MUNEA'26

Study Guide

IMO

Agenda Item: The Emergence of New Trade Routes Due to Arctic Ice Melt

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MUNEA'26

International Maritime Organization

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The Emergence of New Trade Routes Due To the Arctic Ice Melt

Under Secretary General: Merve Naz Aydoğdu
Under Secretary General: Ege Tenekeci
Under Secretary General: Ceren Ece Öztürk

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1.1 Letter from Secretary General

Esteemed Participants;

My name is Mustafa Gürmeriç and I am serving as the Secretary General of MUNEA'26. It ıs a great honour to welcome you all to the 2nd edition of Ankara Erman Ilıcak Science High School's Model United Nations Conference, MUNEA'26.

This conference means a lot to me, not just because I helped organize it, but because I began my MUN career in 9th grade with MUNER'24, our school's mock MUN. Since then, I've continued to participate in conferences, and I've finally come back to where I started but this time not as a delegate, but as someone organizing it. This entire process has not only taught me a great deal but has also been a significant experience that has shaped who I am today.

As the MUNEA'26 community, we have dedicated ourselves fully to this process and worked tirelessly to bring you one of the best conferences possible. And I cannot conclude without thanking the entire academic community and the organizing team, especially my colleagues on the executive team for their contributions to this process.

And finally, dear delegates, I would like to thank you for joining us on this journey; it would not be complete without you. I hope you come to your committees well prepared and enjoy three days that are as academic and fun as possible. I look forward to seeing you all at our school from May 22–24. Debate. Collaborate. Make a Change.

Sincerely,
Mustafa Gürmeriç
Secretary General of MUNEA'26

1.2 Letters from Co Under Secretaries General

Dear Delegates,

My name is Merve Naz Aydoğdu, and it is my pleasure to welcome you all to the International Maritime Organization (IMO) committee of MUNEA'26 as one of the under secretaries general.

I would like to start by introducing myself. Im an 11th grader in Ankara ABC Schools and I have been doing Model United Nations Conferences for 4 years. It is agreat honor for me to be a part of this conference.

Atthe outset, sincere appreciation is extended to my dear co-undersecretaries general Ceren Ece Öztürk and Ege Tenekeci, the executive team and the organization team whose tireless efforts made this conference possible.

You will be engaging with the agenda item, The Emergence of New Trade Routes Due To the Arctic Ice , a topic which highlights great importance, particularly in today's world. I encourage you all to critically and precisely examine the underlying reasons and consequences of this situation. Beyond analyzing your role is also necessary to consider solutions that are appropriate and feasible within the committee.

At the same time this committee presents a valuable opportunity for you to make the most of this experience and gain unforgettable memories. I wish you all a wonderful conference and fruitful debates.

If you have any inquiries, do not hesitate to contact me

-mervenazaydogdu@gmail.com

Merve Naz Aydoğdu

Warm regards,

Under Secretary General

Dear Delegates of IMO,

It is my utmost honour to welcome you to our committee during MUNEA'26. My name is Ege Tenekeci, I am currently an 11th grader studying in Eryaman Doğa College.I hope you spend this conference in a good way while having fun and expanding your academic potential and interest in space security and frameworks

The most important things that I expect to see from you is your ability to engage with complex legal frameworks, interpret the provisions of the IMO and discuss the past agreements of our world upon maritime resources, and apply them thoughtfully to the agenda that is discussed. Your arguments consist of not only strong research but also a genuine understanding of the values that our committee seeks to protect.

This committee aimed to simulate the decision-making processes of the IMP, encouraging critical thinking, respectful dialogue, and well-reasoned judgments. I hope your performance will exceed our expectations and create a truly enriching and intellectually stimulating environment.I sincerely hope that this experience will

enhance your interest in international relations and decision making process of the United Nations.

If you have any questions,please don’t hesitate to contact me via egetenekeci05@gmail.com

Yours sincerely,

Ege Tenekeci

Distinguished delegates of IMO,

I would like to welcome you all to the International Maritime Organization committee. My name is Ceren Ece Öztürk. I'm an 11th-grader at ABC College, and I've been attending MUN conferences since 2023.

As I can estimate, some of our delegates -maybe most of them- will be first-timers. I would like to remind you that, in addition to your academic growth, these conferences will give you a lot of personal growth and very dear friends. I personally want you to have real fun and entertainment at this conference. Take this as a chance to both improve yourself and have academic growth for your future.

In this committee, we aim to develop your abilities to think outside the box and work in groups on complex tasks. So, while being part of this committee, try to think about what we, our world, haven't yet thought about, because now you are part of something bigger than yourself.

As my co-USGs and I tried to make this Study Guide as clear and understandable as we could, you are always allowed to make further reliable research upon this topic and in any case of problem, don't shy away to ask us.

For any type of questions, my contact info,

cereneceozturk@icloud.com

Best regards, Ceren Ece Öztürk

2. Introduction

2.1 Introduction To the Committee: International Maritime Organization

As a specialized agency of the United Nations, the International Maritime Organization (IMO) is the global standard-setting authority for the safety, security, and environmental performance of international shipping. Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented.

In other words, its role is to create a level playing-field so that ship operators cannot address their financial issues by simply cutting corners and compromising on safety, security and environmental performance. This approach also encourages innovation and efficiency. Shipping is a truly international industry, and it can only operate effectively if the regulations and standards are themselves agreed, adopted and implemented on an international basis.

And IMO is the forum at which this process takes place. International shipping transports more than 80 per cent of global trade to peoples and communities all over the world. Shipping is the most efficient and cost-effective method of international transportation for most goods; it provides a dependable, low-cost means of transporting goods globally, facilitating commerce and helping to create prosperity among nations and peoples. The world relies on a safe, secure and efficient international shipping industry and this is provided by the regulatory framework developed and maintained by IMO.

IMO measures cover all aspects of international shipping including ship design, construction, equipment, manning, operation and disposal to ensure that this vital sector for remains safe, environmentally sound, energy efficient and secure. Shipping is an essential component of any programme for future sustainable economic growth.

Through IMO, the Organization’s Member States, civil society and the shipping industry are already working together to ensure a continued and strengthened contribution towards a green economy and growth in a sustainable manner. The promotion of sustainable shipping and sustainable maritime development is one of the major priorities of IMO in the coming years.

As part of the United Nations family, IMO is actively working towards the 2030 Agenda for Sustainable Development and the associated SDGs . Indeed, most of the elements of the 2030 Agenda will only be realized with a sustainable transport sector supporting world trade and facilitating global economy.

