

Arctic Shipping and Polar Seaways

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1 Introduction

Climate change in the Arctic triggered a series of discourses about the opening up of a previously unreachable region. The long-fantasized northern routes would be on the verge of becoming actual seaways as a consequence of the melting of sea ice. In reality, navigation remains difficult in the Arctic, transits are still very limited, as sea ice is still a major constraint. The passages have always intrigued though, provoking fascination as early as when the Vikings reached the western coast of Greenland, to the vivid reaction to the Russians planting a flag on the North Pole in 2007. With climate change, the Arctic is being scrutinized more than ever; hence, the numerous discourses about navigation in particular. In this article, we analyze the development of both the Northwest Passage (NWP) and the Northern Sea Route (NSR). We then investigate the recent trends in Arctic shipping in order to put those discourses into perspective and portray the current tendency.

2 The Soviet State and the Development of the Northern Sea Route

The Northern Route, *Sevmorput* in Russian, was partially explored and used in its western part as early as the eighth century by Irish monks, the Vikings in the tenth century, and also Basque whalers in the fourteenth century [1]. The search for a route from Europe to Asia began in the sixteenth century by British, Dutch, Danish merchants, and later, Peter the Great envoys [2]. Explored in phases during the nineteenth century, the Northeast Passage was first traversed in two seasons in 1878 and 1879, from Tromsø to the Bering Strait by Swedish explorer Nordenskjöld, and the first voyage between Arkhangelsk and Vladivostok in a single season was carried out in the summer of 1932 [1].

The Russian government regained interest in the Northern Route at the end of the nineteenth century, particularly for its strategic importance during the 1904–1905 Russian–Japanese war [2]. In February 1932, the Soviet Union established the Chief Administration of the NSR, called *Glavsevmorput*, to conduct and manage the NSR in accordance with the Soviet National Interest and the Arctic Institute [1, 3]. Its mission was to design, set up, and manage a regular navigation system in the Russian Arctic. The NSR is the section of the Northeast Passage comprised between the Kara Gate and the Bering Strait, and administered by the Northern Sea Route Administration (NSRA). This specification is important inasmuch as it accounts for the fact that, for instance, ships sailing from Murmansk to Asia are considered as transiting ships by the NSRA, whereas, when compared to the Northwest Passage, they are performing a destination voyage, as they departed from a Russian Arctic port (see Figure 1).

The route was opened every summer from 1935 and was navigable all year round in its western part since 1978 [4]. The Soviet project was exclusively intended for the development of the Siberian North by the Soviet merchant fleet: until 1966, no transit dimension between Europe and Asia was considered, nor was the opening of a service to non-Soviet shipping companies in the Arctic [5]. Three priority objectives were assigned to the *Sevmorput* administration: scientific research, aids to navigation, and the constitution of an Arctic fleet. Funded by the State until 1987, this administration trained qualified staff able to work in high latitudes: sailors, aviators, meteorologists, dockers, etc. [4, 6]. Commissioned in 1959, the *Lenin* was the first nuclear-powered icebreaker and could reach isolated regions without fuel capacity limitations [3]. Only the USSR and then Russia deployed a fleet of nuclear icebreakers, and the maintenance of the NSR presently still rests on these powerful vessels. The *Glavsevmorput* also



Figure 1 Arctic Shipping routes.

opened several ports along the NSR including Dikson, Tiksi, Mys Shmidta, and Provideniya [3, 6]. From the first five-year plans (1928–1932), the development along the NSR was integrated into the Arctic regions development programs: the development of shipping along the NSR, meant as a tool to tap into Siberian resources, is largely the result of the centrally planned soviet economic system. Moscow promoted the construction of railways, Siberian ports, and the articulation of sea traffic along the Siberian coast with river transportation for the development of the hinterland, along the Ob, Ienisei, Lena, and Kolyma rivers. Resource development, construction, and operation of the ports also initially depended on the Gulag administration and the pioneering fronts developed largely through the contribution of prison labor. Vorkuta (coal mining), Norilsk (a major nickel-mining center), Pevek, and Magadan initially developed as gulag camps or hubs, set up to exploit natural resources.

On the military perspective, the *Sevmorput* was used during World War II to transfer military and supplying ships from the Far East bases to Murmansk to support

convoy escorts on the North Atlantic and as an alternate supply route from American West Coast ports to Russia's northern ports through the Bering Strait [1, 3, 4, 7]. After World War II ended, the Soviet grew increasingly appreciative of the value of the NSR for defense strategy reasons [1]. During the Cold War, multiple radar surveillance stations, missile and naval launch bases, military aerodromes, and border guard camps were established along the NSR. Several experimental centers for underground nuclear tests took place: 130 tests between 1955 and 1990, especially in Novaya Zemlya.

