News & Insights

As Arctic ice thaws, questions around Arctic shipping heat up

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By Stella Bartolini Cavicchi, OceanMind

News

Ocean shipping quite literally floats the global economy, with an estimated 90% of traded goods carried over the waves, per the OECD. It's one of the most emissions-efficient methods of goods transport, but in aggregate still totals some 2% to 3% of GHG emissions worldwide. That number could climb significantly in the years ahead, with maritime trade expected to triple by 2050.

concerns that the changing climate will open up previously es — especially in the Arctic. It's a region already experiencing magnified, faster-than-average impacts of global warming, now at heightened risk of increased environmental impacts in relatively pristine areas that have, until recently, escaped the more localised effects of black carbon pollution.

The attraction of Arctic shipping for international trade

Like many industries, shipping has been looking for ways to boost efficiency while decarbonizing its climate footprint — via business-specific initiatives, trade groups like the International Chamber of Shipping, and through government-level efforts such as through the International Maritime Organization (IMO).

Nonetheless, the overwhelming majority of shipping business decisions remain primarily based on maximising profit and outperforming competition, not on sustainability considerations. The shortest and fastest route between two ports is the main driver of these variables, which is why the opening of new potential shipping routes in the Arctic has become such a hot topic, with its huge potential for reducing journey times… even with the additional costs associated with the requirement to be polar ship certified.

For example, two of the largest ports in the world are Shanghai (China) and Rotterdam (the Netherlands). Shanghai has been the world's "busiest container port" for 13 years running. In 2021, Rotterdam became the first port outside Asia to surpass the 15 million container mark. The current average journey time between the two ports for a container vessel is one month. But as the Arctic warms and sea ice melts, that could change.

Under a 1.5°C global warming scenario, the journey time could be reduced to 22 days by 2100; under extreme climate scenarios (>4°C global warming), the journey time could theoretically cut to 17 days, approximately half the current time (but in a world that has moved past planetary tipping points, where sea level rise would create major challenges for shipping access to ports).

Routes through a changing Arctic

The history of Arctic shipping goes back as long as humans have inhabited and sailed those regions — from local Indigenous routes, to the discovery of a sea route connecting North America and Asia in 1648, to the first chart showing how to cross the Arctic Ocean half a century later.

Successful crossings by cargo vessels only began in the years 1935–1937 and continued during World War II, primarily for military purposes rather than commercial. Since that time, the Arctic has been a strategic location for geopolitics. But it wasn't until the dissolution of the Soviet Union during the late 1980s and early 1990s that foreign vessels began to be allowed to navigate, marking the true beginning of the Arctic being used as an international trade route in the modern era.

Three primary shipping routes — two currently viable, one possible in the future — span the Arctic region: 1) the Northern Sea Route (NSR), 2) the Northwest Passage (NWP), and 3) the Transpolar

Sea Route (TSR), sometime also called the Central Arctic Shipping Route (CASR).