Energy efficiency, new technology and innovation, maritime education and training, maritime security, maritime traffic management and the development of the maritime infrastructure: the development and implementation, through IMO, of global standards covering these and other issues will underpin IMO's commitment to provide the institutional framework necessary for a green and sustainable global maritime transportation system.

2.2 Introduction To the Agenda Item: The Emergence of New Trade Routes Due To the Arctic Ice Melt

The effects of global climate change are felt in various ways all over the world and lead to some alternative consequences. One of these is the new alternative routes emerging in terms of maritime lines in the Arctic region. Global climate change has placed the Arctic at the center of geopolitics; the melting of ice in the region has begun to transform the region from an area of scientific interest into a vortex of competing commercial, national security, and environmental concerns, with profound consequences for the international law and political system.

The economic and political importance of the Arctic, which is becoming increasingly accessible as ice melts due to rising global temperatures, should not be ignored. As the region opens up to increased human activities such as commercial shipping, tourism, and oil and gas exploration, maritime vessels will increase the density of commercial work. In this case, as commercial activities increase, the ice cover in the region will become greyer. It will cause more sunlight to be absorbed, further accelerating the melting process of the glaciers.

The effects are beyond the anticipated amount. Considering the current ice amount compared to the amount in 1950, only half is left. Moreover, since 2013, ice-free arctic summers have begun to appear in certain regions in the last 10 years. The region was opened to global trade for the first time on 21 August 2009, with the announcement that two German commercial ships, accompanied by icebreakers, were heading from Vladivostok to the

Netherlands via the Northern Sea Route (Reuters, 2009). Trade routes have played a key role in economic and political developments throughout history. The preservation of existing trade routes and the discovery and implementation of new trade routes have played a vital role in many historical developments. Similarly, today, trade routes have a key role not only geopolitically, but also because they are economical and safe. Because the crowded and long trade routes used in foreign trade are measured by the time gained. To reduce costs in foreign trade, the shortest time and most economical route is sought.

The need for any country to lead and direct other countries in the world economy is one of the factors that make maritime trade risky. In recent years, there have been discussions about melting the ice in the Arctic region and whether a shipping channel should be opened that would reduce the distance between the Far East and Europe. The passage that the global war will occur in the new century has been claimed by those who argue that the effects are unpredictable or distant from the effects and that the world is used continentally. (Şöhret, 2024)

Arctic routes are already vulnerable enough, considering their diverse marine population and environmental risks. However, there are still some implications and discussions for further processing regarding trading. While this left many confused, it also led to opportunities to ignite. In the recent years, interest in Arctic shipping has increased: exploitation of Arctic oil and gas reservoirs, global warming resulting in an increase in the icefree

navigable season on the shorter routes between North Pacific and North Atlantic Oceans compared to southern latitudes, as well as technological development of ice going vessels, are all contributing factors. As presented in Figure 2-1, the routes between these Oceans can be divided to the Northeast Passage (NEP), the Northwest Passage (NWP), and the Transpolar Route (TPR). Today only the Northeast Passage, of which the Northern Sea Route (NSR) forms part, is currently used for commercial transportation, whereas the NWP and the TPR (also referred as "North Pole Route") are predicted to be utilized for commercial shipping later in the future. The decreasing trend of ice extent and ice thickness, driven by global warming, increases the interests towards utilization of these routes in shipping. However, even as the ice conditions in the Arctic become more navigable for shipping at a general level, difficult ice conditions persist and ice-caused challenges to shipping will be encountered in the future. In addition, intra and inter-seasonal ice variability, environmentally sensitive areas, political and jurisdictional disputes, lack of modern infra (deep-water ports, search & rescue capabilities) all generate additional challenges for Arctic Shipping. Analysis, storage, and distribution of big data from diverse sources (e.g., meteorology/climate, ocean, remote sensing, environment, economy, computer-based modelling) applied with modern technology aids (like satellite technologies, etc.) and software algorithms are needed to plan shipping activities arctic waters and exploit of Arctic routes in shipping.

2.3 Overview of Arctic Ice Melt

The most striking feature of recent changes in the Arctic, particularly in sea ice, is how quickly the Arctic is warming and ice is melting relative to changes seen in the long-term climate record. The most direct and obvious impacts to date are in the Arctic, where sea ice loss is affecting people, marine life, and the Arctic climate. However, there are emerging signs of impacts that extend into the mid-latitudes.

Spring melt is occurring earlier and freeze-up is trending later, allowing the ice-ocean system to absorb more solar radiation and increasing the energy input into the Arctic. At this point, ice-free conditions will likely emerge in September by the middle of the century (e.g., Notz and SIMIP, 2020). It is only under limited future emissions scenarios that the likelihood of largely sea ice-free conditions during summer can be avoided on a regular basis.

The impacts of sea ice loss are myriad within the Arctic: warmer ocean waters, longer fetch, more frequent storms, and increased coastal erosion, along with associated effects on the Arctic ecosystem and human activities in the region. The loss of sea ice also amplifies Arctic warming, impacting Greenland ice mass loss and permafrost thawing. (Humpert & Raspotnik, 2020)

2.4 Importance of New Emerging Trade Routes

These waterways were of little interest to shipping companies when thick “multiyear” sea ice choked the waters along Canada and Russia’s northern coasts. But now, climate change is causing the ice to thin and recede. Since 2007, in late summer, both the Northwest Passage and Northern Sea Route have been temporarily ice-free. Within the next decade, the Arctic could experience a complete late-season melt-out – and, with that, a permanent loss of the multiyear ice.

Shipping traffic along the NSR is expected to double this year due to increases in the size and frequency of ships traveling along the route. In 2010 the Danish 40,000 ton MV Nordic Barents was the first non-Russian bulk carrier to use the NSR as a transit trade route.

This year, the Japanese bulk carrier Sanko Odyssey, a ship almost twice its size, delivered iron ore from Murmansk, Russia to Xingang, China. Summer 2011 also saw the first supertanker, the 160,000 ton Suezmax-class Vladimir Tihkonov, using the shortcut from Europe to Asia.

While sustained sailing speeds along the NSR do not yet rival those along the world’s major shipping routes, they are likely to continue to increase as first year drift ice becomes less likely to present a serious obstacle during the summer months. The Vladimir Tihkonov maintained an average speed of 14 knots and sailed from Novaya Zemlya to the Bering Strait in seven and a half days surpassing the record set by the 74,000 ton Panamamax-class STI Heritage earlier this year.

Growing economic activity in the Arctic invites questions about the medium- and long-term prospects of shipping along the NSR.