The Arctic Soviet economic development policy was largely based on the centrally planned economic policy and the government's will to maximize the development of Soviet resources, for political reasons: the USSR should not depend on foreign supply of raw materials [5]. Traffic gradually increased as ports were set up and Arctic mines, as in Norilsk, were opened, and peaked in 1987 at 6.6 million tons (Mt) [4, 8]. The goods sent to Arctic ports were composed of energy products (oil products and coal), construction materials, construction and industrial equipment, foodstuff, transportation, and

Table 1 Evolution of Northern Sea Route transits, 1991–1997.

	1991	1992	1993	1994	1995	1996	1997
Number of vessels	15	12	22	7	8	3	2
Tonnage (1000 tons)	210	186	226	10	120	38	30

Source: CHNL Information Office (2013). *NSR Transits Before 2011*, www.arctis-search.com/NSR%2bTransits%2bbefore%2b2011 (accessed 24 January 2018).

consumer goods for the local population. On return journeys, the ships transported raw materials [4].

2.1 NSR Decline with the Fall of the USSR

The *Sevmorput* exploitation remained profitable until 1991, when traffic had, however, fallen to 4 Mt. The economic decline and the suspension of public subsidies that followed the collapse of the USSR led to a decline in traffic that reached a post-Soviet low in 1998 with 1.45 Mt [4]. The Arctic regions were struck by profound economic and demographic recession. With the collapse of the USSR, the jurisdiction over the NSR passed to the Russian Federation. Financial and economic disruption forced an administrative reset: the Ministry of the Merchant and the Ministry of River Transport were reorganized as departments under the new Ministry of Transport, which resulted in budget cuts [3, 6]. Also, due to the dismantlement of the USSR, Russia's port capacity was reduced by 53%, as 11 of 18 ports were closed, and the national commercial fleet was severely compressed [3]. Many land equipment was no longer maintained. The end of the USSR was accompanied by a demilitarization of the Arctic. On the Kola Peninsula, the military-industrial complex collapsed, military shipyards went down, and a large number of soldiers left the region. The city of Murmansk, which partly benefited from its development of the military sector, lost 100 000 inhabitants between 1991 and 1999, down from 450 000 to 345 000.

Before its collapse in 1991, the USSR had tried to foster international interest for Arctic shipping. In 1987, according to the policy of openness, the president of the USSR Mikhail Gorbachev suggested that the NSR should open for commercial foreign vessels. The official opening took place on 1 July 1991 [9–11]. However, largely due to complex formalities, up until 2009, Soviet (later Russian) ships carried out most transit voyages along the NSR.¹ This renewed interest in the NSR led to the establishment of international research assessments, such as the “International Northern Sea Route Program” (INSROP), an initiative of Russian, Norwegian, and Japanese organizations [1, 3]. Despite the conclusion of the research underlining the difficult commercial conditions for shipping at the time, it was a pioneering

comprehensive study focused on the navigation and commercialization of the NSR. More than 160 reports were produced in this context between 1993 and 1999 and cover both the prospects for the economic and social development of the Arctic regions and the environment, ecosystems, meteorology, navigation, ports, and the merchant marine [4].

However, the economic crisis that hit Russia after the collapse of the USSR led to a dramatic decline in traffic along the NSR, especially transit traffic (Table 1).

2.2 Renewal of Russian Interest in the NSR

Following a decade of economic decline and demography in the Russian Arctic, the Russian government decided in 2000 to establish the NSRA [6]. This centralized public service manages the icebreaker service, the organization of the prevention and control of accidental spills of gas and oil, and the operation and maintenance of navigational aid systems in the NSR. This service also monitors hydrographic conditions, including port and port basin access, as well as the use of nuclear energy in maritime transport, ship support (rescue operations), the dispatch, and the positioning of the icebreakers fleet. The Administration sets the fees for navigation and icebreaker escort. These are reviewed annually and determined based on the nature of the goods transported and deadweight of the ship [4]. The renewal of the fleet is also a part of the Maritime Doctrine adopted by President Putin in 2001 [7]. Besides its military and scientific aspects, the maritime doctrine emphasizes the need for Russia to possess a merchant marine and efficient maritime transportation sector, with the construction of ice-classed tankers and strong but costly icebreakers. Russia is the only country exploiting nuclear icebreakers, under the administration of Rosatomflot. The conventional icebreaker fleet is also aging, and plans for renewal of the fleet have been discussed for many years in much the same way as for the nuclear icebreakers. In 2018, Russia exploited 4 nuclear (plus 3 under construction) and 35 diesel-electric icebreakers (plus 4 under construction). In 2007, a titanium Russian flag was planted at the North Pole, which led to widespread concern [12]. Other than its military and scientific aspects, the maritime doctrine emphasizes the need for Russia to possess a merchant