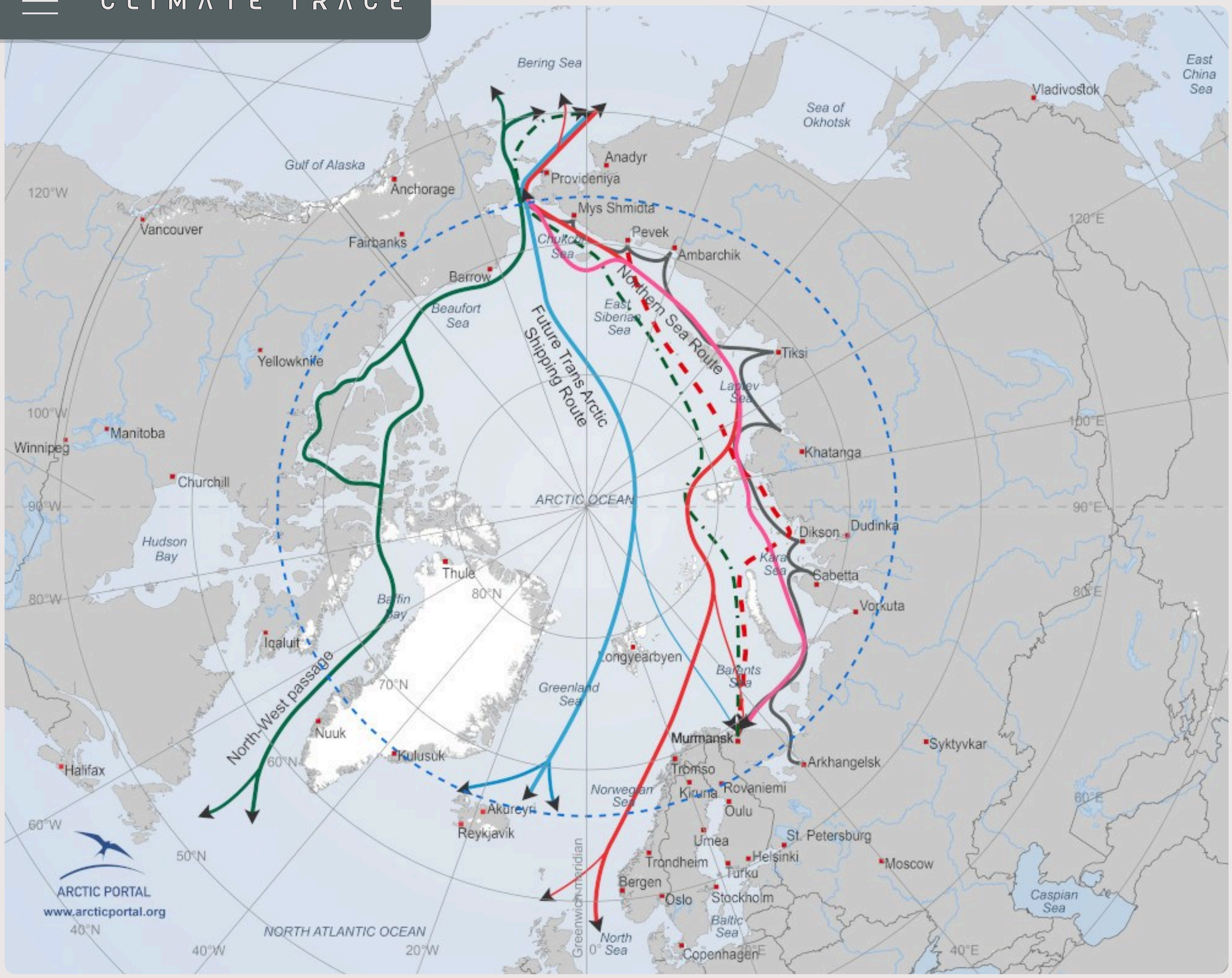


Image: Artic Portal

Northern Sea Route (NSR): The NSR is officially defined by Russian law as being between the Atlantic Ocean and the Pacific Ocean, specifically running along the Russian Arctic coast from the Barents Sea, along Siberia, to and through the Bering Strait. It was only in 2009 that the NSR started functioning as an international transport corridor, and up until 2018, the NSR was only viable for approximately 3 months of the year for ice-strengthened ships. This is now changing — fast.

During the period 2014–2021, cargo traffic along the NSR grew almost fivefold, reaching 33 million tons in 2020. Russian officials predict that number could reach 100 million tons by 2030, which eerily aligns with what some scientists now say will be the first-ever days with no summer sea ice. Incidents such as the 2021 grounding of the Ever Given, which blocked the Suez Canal for 6 days, have only heightened focus on the NSR, which can shave 4,000 nautical miles off traditional Asia-to-Europe shipping routes.

Northwest Passage (NWP): The NWP follows the northern coast of North America and crosses the Canadian Arctic archipelago. Already by the 1980s, more than 30 complete transits of the passage were undertaken. As of late August and early September last year — the time period when

Arctic sea ice extent usually reaches its annual minimum — the southern option of the NWP, known ... completely free of sea ice.