Shipping companies and supporters of increased traffic in the region cite significant cost savings for ships that have sailed along the NSR and predict a rapid growth of Arctic shipping. Bulk carrier tonnage may increase tenfold, from 2 million tons today to 20 million tons by 2020, and oil and gas volume is predicted to grow along similar lines to 40 million tons per year by the end of the decade.

Researchers and shipping experts, however, remain skeptical about the commercial viability of the NSR. Canadian and American maritime experts say two percent of global shipping could be diverted to the Arctic by 2030, reaching 5 percent by 2050. Experts cite several factors which may determine the future growth of shipping in the Arctic. This series about the Northern Sea Route will explore how global trade dynamics and world trade patterns, the severity and speed of ice decline, fuel cost savings and transit fees, Russia's Arctic natural resources development, and the emergence of China, South Korea and Japan as Arctic maritime nations, may influence the development of the NSR.

Growing economic activity in the Arctic invites questions about the medium- and long-term prospects of shipping along the Northern Sea Route (NSR).

Over the past decade, Asia has overtaken North America as the largest market for European exports and the doubling of world trade by 2020 will further increase the importance of shipping lanes.

The attractiveness of the NSR as a shorter connection between Europe and Asia may increase further as container ship operators adopt “super-slow steaming” in order to reduce fuel consumption and costs.

The majority of cargo ships that ply the world’s oceans operate on regular schedules, called liner service. In total more than 6,000 ships, most of them container ships, follow a set route calling at a number of ports to load and unload cargo. The global maritime industry operates on just-in-time cargo deliveries. The ability to schedule journeys long-time in advance and to guarantee uninterrupted service are key for container ship operators.

The lack of schedule reliability along Arctic shipping routes represents a major obstacle to developing the NSR. The Arctic Ocean off the coast of Northern Russia may be ice free anywhere from late June until November. During some years the ice recedes early during the season and does not return until late into Fall, while in other years the ice-free period may be as short as six weeks. Simply put, there are no guarantees when ice-free conditions start or end. In addition, throughout the summer drift ice originating further north is likely to be pushed into the shipping lanes by wind and ocean currents. Even during the summer months Arctic weather remains unstable. Fog, poor visibility, and violent winds may interrupt the pace of regular liner services.

The regional impact of global climate change has been most amplified in the Arctic, where the annual average temperature has increased at double the global rate over the last 100 years. The Arctic is now warmer than is has been at any time during the last 2,000 years.

The Arctic Ocean, which has had perennial ice cover for the past 700,000 years, is on a trajectory to a new, seasonally ice-free, state.

The Intergovernmental Panel on Climate Change (IPCC) estimates that over the next century, Arctic temperature increases will exceed the global annual mean by a factor of four and will range between 4.3 degrees Celsius (°C) and 11.4°C in the winter and 1.2°C and 5.3°C in the summer.

This temperature rise will continue to have dramatic effects on Arctic sea-ice extent, which has diminished 40 percent between 1979 and 2010.

Over this same period, the Arctic sea ice has thinned considerably, experiencing a decline in average volume of 70 percent.

The reductions in both sea-ice extent and volume render the remaining ice more vulnerable to secondary risk factors, such as changing wind patterns, ocean circulation, and reduced sea-ice albedo.

As a general rule, first-year ice is more likely to melt during the summer months than multiyear ice, since ice that survives the summer is able to harden and become denser during the following winter. The Arctic has witnessed rapid loss in multiyear ice: whereas in 1988 the vast majority of ice was between four and 10 years old, by 2005 the majority of ice was less than four years old.

Reliable figures about actual cost savings along the NSR are limited since less than two dozen commercial vessels traversed the NSR since 2010. Cost savings along the NSR are closely linked to savings in fuel costs. Shipping operators can achieve fuel cost savings in two ways:

A vessel traveling from Murmansk to Yokohama via the NSR will, on average, arrive at its destination seven days earlier than the same vessel sailing through the Suez Canal. Due to the shorter sailing distance the shipping operator realizes fuel cost savings. The operator also derives savings from the reduced number of days at sea which allows the the ship to make more return trips within a given time period resulting in increased revenue and potentially greater profits. Instead of realizing time savings, operators can also adopt super-slow sailing which more than doubles fuel efficiency. Due to the shorter length of NSR, a ship going from Murmansk to Yokohama can reduce its speed by 40 percent and still arrive in Japan at the same time as a ship sailing at full speed traveling through the Suez Canal. Especially for bulk shipping operators transporting low-value raw materials, such as ore, the primary incentive to travel along the NSR may not be the reduced lead time, but fuel cost savings.

In addition, the costs of using the NSR are frequently understated or ignored. Besides the frequently cited costs for ice-breaker escorts shipping companies also incur significant indirect costs. In order to sail the NSR operators have to file for a permit with the Administration of the NSR four months in advance. Few operators are able or willing to plan that far in advance and deal with the bureaucracy of obtaining a permit. In

comparison, the process of sailing through the Suez Canal only requires a 48-hour advance notice.

Vessels are only allowed to sail along the NSR after they have been inspected for ice worthiness by either the Murmansk Shipping Company or the Far Eastern Shipping Company. The operator bears the logistical costs associated with that inspection. Furthermore, during the inspection and during the actual transit of the NSR, operators often need to hire interpreters as pilots and ice-breaker crews seldom speak English

3. Arctic Maritime Routes

3.1 Northern Sea Route (NSR)

The Northern Sea Route is the shortest sea route linking Europe to Asia.However, until the last century, due to its harsh icebound environment, the only ships that used it (other than the merchant ships of nations along the coast) were oceanographic ships conducting surveys. In recent years, though, it has begun to attract global attention because the reduction in the quantity of ice in the Arctic Ocean has brought about an increase in the number of foreign merchant ships using the Northern Sea Route to sail between Europe and Asia.Special skills and expertise are needed to sail

safely through the Arctic Ocean and other seas where ice might be encountered.

These include early detection of ice by means of appropriate watchkeeping, estimation of the direction and speed of ice movement, and visual determination of the hardness and thickness of ice. Even a slight error in the response could lead to a collision with the ice,causing a major accident.