marine and efficient maritime transport. While in the 1990s the administration of the NSR was mainly based on shipowners and the regions, more and more private actors are emerging, particularly in the mining and oil & gas sectors, such as Norilsk Nickel, Gazprom, Lukoil, and Rosneft. [4]. This translates into the development of dedicated fleets and infrastructure by these actors, like the Sabetta port opened in 2017 in the Yamal Peninsula. The modernization of the fleet also corresponds to the Northern Regions Development policy, designed to foster the resource-based economic development of the area that the cash-starved federal government aims to promote. The federal state thus regained a centralized control over the Route. The extraction sites are for the most part almost inaccessible by land, and the new projects for the Arctic highlight the need to improve maritime transport. The Sevmorput indeed gives access to many solid mineral deposits: apatite (90% of Russian reserves) in the Kola and Taymyr Peninsulas, nickel (85%) and copper (60%) in Norilsk and the Kola Peninsula, wolfram (50%) in the north of Yakutia and Chukotka, as well as gold and silver deposits. Community servicing also remains an important service.

In September 2017, the Russian Ministry of Economic Development introduced the 2025 Arctic Development Agenda [7, 13]. This strategy envisions a new impetus for the development of the Russian Arctic region, including the creation of a new deep-water port at Arkhangelsk; the expansion of port facilities on the Yamal peninsula; and the modernization of the ports of Tiksi, Pevek, and Anadyr in the easternmost part of the Arctic. The 2017 law also reserves coal, oil, and gas cargoes from Russian waters along the NSR for the Russian-flagged fleet, in effect setting up a protectionist ban on foreign ships for this market [7].

3 The Slow Development of Shipping in the Canadian Arctic

Before the twentieth century, the Canadian Arctic and the Northwest Passage remained largely unexplored territory. The first complete passage was the result of a three-year expedition led by the Norwegian explorer Roald Amundsen in 1903–1906. Explorations started quite earlier, however, as the Vikings reached Greenland and the western coast of Canada before 1000 CE. Beyond a fascination that still persists today among Westerners, the region remains hostile for navigation: the ice and its unpredictability continues to be a major hindrance, and no climatic models foretell an ice-free winter in the region in the foreseeable future.

The European fascination for the Northwest Passage is watermarked by the many expeditions launched there

by the end of the Renaissance. The turning point was the 1575–1577 expedition led by Martin Frobisher, which reached Baffin Island and started the modern era of Arctic shipping [14], with the quest for the fabled Northwest Passage to circumvent North America on the way to Asia. Those voyages were dangerous, often resulting in many fatalities, and the famous ill-fated Franklin expedition highlights the hazardous nature of such quests. The exploration departed Britain in 1845 under the command of Captain John Franklin and got icebound approaching King William Island. All of the 129 crew members perished in that voyage, and the two ships were only located in 2014 and 2016, triggering much media attention [15]. Some expeditions were successful though: Kaynes, Hayes, and Hall are, for instance, the first ones to go through the channel between Greenland and Ellesmere Island [16], and in 1831, James Clark Ross became the first recorded man to reach the magnetic North Pole [17]. In 1906, Roald Amundsen and his crew successfully transited the Northwest Passage, while in 1909, Robert Peary claimed he reached the geographic North Pole.

Beyond those adventurous quests for the North Pole and the Northwest Passage, another important development occurred regarding Arctic navigation: the expansion of commercial shipping in the region. The fur trade, along with whaling activities, and the development of the Hudson Bay Company were significant in Arctic shipping up until the beginning of World War I [14]. By mid-nineteenth century, shore stations started to develop along the coast beginning in Eastern Arctic, allowing the development of a lucrative business based on whaling [18]. The fur exploitation was, however, the most important activity, and the Hudson Bay Company had an almost monopoly over the trade from its establishment [19]. As of the 1920s, cargo shipping was present in the Canadian Arctic, albeit with limited numbers, for community supply, the development of natural resources projects, and for grain export after the construction of the port of Churchill in Hudson's Bay in 1931. This shows again that Arctic shipping rested for a good measure on the State initiative with the construction of the port of Churchill, but to a much more modest extent than in the USSR at the same time. Because in the Canadian Arctic the government was much less involved than in the Soviet Arctic, the region has for long (and still does) witnessed much smaller levels of shipping activity.

It is important to underline that the fascination for the Arctic and the transit route across the Northwest Passage was shared by few people. The Great North was largely ignored by the general population and politics: when the United States bought Alaska to Russia in 1867, it was done in general indifference [20], and many expeditions were actually sent reluctantly by governments to

serve sovereignty purposes: only minimal activity was deployed because the region remained a hostile one with relatively limited economic potential [14].