Transpolar Sea Route (TSR): The TSR is the most-direct path connecting the Atlantic and Pacific oceans, passing straight through the central Arctic, outside any Arctic coastal state's national jurisdiction. However, this route is not commercial for the time being and still won't be for the next few decades, as it is only navigable by heavy icebreakers. How quickly this happens will be a litmus test for the irreversible deterioration of Arctic ice.

Shipping companies are already facing choices on routes considering the changing Arctic environment and the risks and opportunities this will offer. This will only increase with time. In fact, Russia has already committed several large infrastructure projects to support the NSR, including railways and emergency rescue centres. China also has plans to build infrastructure for a Polar Silk Road and to conduct trial voyages.

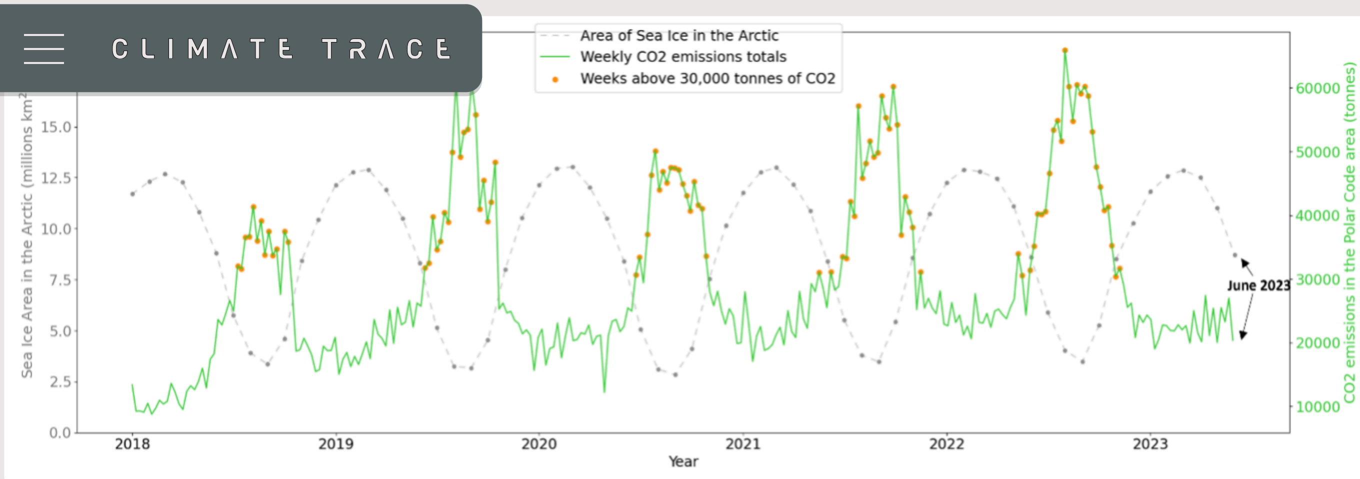
Black carbon, a warming planet, and "ice no more"

There is no official and internationally agreed definition of what constitutes 'the Arctic.' But this much is plainly apparent about the Northern Hemisphere's polar region: it is a critical part of the Earth's climate, it has been experiencing significant warming since the 1970s, and the extensive sea ice loss it has been undergoing means it is now acting as a climate change "magnifying lens," warming nearly four times faster than the global average and experiencing exponential rates of change.

In the current millennium, a major shift in the condition of Arctic sea ice happened in 2007. Summer ice extent and thickness in areas of ice formation have not recovered to pre-2007 state, and might never do so again. The ice-free periods seen in recent years are predicted to continue and expand, becoming months longer over the next decades. 2012 was another negative record year for summer sea ice minimum at 3.41 million square kilometres, the lowest ever on satellite record, and 18% lower than in 2007. Under high warming scenarios, we would be faced with an ice-free period exceeding 6 months for most of the Arctic; according to other scientific studies, sea ice would completely disappear by the end of the century.