3.2 Northwest Passage (NWP)

The Northwest Passage is a waterway connecting the Pacific and the Atlantic, stretching from the Bering Strait to Baffin Bay, traversing above North America. The route is situated in the Inuit Nunangat, the homeland of the Inuit. Most of the year, the route is completely frozen.The Northwest Passage is one of the three potential Arctic maritime routes. Despite the global attention since Roald Amundsen's first navigation of the route, so far, the NWP has been transited 430 times in total, ever, including ice breakers, cargo vessels, leisure boats and cruise ships.The legal status of the Northwest Passage is debated: Canada sees it as internal waters, whereas the United States considers it as an international strait. As the sea ice is melting, the legal status of the NWP becomes increasingly important as more activity is possible. However, the excitement towards the Arctic maritime route is based on the hopes of the future, not necessarily on the transit numbers of today.

The melting of the sea ice is an ecological and cultural catastrophe for the creatures that depend on it. However, melting sea ice also opens up new resources, such as the Arctic sea routes. The Arctic sea routes are deemed utopian or dystopian, depending on one's point of view. Navigating the polar waters can be treacherous with ice, difficult weather conditions and poorly charted marine spaces,but even still, there is increasing geopolitical attention towards a more active utilization of these sea routes.

3.3 Transpolar Sea Route

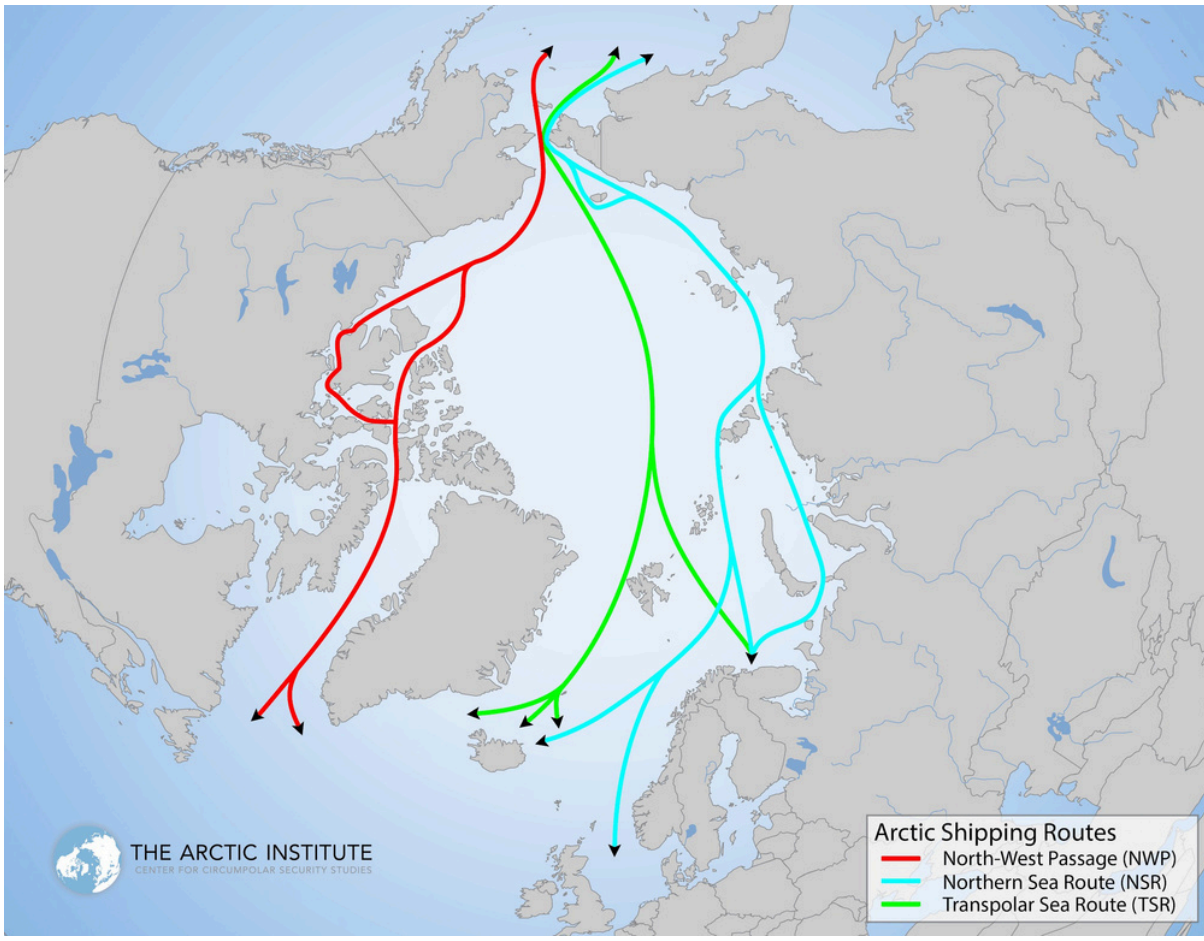
The Transpolar Sea Route (TSR) is a future Arctic shipping route running from the Atlantic Ocean to the Pacific Ocean across the center of the Arctic Ocean. In contrast to the Northeast Passage (including the Northern Sea Route) it largely avoids the territorial waters of Arctic states and lies in international high seas.The route is currently only navigable by heavy icebreakers. However, due to the increasing decline of Arctic sea ice extent, the route is slated to emerge as the predominant Arctic shipping route by 2030.

As climate change accelerates and the Arctic Ocean reluctantly exchanges its year-round ice cap for merely seasonal cover, this transpolar passage is likely to open up by mid-century, if not sooner.If Arctic sea ice disappears even for just one summer, as the comprehensive 2009 Arctic Marine Shipping Assessment notes , this would spell “the disappearance of multi-year sea ice in the central Arctic Ocean.

Such an occurrence would have significant implications for design, construction, and operational standards of all future Arctic marine activities.” In the absence of thick multi-year ice, which can be up to five meters deep, any water that refreezes would take the form of much thinner, more navigable seasonable ice.Forget needing nuclear icebreakers, within the next few decades, in summer, it may be possible (even if insurance companies and the Polar Code still mandate polar-class, ice-resistant ships) to sail in a regular vessel across the top of the Earth.In a world where timeliness means the difference between loss and profit, the Transpolar Passage could prove enticing, just as the Northern Sea Route and Northwest Passage do. For journeys between Europe and Asia, the Northern Sea Route can already be two to three weeks faster than the Suez Canal.

By cutting straight across the Arctic, the Transpolar Passage could save a further two days.Fast shipping isn’t everything, of course. Besides time, shipowners also consider risks and costs, and polar shipping still is a more dangerous and pricier undertaking due to the advanced types of ships required, insurance costs, and icebreaker escort fees. Most shipping these

days also follows the pendulum model, with vessels stopping at ports between their origin and destination to make deliveries. This logistics chain requires markets, of which there are obviously none in the middle of the Arctic Ocean.