3.1 Canada Uneasy About a Strong American Military Presence

By the time World War I sparked, navigation in the Northwest Passage was still very limited. Whaling and the fur trade declined; commercial shipping to resupply northern communities remained, yet only during summer time with short navigable seasons. During the two conflicts, the North American Arctic was clearly a peripheral zone, but it gained in significance during the Cold War. With the *forward development strategy* of the Marine forces of the United States, aiming at protecting the North Atlantic, the Arctic became a major strategic region in the USA/USSR opposition [21]. The Cold War was significant regarding the North American Arctic because it witnessed a strong, yet uneasy cooperation between the USA and Canada in the region. In 1954, the two countries signed an agreement planning defense infrastructure on the territory with two radar lines to protect the region against a soviet attack. It was the first time that the United States actually recognized Canadian sovereignty on the Far North islands [22, 23]. Navigation was then largely military. This cooperation raised many questions about navigation in Arctic waters and their status, a debate that still persists today as Canada felt the American military presence in the Arctic would threaten its nascent claim to the Arctic waters.

3.2 Commercial Navigation in the North American Arctic: Also Fueled by Natural Resources

Government and military navigation in the Arctic remained fairly stable throughout the twentieth century. The evolution of commercial navigation proved less stable on the other hand. It is only in 1974 that the Northern Canada Vessel Traffic Services was instated: from this moment forward, annual data is available regarding navigation in the Arctic. It shows that even with climate change and the slow opening up of the passage, navigation remains quite limited. Figures show a stable traffic level between 1980 (112 voyages) and 2003 (131 voyages), with a low of 89 in 1987 [16]. Natural resources exploitation did generate some traffic, with oil on Cameron Island (1985–1997) and the zinc–lead–silver mine at Nanisivik (1976–2002). Both these ventures closed down when natural resources collapsed at the end of the twentieth century.

From 2004, the increase in traffic is steadier, but in spite of a media discourse announcing the opening up of a polar seaway catalyzed by climate change,

navigation remains actually limited, with very few companies operating in the region [24] (see the following discussion).

Service to the Nordic communities and export of natural undermentioned resources are the main growth engines for navigation in the North American Arctic, just like with the Russian/Soviet Arctic. Several factors contributed to the slow development of commercial shipping, beginning with the potential for natural resources. The melting of sea ice has indeed opened up the possibility of easier natural resources extraction. Exploitation remains very costly though, because of remoteness, lack of infrastructure, and a climate that remains harsh, in spite of climate change [25]: sea ice extent remains very variable and unpredictable from year to year. In the mid-1950s, exploration programs such as Operation Franklin, Eureka, or Admiralty were undertaken to assess the geological indicators for minerals, oil, and gas resources [14], and the first actual well drilled in the Arctic was Dome Winter Harbor on Melville Island, in 1961–1962. The high potential for oil in Alaska was discovered only a little while later in 1968, but the economic rationale for the pipeline was much stronger than for Arctic shipping, and thus Alaskan oil is shipped overland to ice-free anchorage. If the economic potential is definitely present, however, technical difficulties remain and even if exploration and exploitation activities are still going on, many significant projects were discarded due to the lack of infrastructure and the difficulties associated with Arctic exploration and navigation. Oil and gas are the most mentioned resources when it comes to the Arctic, but there is also a significant potential for mining activities. Natural resources extraction is presently likely to remain the growth engine for navigation in the region as there are no competing modes of transportation [24].

4 Sovereignty Issues: The Status of Strait Waters

In 1969 and 1970, the oil tanker *Manhattan* transited the Northwest Passage, escorted by American and Canadian icebreakers, sparking an important public debate about Canadian actual sovereignty in the Arctic as the tanker had not consulted with Canada before entering into the passage [26]. The 1954 agreement between the two countries foresaw that US ships had to wait for a formal authorization to enter those waters, but the United States claimed that those authorizations were only required regarding military ships dealing with the defense infrastructures related to the agreement [16]. The official discourse in Ottawa was that Arctic waters in the Northwest Passage were Canadian inner

seas, but before the *Manhattan* crossed it, this position never had to be publicly put forward [27]. The Canadian response was the Arctic Water Pollution Prevention Act of 1970, essential preamble of the article 234 of the UN convention of the Law of the Sea [28]. It had become clear that Arctic waters and the potential for navigation were going to be a key issue for Canada and the United States regarding their Arctic Strategy. In 1988, the Arctic cooperation agreement signed between Canada and the United States about American icebreakers navigating in the passage stated that all movements in waters claimed by Canada would be undertaken with Canadian consent: the United States would give notice but not have to ask for permission, and Canada would be considered to have consented. The agreement also stated clearly that this cooperation did not affect the official position of either state regarding the legal status of the passage [16].

