreearctic.org/wp-content/uploads/2016/10/The-Impacts-of-an-Arctic-Shipping-HFO-Ban-on-Emissions-of-Black-Carbon.pdf, [https://perma.cc/P427-UJMB].
268 *See supra* Part III.B.4.
269 *See* Lack, *supra* note 267, at 8 (noting that 75% of fuel carried by vessels in the Arctic during 2012 was heavy fuel oil).
270 *Id.*, at 11–12.
271 Vard Marine, *supra* note 101, at 33.
272 Int'l Maritime Org., *Initial IMO Strategy on reduction of GHG emissions from ships*, Res. MEPC.304(72) (April 13, 2018) [hereinafter *Initial IMO Strategy*], http://www.imo.org/en/OurWork/Documents/Resolution%20MEPC.304%2872

The IMO strategy first calls for adoption of short-term measures to quickly reduce greenhouse gas emissions from the shipping sector.[273] Slow steaming could be an important way to achieve short-term reductions. If a ship reduces its speed by 10%, it can reduce fuel consumption by nearly 20%.[274] On a global scale, researchers predict that slowing the container, dry bulk, and crude/product tanker fleet by 10, 20, and 30% would reduce overall emissions by 13, 24 and 33% respectively.[275] One study of global shipping concluded implementation of existing technologies and operational measures could reduce shipping emissions from 2008 levels by up to 75% by 2050.[276]

The IMO strategy also calls for a plan to meet mid-term (2023–2030) and long-term (2030–2050) goals to curb greenhouse gas emissions from the shipping sector.[277] IMO's plan calls for 2050 greenhouse gas emissions from the shipping sector to be reduced by at least half, relative to 2008 levels.[278] Importantly, the 50% reduction is a floor, not a ceiling. During negotiations, a coalition of

%29%20on%20Initial%20IMO%20Strategy%20on%20reduction%20of%20GHG%20emissions%20from%20ships.pdf, [https://perma.cc/RFW9-A6U4].

273 *Id.* §§ 4.1.1, 4.7.

274 *Speed Management*, Global Maritime Energy Efficiency Partnership (undated), https://glomeep.imo.org/technology/speed-management/, [https://perma.cc/4FFH-DZY8].

275 J. Faber et al., *Regulating speed: a short-term measure to reduce maritime GHG emissions* 10 (2017), https://cedelft.eu/en/publications/2024/regulating-speed-a-short-term-measure-to-reduce-maritime-ghg-emissions, [https://perma.cc/M3YB-4F7L].

276 E. Bouman et.al. *State-of-the-art technologies, measures, and potential for reducing GHG emissions from shipping – A review*, 52 Transp. Res. Part D 408, 418 (May 2017), https://www.sciencedirect.com/science/article/pii/S1361920916307015, [https://perma.cc/XG7Q-TKFZ].

277 *Initial IMO Strategy*, *supra* note 272, §§ 3.1.3, 4.1.2, 4.1.3.

278 *Id.* at § 3.1.3.

states argued for complete decarbonization of the shipping sector,[279] and the IMO plan leaves room to continue to push for that approach.

While transitioning to a fully decarbonized shipping sector by 2050 might strike some as unrealistic, at least one major player in the shipping industry has already pledged to achieve zero-carbon emissions from its fleet by 2050.[280] Given the pace and scale of the climate challenge facing the Arctic—and the global ocean—a rapid and aggressive transition toward a zero-carbon shipping fleet is the only responsible path forward.

VI. CONCLUSION

Climate change is affecting the ocean all around the world, and its impacts are particularly acute in the fast-warming Arctic. Sea ice is melting, Arctic waters are becoming more accessible, extractive industries are expanding, and new trans-Arctic shipping routes are emerging. While there has been significant progress in some areas, more must be done to safeguard Arctic waters from the sweeping change already underway.

Despite the rapid pace of change in the Arctic, there remains a window of opportunity to put in place additional Arctic-specific regulations and best practices that will bolster shipping safety and minimize the impacts of increased shipping on the Arctic marine environment—impacts that include greater risk of oil spills,

[279] Jessica F. Green, *Why do we need new rules on shipping emissions? Well, 90 percent of global trade depends on ships*, Washington Post (April 17, 2018), https://www.washingtonpost.com/news/monkey-cage/wp/2018/04/17/why-do-we-need-new-rules-on-shipping-emissions-well-90-of-global-trade-depends-on-ships/?noredirect=on, [https://perma.cc/3AW5-AN88].

[280] *See, e.g.*, Camila Domonoske, *Giant Shipper Bets Big On Ending Its Carbon Emissions. Will It Pay Off?* NPR NEWS (July 15, 2019), https://www.npr.org/2019/07/15/736565697/giant-shipper-bets-big-on-ending-its-carbon-emissions-will-it-pay-off, [https://perma.cc/J25S-NSEX].

discharges of sewage and graywater, subsea noise, ship strikes on marine mammals, and spread of invasive species.