4. Opportunities Provided by the Arctic Sea Routes

4.1 Reduction in Shipping Distances and Costs

The industry stands at a critical milestone for its future. That is being the dual imperatives of environmental sustainability and economic efficiency. As the International Maritime Organization (IMO) concentrates its regulatory framework to achieve the Sustainable Development Goals (SDGs), the industry is increasingly focusing on the optimization of the logistics network.

The primary opportunity of Arctic sea routes lies in providing an alternative to the historically and economically crucial Suez Canal. This shift is driven by fundamental economic principles, in a market where similar alternatives exist for a important service, the economy avoids the risks of any monopoly. By introducing competition to traditional maritime gates, these routes help maintain lower shipping costs and prevent total dependence to a single transit point, ultimately encouraging a more resilient and balanced global trade network.

Apart from the geographic reduction in mileage, the Arctic sea routes also offer a critical solution to the chronic logistic bottlenecks that plug the Suez Canal. In the modern shipping industry , time is often more expensive than

fuel, and the Suez Canal has become an increasingly expensive site of slowdown. Due to the physical limitations of the canal and its heavy traffic, ships often have to wait long periods in anchorages and transit at slow speeds. The Northern Sea Route eliminates these traditional choke points , allowing shipping companies to avoid the extreme numbers of unpredictable delays from congestion, labor strikes, or mechanical blockages like the infamous six-day grounding of the *Ever Given* in 2021 that held up billions of dollars of global trade.

Cutting transit times from 35 days through the Suez to 22 days through the Arctic has a huge economic ripple effect. saved days can mean lower daily charter rates, lower wages paid to crew members, and much lower inventory holding costs for companies waiting for their goods. For example, a freighter sailing between South Korea and Germany can take two weeks off the voyage, effectively enabling the ship to do more round-trips a year. And this efficiency boost means more than faster shipping it means an extreme level of cost reduction. It means maximizing the productivity of the fleet and keeping supply chains fluid, rather than being caught in a maritime traffic jam.

4.2 Economic Opportunities for Arctic and Non-Arctic States

The melting of polar ice has opened a new era in the global economy with comparable yet distinct opportunities for Arctic coastal states and non-Arctic states. The main advantage for the Arctic States (e.g., Russia, Canada, and Norway) is the direct control of resources. These countries are sitting on an enormous treasure of natural wealth, including an estimated 30% of the world's undiscovered natural gas and large deposits of critical minerals such as nickel and rare earth elements. By constructing such "High North" infrastructure, these states can turn remote coastlines into global energy hubs, making huge sums in extraction taxes, port fees, and compulsory icebreaker escort fees for passing ships. And these countries are set to step in as fish stocks shift into cooler waters. And with fish stocks shifting to colder waters, these countries are well-positioned to shape the future of global food security via expanded northern fisheries.

on the other hand, Non-Arctic States see the region through the prism of investment and trade efficiency. These states are dominated by economic bigs like China, Japan, and EU members. The development of Arctic maritime lanes represents a logistical revolution for these export-driven economies. They can cut transit distances by up to 40% by avoiding the traffic jams and geopolitical dangers of the Suez and Panama Canals by using the Northern Sea Route or the Northwest Passage. Non-Arctic States,

on the other hand, see the region through the prism of investment and trade efficiency.

4.2 Economic Opportunities for Arctic and Non-Arctic States

The Arctic has become a critical arena for geostrategic and geo-economic competition. Rising temperatures, melting sea ice, and thawing permafrost are exacerbating regional security risks and vulnerabilities. Changing environmental conditions are also reshaping patterns of economic access and resource availability. New economic prospects are fueling interest in the region from Arctic and non-Arctic states. Economic activity in the Arctic is expanding across several areas, including resource development, infrastructure investment, commercial shipping, and sectors such as fisheries, tourism, and information technologies. Economic opportunity in the Arctic is increasingly a driver and a multiplier of strategic competition. Decisions about resource development, infrastructure, and connectivity shape long-term access to and resilience in the region, influencing states' ability to operate and to project soft and hard power. Arctic economic activity is subsequently no longer separable from geopolitics.

Local realities also shape Arctic economic development. For those who live and work in the region, priorities include their livelihoods, reliable transport, affordable energy, food and job security, health care, and the viability of their communities, which are facing rapid environmental

change. Most Arctic communities are in remote and sparsely populated territory. This raises the cost of infrastructure, transportation, energy, and public services, while limiting economies of scale. Climate change intensifies these pressures. Thawing permafrost is already affecting roads, airports, pipelines, and housing; coastal erosion threatens settlements; and changing ice conditions affect food sources on which long-standing cultural and subsistence practices rely.

For Arctic communities, development is not an abstract strategic debate. The future of many local and Indigenous communities' long-term resilience depends on increased and sustained investment, particularly in infrastructure, transport links, energy access, and essential services. As a result, debates on Arctic economic potential intersect directly with questions of community viability.

4.3 Access to Natural Resources

The world's major economic powers are now competing furiously for control of the Arctic is melting very quickly. For a global giant in the economy like the

People's Republic of China, the Arctic is far more than a new shipping route. This is a key practical for long-term energy security. The fight for these resources has

become a defining geopolitical issue, with the region estimated to contain 30% of the world's undiscovered natural gas and 13% of its untouched oil.

The power struggle comes down to a basic question: who will ultimately control

the rights to these reserves? Energy dependent nations shall establish a foothold in the Arctic if they want to ensure their industrial survival and economic primacy in

the decades to come. The Arctic is no longer a remote wilderness but a central point of global statecraft, where the struggle over resource ownership will likely determine the future balance of international economic power.

5. Impending Risks Caused by the Situation in the Arctic

5.1 Environmental Risks

The Arctic is now the frontline of the global climate crisis, where something called Arctic Amplification is occurring. Surface temperatures are increasing at four times the pace of the global average, and the "albedo effect" the process of white ice reflecting solar radiation is being replaced by a warming loop. Ice melt exposes dark ocean water, which absorbs heat and accelerates melting of nearby glaciers.

This is not a regional problem. Destabilization of the Greenland Ice Sheet is a major contributor to global sea-level rise, threatening low-lying coastal cities from Jakarta to New York.