For Canada as for Russia, sovereignty over the Northwest Passage and the Northeast Passage rests on the status of internal waters. Under the 1982 United Nations Convention on the Law of the Sea (UNCLOS), internal waters constitute a maritime area in which the coastal state has full sovereignty, including the right to suspend foreign navigation. Canada and Russia estimate that their title over their respective straights comes from a historic title. In 1986, Canada clarified this claim by enacting the baselines that enclose the Arctic Islands and delimit the inland waters below. The then Soviet Union had adopted a very similar position in 1984 with regard to the Northeast Passage, a route that runs along the Siberian coast and takes several straits between it and the offshore archipelagos.

Canada and Russia formally declared that it is not their intention to prohibit international navigation in their claimed internal waters; rather, they reserve the right to regulate navigation to protect the Arctic environment – the effects of an oil spill on the Arctic ecosystem would be devastating – even if that reason is also an instrument of political assertion. This position was reaffirmed by Canada in 2010, with the promulgation of the mandatory ship reporting to the Northern Canada Vessel Traffic Services Zone (NORDREG) control system. In Russia, navigation by foreign vessels is actively promoted for commercial reasons. Ships must also obtain clearance from the NSRA before entering its waters and must pay a navigation fee for the services provided, whereas Canada up to now (2018) does not levy any fee – but offers far less services. The European Union and the United States, on the other hand, believe that the Arctic passages are international straits according to UNCLOS, and that as such all ships in transit can navigate freely without any regulatory constraint (article 38).

In fact, the dispute with the European Union and the United States seems essentially to be the conclusion of a

disagreement, no party seeking to make it a major political battleground. A US State Department document even acknowledges that US commercial vessels are subject to Canadian regulations: for Washington, it is primarily the freedom of transit for military vessels that is at stake, and the fear of the previous one [29].

It is mostly Canada that worries – or pretends to worry, for domestic politics purposes? – about a possible stronger protest against its claim, while Washington is content to reiterate its position following each Canadian government declaration. The United States and the European Union will not recognize the Canadian nor the Russian claim, but will not challenge it either, especially the European States. It is because of its desire to defend a sovereignty claim opposed by the United States and the European Union that Canada displays a determination that contrasts with a lack of civilian and military means in the region.

5 Recent Shipping Activity in the Arctic: Transit Remains Elusive

A total of 11 066 ships were detected in the Arctic (north of the Arctic Circle) in 2014, the majority being supply, research, and survey vessels, and then fishing vessels (1960), cargo ships (1892), tanker (524), and passenger (308) vessels. Most of these ships were concentrated in the Arctic reaches of the North Atlantic, especially in the North and Barents Seas. With such a large geographical definition, Arctic shipping represented 9.3% of the world's shipping traffic in movements [30].

Fishing vessels represent the most numerous single category. They are concentrated, however, in the Barents Sea, in the waters off Iceland, off southern Greenland, and in the Bering Sea: there is no commercial fishery in the Central Arctic Ocean, and a 16-year ban that has been agreed upon in December 2017 will prevent the development of such fisheries despite the melting of sea ice [31].

Arctic shipping is thus not new. However, after the aftermaths of climate change were beginning to become apparent for the media with sea ice melting, debate about its scope and possible development took the front of the scene. Indeed, paralleling the movement of the retreat of sea ice, it rapidly took off in several regions where it previously was constrained by ice. For instance, in Greenland, cruise tourism expanded fast since 1994, especially since 2003 with the number of port calls going from 164 in 2003 to 375 in 2008 [32]. The Norwegian port of Hammerfest is witnessing a significant traffic fueled by the gas exploitation in the Barents Sea. The number of voyages in the Canadian archipelago, all types of ships together, went from 121 in 2005 to 416 in 2017 [33].

However, directly linking the expansion of traffic to the reduction of sea ice would be an oversimplification. Pizzolato et al. [34] underlined the fact, in their statistical analysis of shipping traffic in the Canadian archipelago, that macroeconomic and business factors, rather than sea ice conditions, may be driving the observed increases in shipping traffic in the Canadian Arctic, with the melting of sea ice acting as an enabler rather than a driver. Contrasting images can be drawn from the observation of traffic along the two major sea lanes of the Arctic.

5.1 The Northwest Passage

As for transit traffic along the Northwest Passage, it remains very modest and mainly fueled by tourism and pleasure crafts (see Table 2). As for destination traffic, i.e. ships going to the Canadian Arctic to either load, unload, or perform an economic activity there, it is apparent that this segment is experimenting a significant growth, fueled by fishing but also commercial cargo traffic: this market is driven by the servicing of local communities, natural resources exploitation, and the Arctic Bridge traffic up until 2016, the year the port of Churchill was closed down by its owner, OmniTRAX (Table 3).