On one hand, navigable and ice-free Arctic waters would allow shipping companies to complete shorter routes in less time, yielding potential overall average GHG emissions reductions for the shipping sector globally — even as it would increase emissions precisely within the area where those emissions will be multiplied, through Arctic Amplification.

In fact, OceanMind / Climate TRACE data already show this trend unfolding in recent years. The total tonnes of CO2 emitted in the Polar Code region grew 67% from 1.10 million in 2018 to 1.84 million in 2022, even as total global shipping emissions remained relatively flat across that same time period. Also during this time period, the number of weeks where Polar Code weekly GHG emissions exceeded 30,000 tonnes more than doubled.



On the other hand, a further shift toward Arctic shipping would also impose new and potentially severe environmental costs. For example, with the increase in numbers and percentage of vessels carrying oil or hazardous cargo, there is an ever bigger danger of an accident, stranding, or oil spill, which would be catastrophic anywhere but especially so in the Arctic environment's sensitive ecosystems.

Then there is the threat from "black carbon." Black carbon (i.e., soot) is an air pollutant formed from incomplete fossil fuel combustion. In the Arctic, it mostly comes from ships like oil tankers and bulk carriers using heavy fuel oil (HFO), a low-grade, cheap oil contaminated with substances including nitrogen and sulphur. Black carbon causes a vicious feedback cycle, whereby contamination of the snow and ice darkens the surface, reducing reflectivity from the sun's radiation and increasing heat absorption — all of which conspire to exacerbate melting and further, faster loss of yet more sea ice.

At the United Nations' COP27 climate conference in Egypt in November 2022, experts and environmental groups alike called for more-serious consideration of black carbon emissions alongside other greenhouse gases.

Who is sailing the Arctic today?

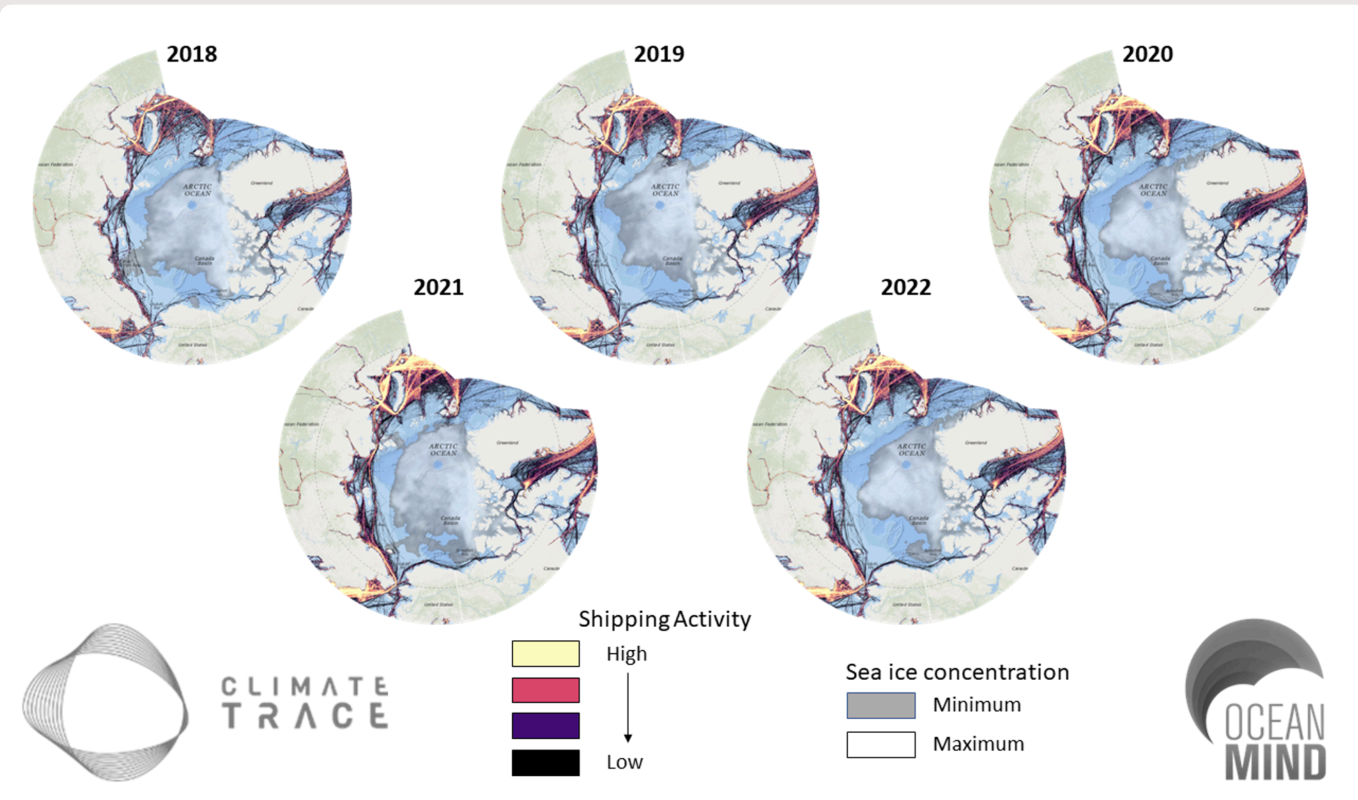
As the maritime sector data lead for Climate TRACE, OceanMind is able to analyse the movements (and associated emissions) of each individual vessel that passes into the Polar Code area.