The industrialization of the High North is also carrying with it, besides climate feedback, the catastrophic risk of oil spills in ice-covered waters. Traditional oil spill response methods, like booms and chemical dispersants, are not effective in

the Arctic. Oil can be trapped beneath moving ice floes, where it cannot be tracked or recovered. In addition, the lack of sunlight for six months of the year and the coldtemperatures enormously inhibit biological degradation of hydrocarbons, so a

single spill could decimate local fisheries and native food sources for decades. The increase in shipping traffic also means that black carbon is deposited on the

ice. The soot absorbs sunlight, turning the ice into a heat sink and creating local “melting furnaces” which destroy the habitat of species such as polar bears.

Finally, permafrost thawing is a ‘hidden’ environmental risk of global proportions.

When frozen ground in Siberia and Northern Canada thaws, it destabilizes local infrastructure, causing buildings and pipelines to collapse. More importantly, it

releases large amounts of trapped methane, a greenhouse gas far more potent than

carbon dioxide. This release threatens to unleash a “carbon bomb” that will make it virtually impossible to meet international climate goals, including those contained in the Paris Agreement.

5.2 Safety Challenges

You are gambling, you are working in the Arctic, against some of the harshest physical environments on earth. The promise of shorter routes has not made the region a logistics black hole. The biggest safety issue is the major lack of Search and Rescue (SAR) infrastructure. In established shipping lanes like the

Mediterranean, assistance for a rescue is typically hours away; in the Arctic, the

closest icebreaker or medical facility might be days away or even a week away. The incident involving the cruise ship Viking Sky off the coast of Norway in 2019 is a

stark reminder that even near-shore emergencies in cold waters can quickly become near-disasters.

Navigation in high latitudes was plagued by technical failures and “white-zone” mapping.Much of the bottom of the Arctic Ocean has never been surveyed

hydrographically to modern standards . Ships are sailing in uncharted waters , and any time they might hit an unseen reef and be holed . Traditional compasses do not work near the magnetic North Pole and the earth’s curvature can block satellite communication, leaving crews isolated in emergencies.

Also, the physical threat of ice accretion could alter the centre of gravity of a vessel, creating a risk of capsizing. “Ice-Class” also takes an enormous

psychological and physical toll on the crew. The dense “sea smoke” of the

polar night in total darkness creates a zero-visibility situation where detecting a rogue iceberg is a difficult task even with high-end radar.

The United Nations Convention on the Law of the Sea (UNCLOS) governs the complicated"diplomatic minefield" that is the legal terrain of the Arctic.The Arctic is an ocean surrounded by sovereign governments anxious to claim their share of the prize, in contrast to the Antarctic, which is protected by a treaty that forbids military and commercial exploitation.The Extended Continental Shelf (ECS) is the most controversial legal topic.Russia, Canada, and Denmark (via Greenland) have all filed overlapping claims to the underwater mountain range known as

Lomonosov Ridge.Each country claims that the ridge is a geological extension of its own landmass, giving it exclusive rights to the gasses and minerals on the seafloor all the way to the North Pole.

The legal status of Arctic waters is another subject of contention.According to Russia, the Northern Sea Route (NSR) is part of its internal waters, which gives it the authority to control all traffic, impose taxes, and require the use of Russian pilots.The United States and a number of EU countries strongly disagree, viewing the NSR as a "international-strait" where the right of innocent passage ought to be protected.

As non-Arctic nations like China proclaim themselves "Near-Arctic States," legal

tensions rise. Despite not having any sovereign territory in the Arctic, China's

"Polar Silk Road" plan aims to include Arctic resources into its global supply network. Members of the Arctic Council are now worried about "creeping

jurisdiction" and the possibility of non-regional forces undermining the current legal system. The Arctic is in danger of changing from a region of "High North, Low Tension" to a new theater of international conflict due to the recent

militarization of the area, which includes the reopening of Soviet-era outposts and increasing NATO drills.

5.4 Impact on Arctic Wildlife

As environmental conditions change and human activity continues to increase in the Arctic marine environment, it becomes more important than ever to have a clear understanding of the abundance and distribution of the many and varied wildlife that are present (permanently or temporarily). This will ensure that the impacts of human activities can be minimized; conservation measures can be deployed and managed to protect the most vulnerable species and habitats; human activities and industrial/economic developments occur sustainably; and that indigenous communities and their way of life are preserved, consulted, and supported now and in the future. The Arctic is home to seven endemic marine mammals, which are dependent or highly associated with sea ice for part of the year. Some of the arctic wildlife animals are the following;

narwhal (Monodon monoceros), beluga whale (Delphinapterus leucas) , bowhead whale (Balaena mysticetus) , walrus (Odobenus rosmarus) , Polar bear (Ursus maritimus)

The Arctic is seasonally populated by approximately 200 species of bird (of which the majority are migratory). There are 64 species of seabirds (birds which spend a proportion of their time at sea, primarily feeding); 44 species of seabird and 59 species of shorebird (associated with coastal areas, but some sea ducks, divers, geese and swans may spend some time at sea) that breed (23 in the high Arctic and 41 exclusively in the low Arctic) in the Arctic. In both polar regions, diving seabirds reach their maximum diversity in sub-polar latitudes, and the highest densities of breeding seabirds occurs in Arctic waters (CAFF, 2013). Of the 16,000 global fish species, 633 are known to occur in the Arctic Ocean, with 15 species considered to be rare and endemic to the Arctic, with an additional 63 considered to be true Arctic generalists.

Overall, the status of many Arctic marine fish is unknown and it is thought that about 95% have not been evaluated for threat/vulnerability (CAFF, 2013). Fish species endemic to the Arctic Ocean and adjacent seas (AOAS) are the ice cod (Arctogadus glacialis) and polar cod (Boreogadus saida); 49 species of cartilaginous fishes (21 shark species, 27 skate species and 1 rabbit fish species), spatial distribution varies, with some sea areas devoid of these fish.

Fish in the Arctic Ocean are an important part of the ecosystem and food web. Some species live within the water column (pelagic) and others live close to the seafloor (demersal). Fish are important predators on plankton and bottomdwelling animals (benthos; (Norcross & Iken, 2016)). Fish are a key food source/prey for marine mammals, seabirds and humans, particularly the Arctic cod. Climate change is a specific concern for Arctic cod because its young life stages depend on sea ice as a habitat, and this central species in the Arctic food web may be severely impacted by the ongoing and projected sea ice loss (Norcross & Iken, 2016)

6. Influence on Maritime Security

6.1 Militarization and Strategic Competition

The Arctic is a gateway to the North Atlantic, hosting vital trade, transport and communication links between North America and Europe.