The figures underline several facts:

- Traffic is indeed increasing in the Canadian Arctic, with 416 voyages to the Arctic region in 2017, compared to 121 voyages in 2005: over that period, it was multiplied by 3, 4.
- Commercial cargo ships represented 188 voyages (45.2%) of these voyages in 2017, against 121 (53.7%) in 2005. The expansion of their traffic does not appear very affected by the closing down of the port of Churchill and the end of the Arctic Bridge.
- Even though the general trend may be toward the expansion of traffic, some submarkets may stagnate or contract. For instance, the Arctic bridge never really took off as traffic declined after 2010 without OmniTRAX being able to develop alternate markets. The 2012 closure of the Canadian Wheat Board was not good for the economic fortunes of Churchill or the Hudson Bay Railroad since it provided the vast majority of the port's traffic through grain exports. Traffic thus went from 650 000 tons of grain in 2010 to 190 000 in 2015 and then zero in 2016 when the port was shut down. Shipping companies Desgagnés and Royal Arctic Lines had tried to develop a regular service between Churchill and Nuuk, but the profitability never materialized as the project coincided with the economic downturn of 2008 [35].
- Fishing vessel experimented a fast expansion, from 20 voyages in 2005 (16.5%) to 138 (33.2%) in 2017.
- Pleasure crafts and adventurers also increased their presence in Canadian Arctic waters, from 10 ships (8.3%) in 2005 to 32 (7.8%) in 2017.
- These figures attest to a growing destination traffic. Transits remain scarce: they peaked at 31 in 2012.
- Pleasure crafts or adventurers conduct most of these transits. In 2012, they were responsible for 23 (74.2%)

Table 2 Number of voyages in the Canadian Arctic.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ships in the Canadian Arctic (no. of voyages)	121	135	181	209	185	257	317	314	349	301	315	347	416
of which:													
Fishing vessels (number of voyages)	20	26	39	52	44	78	136	114	137	119	129	131	138
Cargo ships or barges (number of voyages)	65	67	101	105	100	124	126	124	127	108	120	147	188
of which:													
General cargo	16	17	28	30	23	34	38	32	35	32	34	36	50
Tanker	17	16	24	29	23	28	30	31	28	25	27	23	24
Bulk	21	17	27	25	27	27	23	26	27	33	36	53	72
Tugs and Barges	11	17	22	21	27	35	33	35	36	18	23	35	42
Pleasure crafts and adventurers	10	6	9	7	13	13	15	27	32	30	23	22	32
Cruise/passenger vessels	12	15	17	20	11	18	11	10	17	11	18	20	19
Government vessels (Navy, Coast Guard)	9	9	9	10	10	13	20	16	17	23	16	20	22
Icebreakers												2	2
Research vessels	6	12	9	12	7	11	11	23	20	10	9	6	13
Others											1	1	4

Source: NORDREG, figures compiled by author from data compiled by Nordreg Iqaluit. Traffic north of 60°N.

Table 3 Transits of the Northwest Passage.

Year	Canadian government ships	General cargo	Tankers	Bulk carriers	Passenger	Tugs	Pleasure crafts and adventurers	Research vessels	Foreign government	Others	Total
2017	2	1	1	0	3	0	21	1	0	2	32
2016	3	1	0	0	3	0	15	0	0	1	23
2015	4	0	0	0	2	0	19	0	0	2	27
2014	4	0	0	1	2	0	10	0	0	0	17
2013	2	0	0	1	4	0	13	2	0	0	22
2012	2	0	1	0	2	2	23	1	0	0	31
2011	4	0	1	0	1	0	15	0	0	0	21
2010	4	0	0	0	3	2	11	0	0	0	20
2009	3	0	0	0	2	2	10	0	0	0	17
2008	3	0	0	0	1	0	7	1	0	1	13
2007	3	0	0	0	2	0	4	0	0	0	9
2006	4	0	0	0	2	2	3	0	0	2	13
2005	4	0	0	0	2	0	2	1	0	2	11
2004	3	0	0	0	1	0	2	0	0	0	6
2003	3	0	0	0	2	6	2	0	1	0	14
2002	4	0	0	0	2	2	2	2	0	0	12
2001	2	0	0	0	2	0	2	0	0	0	6
2000	1	0	0	0	2	0	2	0	1	0	6

Source: NORDREG Iqaluit.