We use data from multiple sources including the EU MRV dataset and Lloyd's Intelligence list to build a machine learning model that estimates the CO2 emissions per nautical mile for each vessel. Combining this model with satellite tracking data along with adjustment factors for the speed of the vessel allows emissions estimates to be made on a per trip basis for individual vessels. (You can read more about our methodology here.)

The Arctic Council estimates that a plurality of ships entering the Arctic are commercial fishing vessels (41%). They also report that other common ship types include bulk carriers, icebreakers, and research vessels. Arctic tourism is also growing.

E database currently includes over 40,000 merchant vessels. Of see 2,736 that enter the Polar Code region. The Climate TRACE model does not currently include fishing vessels and vessels smaller than 500 gross tonnes, so there are differences between the Arctic Council figures and ours.

Nonetheless, based on our vessel database, we find that vessels transporting goods dominate Arctic shipping. Of this, more than 25% are hazardous cargo vessels. Cargo ships were the largest vessel type using the Arctic (69.6% of our commercial shipping data), with vessels mainly servicing ports within the Arctic Circle. Of the cargo and hazardous vessels, 447 were flagged to Russia, making it the largest user of the Arctic by number of vessels, with the next largest being the Marshall Islands with 386 vessels. Bulk carrier activity, in particular, has increased significantly with the increase in iron ore extraction in Canada.



Arctic shipping moves toward greener, safer strategies

Several major initiatives are making promising progress toward protecting the Arctic environment — and global climate — from outside impacts of polar shipping.

Arctic Shipping Corporate Pledge: A group of companies have voluntarily taken a strong stance against Arctic shipping, through the Arctic Shipping Corporate Pledge. The pledge commits that consumer goods companies in the group will agree not to intentionally allow their products to be shipped on vessels via Arctic routes and for no ocean carrier or freight forwarder retained by them to have their product on a vessel sailing or intending to sail Arctic routes.

ncy reported that 42.7% of the world's liner fleet had signed on udes a commitment to promote precautionary Arctic shipping practices for current and future Arctic shipping for those companies refusing to take the Pledge. Best practices include a ban on HFO use and carriage in Arctic waters, the designation of the Central Arctic Ocean by the IMO as a Particularly Sensitive Sea Area, an evaluation of low impact shipping corridors that protect important ecological and indigenous cultural areas, and the adoption of strict pollution controls.