It is also an area of increasing strategic competition. Russia has significantly increased its military activity in the region – setting up a new Arctic Command, opening new and former Soviet-era Arctic military sites (including airfields and deep-water ports), and testing novel weapons systems. China's interest in the Arctic is also growing, as Beijing seeks to gain access to energy, critical minerals and sea lines of communication. Furthermore, increased Russia-China cooperation has strategic and

operational implications for NATO's deterrence and defence posture in the region.

Despite claims that climate change is transforming the Arctic into an arena of great-power competition, the region's strategic fundamentals remain largely unchanged. Territorial disputes persist and are largely procedural, shipping and resource incentives are overstated, and US rhetoric on Greenland is strategically incoherent.

Several long-standing territorial disputes illustrate this dynamic. The North Pole itself is contested between Canada, Greenland/Denmark, and Russia, while the United States, alone among the eight Arctic States in not ratifying the United Nations Convention on the Law of the Sea (UNCLOS), maintains an unresolved maritime dispute with Canada in the Beaufort Sea. Canada and Denmark only settled a territorial dispute over Hans Island in 2022.

Yet these disputes have not driven instability. Governed by established legal frameworks and involving limited material stakes, the disputes over Arctic territory persist primarily because there is little urgency to resolve them.

The fact that the Arctic Council has survived following Russia's invasion of Ukraine owes less to any notion of Arctic exceptionalism than the region's relative mundanity. Cooperation endures because the strategic payoff from confrontation remains low. Yet reports continue to claim, as if it is a matter of fact, that rising temperatures and receding ice will make the Arctic an arena for increased competition.

Commercial behaviour offers a more reliable indicator of risk than strategic speculation. Shipping routes that are central to global trade tend to attract sustained investment and infrastructure development. Arctic routes exhibit neither of these characteristics. Transit remains seasonal and unpredictable, with even summer navigation subject to severe weather, limited search-and-rescue coverage, and high insurance costs. As a result, shipping through the Arctic is best understood as supplementary rather than critical.

Nor would increased Arctic transit imply heightened militarisation. Major disruptions to global shipping in recent years, most notably in the Red Sea, have stemmed from non-state threats such as piracy, not from competition between great powers over access to sea lanes. Comparable dynamics are unlikely to emerge in the Arctic, where traffic volumes remain low and strategic dependence is minimal. With year-round passage not anticipated until 2100, Arctic shipping lacks both the immediacy and economic significance required to drive militarisation.

While the Arctic is indeed rich in resources, those resources won't necessarily produce competition unless they are economically viable, politically contested, and legally ambiguous conditions that do not generally apply to the Arctic Ocean.

For a large offshore oil rig, the time from discovery to first oil can be more than a decade. There are currently no public plans for offshore Arctic oil rigs. The conditions are far too harsh, the costs far too high, and there is no guarantee that petroleum demand will hold into the future. Even if there

were, this would hardly be cause for great-power competition. Arctic maritime territorial disputes are largely procedural, unresolved primarily due to political disinterest rather than controversy. This is evident in the resolution of Russia and Norway's Arctic maritime boundary in 2010 with a treaty dividing the Barent Sea. To the degree that offshore resource deposits will become available as Arctic ice retreats, they are more likely to be economically marginal and legally and politically manageable than cause for a geopolitical maelstrom.

Arctic and non-Arctic countries alike revel in demonstrating Arctic combat capabilities. An Arctic-capable fighting force is a cold weather fighting force. But demonstrating Arctic capabilities does not imply a looming Arctic conflict; it simply allows nations to showcase their potential. Arctic war planning does not inevitably follow from cold weather capability building and signalling. Notably, the United States has not treated Alaska, its more direct point of access to the Arctic, as a locus for sustained militarisation.

6.2 Infrastructural Insufficiency and Vulnerabilities

The Arctic is changing. Temperatures in the region are increasing causing a range of physical and environmental changes. Arctic sea ice is thinning and receding. As these changes expose potential opportunities and because the Arctic Sea provides shorter routes for global shipping, the international interest in the Arctic has increased. The growth of international interest towards commercial utilization of Arctic Seas is inevitable.

The traffic in the Northern Sea Route is continuously growing. Gas related mega-projects, located in the Russian Arctic, as well as governmental cooperative actions of the Russia and China to build the “Ice Silk Road”, will boost the near-future marine activities and shipping in the Northern Sea Route. Commercial utilization of other trans-Arctic routes is still marginal, or practically zero. For the Northwest Passage, several areas are considering project proposals to build transhipment ports that might provide an as-yet undeveloped shuttle service across Arctic passages, including the Transpolar Route. Whether these schemes will go to fruition or not, remains to be seen. Arctic shipping presents not only opportunities, but also challenges and threats. Sea ice, even if it is thinning, still creates major challenges for economically feasible shipping. Ice features, such as multi-year (icebergs, etc.) and compressive ice, which generate threats and hampers shipping, may exist in the encountered ice regime.

The reasonable shipping season for nonspecialised ice strengthened ships is currently only few months long. Marine (coastal) infrastructure, which is currently lacking, must be set up to enable safe and efficient trans-Arctic navigation. The Arctic environment is vulnerable. To enable utilization of Arctic routes in an environmental-friendly manner it is important to consistently study the effects of shipping on Arctic nature. An understanding of Arctic environment, together with findings and learnings from anticipated future studies, can be utilised to plan and execute shipping so that the environmental impacts are minimized. In addition, these studies

would improve the design of “greener ships” and enables the development of the services for “greener navigation” practices. Appropriate services, together with appropriate ships, ensure that Arctic shipping practices are conducted in the most environmentally friendly and sustainable manner in the future.

6.3 Risks of Illegal Activities

The exploitation of the Arctic Ocean has been found beneficial for several states. Climate change has produced several opportunities to use navigation channels for extended summer periods(Ibrion et al., 2021). As a result, it reduces the cost and time of a major trading route from East Asia to North Atlantic countries (Gunnarsson, 2021). However, navigation has significant challenges, and the Arctic States actively safeguard this maritime route (Christodoulou et al., 2022). As the commercial interest in the Arctic Ocean increases, tension among states may appear. Consequently, additional security threats may arise due to territorial disputes in the Arctic Ocean. The main legal framework used to determine maritime borders in the Arctic Ocean is the United Nations Convention on the Law of the Sea (UNCLOS 82). UNCLOS 82 defines territorial sea, contiguous zone, Exclusive Economic Zone (EEZ) and continental shelf (Choi and Lim, 2024). The EEZ extends 200 nautical miles from the shore and allows the exploitation of fisheries, minerals and oil gas (Wood-Donnelly, 2022). Exploitation of EEZs sometimes includes leasing options to private companies. Examples

are the Spratly Islands in the South China Sea and the Grey Zone between Canada and the USA (Knott et al., 2024). Therefore, it is of particular interest to states as it allows a state to exercise control over ships entering this area, although not being territorial waters(Androjna and Perkovič, 2021).