The Canada Shipping Act, 2001, defines a pleasure craft as a “vessel that is used for pleasure and does not carry passengers”. Ministry of Justice. Canada Shipping Act, 2001. (S.c. 2001, c.26). <http://laws-lois.justice.gc.ca/eng/acts/C-10.15/>. Adventurers are pleasure crafts not reporting to NORDREG.

of the transits; 13 (59%) in 2013; 10 (58.8%) in 2014; 19 (70.4%) in 2015; 15 (65.2%) in 2016; and 21 (65.6%) in 2017.

- Canadian government ships come second in terms of transit traffic with between 1 and 4 ships per year, and then passenger vessels, between 1 and 4 transits per year too.
- Commercial cargo vessels, including general cargo, bulk, and tankers, account for a very small share of transit traffic: for most of the period, their traffic is nil; then one ship between 2011 and 2016, but none in 2015, and then two vessels in 2017. The media placed much emphasis in 2013 on the bulk carrier *Nordic Orion* transiting the NWP between Vancouver and Finland, but subsequent years proved the route to remain poorly attractive for commercial cargo transit shipping [36].

It thus appears that if Canadian Arctic waters are definitely busier, this increasing traffic is largely fueled by ships that go to the Arctic to perform their economic objective (destinational traffic), whereas transit traffic remains tiny. Moreover, most of this transit traffic is fueled by pleasure boats. The commercial cargo component for now remains very limited, despite

significant improvement in naval architecture that make ice-class ships more affordable, although still more expensive than ordinary vessels. Destinational traffic is experiencing a real, if not steady, growth. This traffic is fueled by the expansion of traffic from the exploitation of natural resources and by the servicing of local communities. Bulk traffic thus benefited from the exploitation of Arctic or subarctic mines such as Voisey’s Bay (Labrador), Raglan (Quebec), and Mary River (Baffin Island, Nunavut); this traffic largely made up for the drying up of traffic to and from Churchill after its closing down in 2016. For instance, Baffinland Iron Mines shipped 4.1 Mt of ore from its mine in Mary River through its port of Milne Inlet in 2017. The company, Baffinland Iron Mines, eventually intends to reach the volume of 12 Mt annually. The first shipment took place in 2015 [37], and traffic that year reached 920 000 tons. As for community servicing, cargo companies such as Desgagnés, Nunavut Sealink and Supply Inc (NSSI), and Nunavut Eastern Arctic Shipping Inc (NEAS) could take advantage of the receding ice to tap into a real demand for cheaper consumer goods. The shipping season now extends over five months instead of 4; NEAS could set up 16 voyages instead of 12 in 2017 [37].

5.2 The Northern Sea Route

It is in the frame of climate change narratives, the attention paid by a few shipping companies, and the Russian desire to promote traffic through reformed administrative frameworks and tariffs [38, 39] that traffic picked up after 2009 (see Table 4).

Figures show that transit traffic began picking up in 2010 to expand rapidly to 71 in 2013, only to drop sharply afterward to 18 in 2015 and 19 in 2016. This decline, and later stagnation at low levels, in transit traffic along the NSR, is clearly out of step with the media forecasts announcing the advent of heavy traffic along Arctic routes. It is due to several factors [40, 41]:

The decline in oil and fuel prices makes the search for possible reductions in transit costs less attractive for shipping companies.

- The decline in commodity prices makes Arctic resources less attractive, both for exploitation and for initial investment for transport with specialized vessels.
- The continuing decline in both bulk and container freight rates, which discourages shipping companies facing overcapacity from investing in new icebound vessels.
- The reorientation of certain export routes for raw materials, including natural gas with the opening of

the Russian terminal at Ust-Luga on the Baltic Sea, carrying volumes previously shipped via Vitino in the White Sea [42].

- The priority deployment of Russian icebreakers to infrastructure projects, notably the Sabetta port linked to the gas project on the Yamal Peninsula: the lower availability of buildings has dissuaded some carriers from hiring their vessels for lack of guarantee escort.
- A tariff schedule for the services of the NSR, sometimes considered opaque by the maritime carriers.

Here again, it appears economic factors, some of them having nothing to do with the Arctic like world commodity prices or freight rates, have much more impact of the development of Arctic shipping than the mere melting of sea ice that continued unabated during the period of transit decline.

As for Canada, a detailed review of transit traffic compared to destination traffic underlines that the two categories of activity are not evolving on par. The NSR appears attractive given the high number of applications for transit (see Table 5), with figures oscillating between 661 and 730. It seems either the NSR Administration is less demanding or that shipping companies have adapted to regulations, as the number of refusals dropped from 83 in 2013 to 2 in 2017. Interestingly, most applications were made for Russian-flagged vessels, as

Table 4 Number of official transits, Northern Sea Route, 2010–2017.