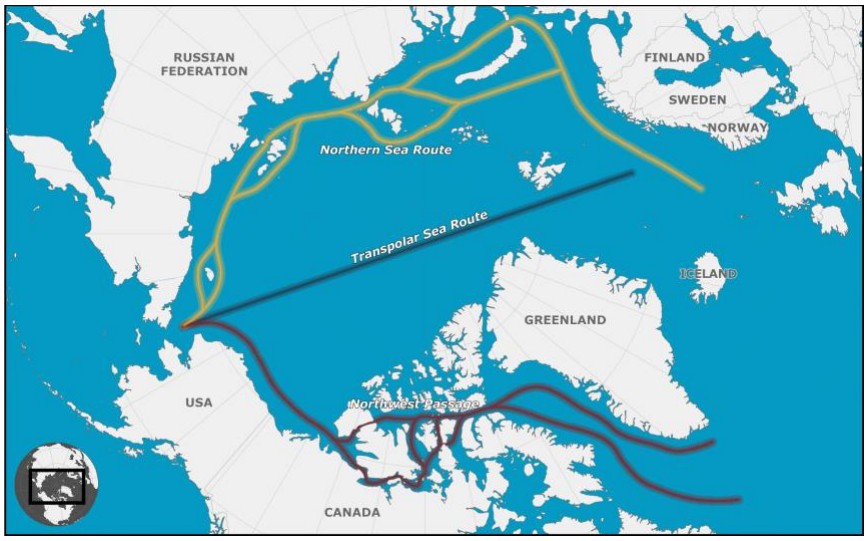
At the same time, shipping measures are only one component of a broader solution that must include a comprehensive governance structure that is able to address impacts from multiple sectors and uses, and that provides for full and meaningful involvement of Indigenous Peoples in decision-making. There is an urgent need to establish both an improved governance structure and specific protective measures now, before the anticipated increase in vessel traffic arrives.

Finally, the Arctic is both the canary in the coal mine and a critical driver for climate change. Global climate change poses extreme threats to the Arctic, and at the same time a melting Arctic has impacts on our global climate, weather and sea-level rise. Given the profound threat posed by global climate change, it is necessary to reduce—and eventually eliminate—shipping-related greenhouse gas emissions in the Arctic and on a global scale. At the same time, global action to reduce greenhouse gas emissions and thus slow and stall the pace of change in the Arctic is critical not only to the future of the Arctic, but to our world. The mechanisms and opportunities exist. All that is missing is the political will to implement them.

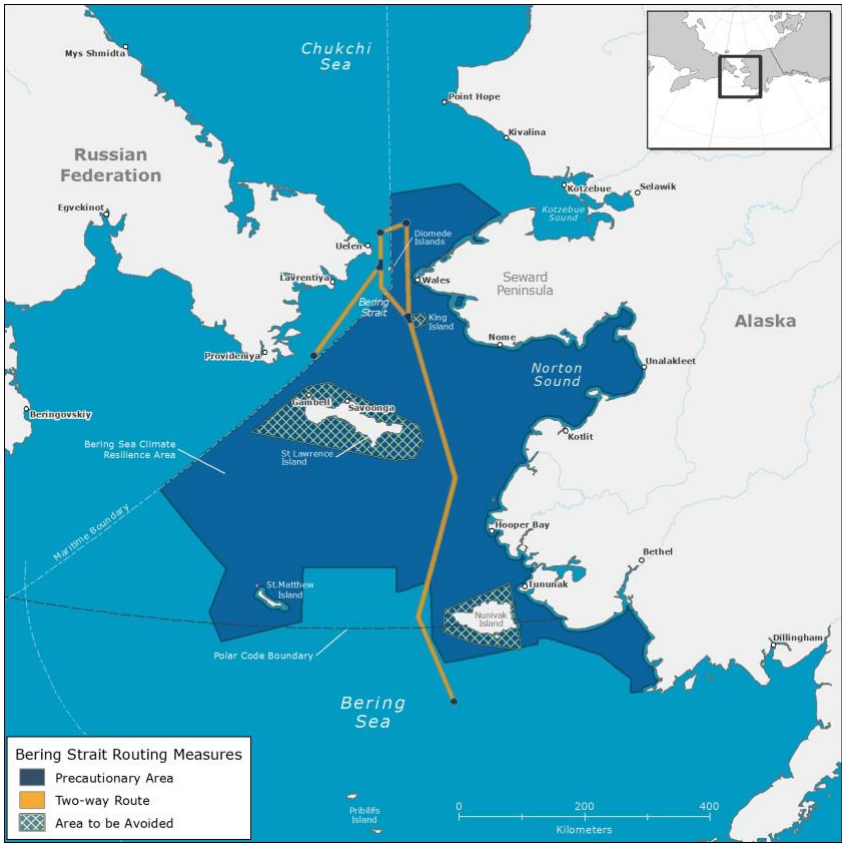
VII. APPENDIX

1.

2.



3.


Chukchi Sea
Mys Shmidta
Point Hope
Kivalina
Russian Federation
Egvekinot
Kotzebue
Selawik
Kotzebue Sound
Uelen
Diomede Islands
Lavrentiya
Wales
Seward Peninsula
Bering Strait
King Island
Alaska
Nome
Providenlya
Norton Sound
Unalakleet
Gambell
Savoonga
Beringovskiy
Kotlit
Bering Sea Climate Resilience Area
St Lawrence Island
Hooper Bay
Maritime Boundary
Bethel
St.Matthew Island
Tununak
Nunivak Island
Dillingham
Polar Code Boundary
Bering Sea
Bering Strait Routing Measures
Precautionary Area
Two-way Route
Area to be Avoided
Pribilfs Island
0
200
400
Kilometers