Each state has economic benefits to maximise its EEZ, even at the expense of other states. Consequently, in many cases, the UNCLOS 82 requirements are deliberately misinterpreted in several cases(Handeland, 2022). Notable examples include disputes about the establishment and use of artificial islands, instalments, and historical claims, as in the case of Dokdo between South Korea and Japan (Choi and Lim, 2024). A far more complicated regulatory gap with UNCLOS 82 is when a state installs wind farms within its EEZ, which has a negative impact on other states' wind farm production, such as the Norway and Denmark case (Finserås et al., 2024). There are also some grey areas in interpreting the definition of EEZ when terms such as ice-covered waters are included (Buixadé Farré et al., 2014). However, there are examples of agreements between states that do not strictly follow the 200-mile rules described in the convention to avoid conflicts (Gavrilov et al., 2022).

One of the main issues with UNCLOS 82 is that several states have not ratified it. In contrast, land borders are usually designed after wars and, therefore, are more complex to challenge for validity. This is a significant security threat from foreign military activities in the EEZ of a state, which could threaten regional stability (Afriansyah et al., 2024). There are fears

that tensions may appear in the Arctic Ocean after the Ukrainian conflict ends. Unless there is a mutual agreement to ensure ship navigation, there could be a severe impact on ship security and navigation. As per generic beliefs, the Russian Federation may increase tension in the Arctic as its position is not in its best interest. Existing cooperation agreements and positions in international bodies provide Russia with disadvantages (Pedersen and Steinveg, 2024). An example of willingness to escalate tension without involvement in military conflict can be seen in the Chinese EEZ. Disputes have the form of objections to Asian nations' military exercises and enforce economic trade barriers.

For commercial ships, it is crucial to know which state jurisdictions are operating (Karahalios, 2021). Several security threats to ships may appear as an escalation in disputed areas. Navigating through disputed maritime zones poses significant challenges to the security of ships. This paper examines how beneficial and, therefore, likely it is for some Arctic states to escalate tension. States' escalation phases and tactics vary from legal disputes to unauthorised military exercises, ship seizures, and cyberattacks. Cybersecurity is a new military domain, and the states have developed significant capabilities in this field. Russian Federation's involvement in foreign affairs with cybersecurity attacks has been suspected by scholars (Linvill et al., 2019).

Cyber-attacks could be part of possible Arctic tensions (Wilson Rowe, 2020). In some cases, ships with spoofed GPS signals were found in disputed territorial water and seized (Androjna and Perkovič, 2021).

Modern ships rely on the Internet for commercial activities (Sarker et al., 2023). However, the lack of expertise in ship management companies, the poor IT infrastructure, and insufficient investments are well documented (Yu et al., 2023). Also, seafarers lack proper training (ENISA, 2019). An example of a cyberattack on a ship could be the loss of navigation charts (Svilicic et al., 2019). Satellite communication jamming and spoofing (Androjna and Perkovič, 2021). A cyberattack on a ship may significantly impact seafarers' health or cause environmental damage(Staupe-Delgado et al., 2022).

7. International Frameworks

7.1 United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea, often referred to by the English acronym UNCLOS, is a multilateral treaty concluded under the auspices of the United Nations and resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place between 1973 and 1982.The convention was opened for signature on 10 December 1982 in Montego Bay and entered into force on 16 November 1994 upon deposition of the 60th instrument of ratification.The Convention defines and codifies the standards and principles of international maritime law, inherited from customary international law relating to maritime affairs and are expressed to a great extent in the United Nations Charter and

current international maritime law norms, such as the Geneva Conventions of 1958. A large portion of these requirements were further strengthened and expanded.The Convention also created the International Court of the Law of the Sea, competent to hear disputes relating to the interpretation and application of that treaty.

7.2 The International Convention for the Safety of Life at Sea (SOLAS)

The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960. The 1974 version includes the tacit acceptance procedure - which provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties.As a result the 1974 Convention has been updated and amended on numerous occasions. The Convention in force today is sometimes referred to as SOLAS, 1974, as amended.

7.3 The International Convention for the Prevention of Pollution from Ships (MARPOL)

The International Convention for the Prevention of Pollution from Ships /MARPOL is an important convention for preventing pollution of the maritime environment.It sets standards for stowing, handling, and shipping, and lays down rules for the disposal of ship-generated hazardous waste, such as cleaning agents and cargo hold wash water.MARPOL and SOLAS are considered two adequate safety and environmental protection tools of the IMO. MARPOL is the main international convention aimed at the prevention of pollution from ships caused by operational or accidental causes. It was adopted at the International Maritime Organization (IMO) in 1973. The Protocol of 1978 was adopted in response to a number of tanker accidents in 1976–1977. The 1978 Protocol was absorbed into the parent Convention and the combined instrument entered into force in 1983. In 1997, a Protocol was adopted to amend the Convention and a new Annex VI was added, which came into force in May 2005. The technical requirements of MARPOL are included in six separate Annexes:

- Annex I—Regulations for the Prevention of Pollution by Oil
- Annex II—Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
- Annex III—Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
- Annex IV—Prevention of Pollution by Sewage from Ships
- Annex V—Prevention of Pollution by Garbage from Ships
- Annex VI—Prevention of Air Pollution from Ships

8. Questions To Be Addressed

1. How can the international community balance the economic opportunities of Arctic trade routes with the environmental risks caused by Arctic ice melt?
2. What measures should the International Maritime Organization (IMO) take to ensure safe mapping and effective search and rescue operations in Arctic waters?
3. To what extent should Arctic and non-Arctic states be allowed to access and utilize emerging Arctic maritime routes and natural resources?
4. How can international legal frameworks such as UNCLOS, SOLAS, and MARPOL be strengthened to address disputes and security concerns in the Arctic region?
5. What actions can be taken to minimize the negative impacts of increasing maritime activity on Arctic wildlife, ecosystems, and Indigenous communities?
6. How can states prevent the militarization of the Arctic while maintaining maritime security and protecting national interests?
7. What strategies can be implemented to reduce the infrastructural and technological vulnerabilities of Arctic shipping routes?
8. How should the international community address emerging risks such as cyberattacks, illegal activities, and jurisdictional disputes in Arctic maritime zones?

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