Despite the number of companies signed on to the Pledge — and despite the risks sailing Arctic waters poses (including unpredictable and extreme weather conditions, long periods of darkness, and the remoteness of the shipping routes from infrastructure and emergency response services) — the Arctic Council estimates that shipping activity in the region has grown 25% in the six-year period 2013–2019. With our OceanMind / Climate TRACE models, we have already observed a further 21% increase in activity for the period 2019–2022.

The Arctic Council's PAME: The Arctic Council was formally established in 1996 and is the intergovernmental forum responsible for promoting cooperation, coordination, and interaction among Arctic states, Indigenous Peoples, and other Arctic inhabitants, in particular on issues of sustainable development and environmental protection.

The Arctic Council's Working Group on the Protection of the Arctic Marine Environment (PAME) monitors Arctic ship traffic trends and issues Arctic Shipping Status Reports using its established Arctic Ship Traffic Data System. In the event of an accident, such as groundings or fires, the cost of salvage and the environmental impact will be considerably higher than in non-Arctic waters. International shipping through the region provides no major economic benefit to Arctic communities, who already are suffering from the rapidly changing local environment and would face devastating consequences from oil spills.

The IMO's Polar Code: The International Maritime Organisation's (IMO) Polar Code is a mandatory set of standards for vessel design, construction, equipment, operational, training, search and rescue, and environmental protection activities for ships operating in polar waters. It entered into force in 2017 and it is supposed to ensure that Arctic shipping develops and operates safely and environmentally. But it has been called into question whether it is still fit for purpose, considering the changing scientific advice on the vulnerability of the Arctic to climate change and the number of key areas that were left unaddressed by the code, such as airborne pollutants and emissions.

In addition, the Arctic can look to its Southern Hemisphere Antarctic sibling for further examples of possible strategies forward. The Southern Ocean is subject to the Antarctic Treaty System (ATS), and the totality of the legal instruments applying to Antarctica is one of the most rigorous legal regimes for environmental protection in the world. A complete ban on the carriage and use of HFO in the Antarctic was adopted by the IMO in 2010, with exceptions only for safety vessels or search and rescue operations.

To that end, IMO regulations on the ban of HFO in the Arctic are due to come into force in 2024 and will apply to all vessels except those from Arctic coastal states (Norway, Denmark, Russia, USA, and Canada). However, a number of exemptions to the ban mean that in practice, 74% of HFO powered vessels will be allowed to continue their operations unchanged until 2029, resulting in a meagre reduction in black carbon emissions.

are increasingly sailing to the Arctic have agreed to follow IMO nd switch to distillates like marine gas oil. The shipping industry also has a chance to demonstrate leadership by switching to cleaner distillate fuel and installing diesel particulate filters, which would reduce black carbon emissions dramatically.

Governments could also take action by requiring their fleets to switch to distillates for voyages to and from the Arctic (or for any voyage for that matter). Global regulation already requires ships to have distillates in their fuel tanks to enter emissions control areas, so it would be straightforward to extend that requirement for other key climatic areas such as the Arctic and to require diesel particulate filters be installed as land-based transport has had to do for many years.

Arctic shipping's future

Despite the "opportunities" posed by the changes in Arctic sea ice, the jury is still out on whether trans-Arctic shipping will become a common reality due to the unpredictable and seasonal nature of Arctic navigation, the high cost associated with complying with Polar Code rules, and the alternative way shown by those companies committing to avoid the Arctic. When making strategic choices on future routes, the shipping industry will have to go beyond the low-hanging (but poisoned) fruit of using the Arctic as a means to cut down journey times and emissions, and instead work on systemic solutions to decarbonisation that do not result in irreversible local and worldwide environmental damage.

Stella Bartolini Cavicchi is marine policy advisor for OceanMind.

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DEC 02, 2023

Climate TRACE Unveils Open Emissions Database

Of More Than 352 Million Assets

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DEC 27, 2023

Conversations With The Coalition: Nick Wise

We recently caught up with Nick Wise, CEO & Founder of OceanMind, about emissions estimates for the shipping industry.

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Conversations With The Coalition: Ted Nace

We recently talked with Ted Nace, Executive Director of Global
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