Ship type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Icebreaker					2	3	2	2	1	2	
Government ship					1	0	1	1	3	1	
Cruise or passenger ship				1	1	0	1	3	1	1	
Tug, supply vessel	1	1		4	4	5	1	1	4	4	
Commercial ship	1	2	5	6	31	38	64	24	15	11	
Research ship				2	2	0	2	0	0		
Total official transit	2	3	5	13	41	46	71	31	18	19	27

Source: CHNL Information Office, Transit Statistics, www.arctic-lio.com/nsr_transits, and NSR transits before 2011, www.arctis-search.com/NSR+Transits+before+2011&structure=Arctic+Sea+Routes (accessed 26 January 2018).

Tentative figure for 2017.

Table 5 Number of transit permit application for navigation in the NSR, 2013–2017.

	2013	2014	2015	2016	2017
Permit applications	718	661	730	721	664
Refusals	83	30	15	3	2
Permit application, foreign-flagged vessels	141	124	130	142	108

Source: Northern Sea Route Administration, *List of Applications*, www.nsra.ru/en/rassmotrenie_zayavleniy/perechen_zayavlenii.html (accessed 22 January 2018).

Table 6 Traffic along the NSR, total and transit, in metric tons, 2010–2017.

	2010	2011	2012	2013	2014	2015	2016	2017
NSR, transit tonnage (metric tons)	111 000	820 789	1 261 545	1 176 454	274 103	39 586	214 513	194 364
NSR, total tonnage (metric tons)	2 085 000	3 225 000	3 750 000	3 914 000	3 982 000	5 432 000	6 060 000	9 737 000

Source: CHNL Information Office, *Transit Statistics*, www.arctic-lio.com/nsr_transits (accessed 26 January 2018); Staalesen [44].

the number of applications for foreign-flagged vessels range between 142 and 108. The trend toward an even greater dominance of Russian shipping companies is likely to be fostered following the Russian Parliament (Duma) recent decision to ban foreign-flagged vessels from the transportation of oil, gas, and coal along the NSR, except if operations are already under way [43], a move reportedly designed to boost Russia's shipbuilding industry so as to tap into an expanding market, but that could represent a risky bet.

Tonnage traffic figures confirm that destination shipping is developing fast, while transit stagnates at low levels. Transit tonnage peaked at 1176 Mt in 2013, and then collapsed in 2014 to 274 103 tons and 39 586 tons in 2015, only to recover to 194 364 tons in 2017 (Table 6).

However, total tonnage in the NSR increased from 2.09 Mt in 2010 to 6.06 Mt in 2016 and then 9.74 Mt in 2017 according to the Russian Federal Agency for Maritime and River Transport, the biggest annual volume ever thus surpassing the previous record of 6.6 Mt set in 1987. In particular, traffic seems to have exploded in 2017. Figures from the Association of Russian Sea Ports show that the Russian Arctic seaports in 2017 handled a total of 74.2 Mt, an increase of 49.1% compared with 2016. The growth is rooted in a significant hike in Russian Arctic shipments [45]. According to data from the Seaport Association, Murmansk accounted for almost two-thirds of all the total port turnover. The harbor masters in the Arctic city last year saw a total of 51.7 Mt of goods being shipped through the port, an increase of 54.5% over 2016. The growth comes as several major Arctic industrial projects related to the exploitation of natural resources are in the making. Among them are the Yamal LNG and the projected Arctic LNG 2, both of them with major effects on regional shipping. Also, oil shipments from new projects such as the Novy Port, as well as the terminal at Varandey, are leading to higher volumes.

The Varandey terminal in 2017 handled 8.2 Mt of oil, an increase of 3.4% year-on-year. Of the volumes handled in Murmansk, as much as 29 Mt were oil products, while the volumes of minerals and ores traditionally handled by the port remain stable. Forecasts expect volumes to continue to grow over the next years, possibly to more than 70 Mt after 2020. Sabetta, the new port on the Yamal

Peninsula, recorded a huge growth in 2017. According to the Federal Agency for Maritime and River Transport, as much as 7.99 Mt of goods were handled at Sabetta, up from 2.85 Mt in 2016 [45].

6 Conclusion

Thus, in Canada as well as in Russian Siberia, it is largely destination traffic that dominates a very real expansion of Arctic shipping: ships come to the Arctic to perform an economic activity, rather than just transiting. Along the NSR, the number of transits and trade volume both increased from 2011 to 2013 and declined in 2014 and 2015, slightly recovering in 2017, indicating an unstable and vulnerable shipping environment up to now [46]. The NSR seems to be more appealing to liquid, bulk, and general cargo transportation, while container shipping companies have not carried out any voyage – this may change as Maersk announced it would carry out an experimental trip.² Currently, most activities are still domestic and destination in nature. This expansion of destination traffic is partly sustained by the expansion of community resupply in Canada, but in both countries, all the more so in Russia, it is the construction of infrastructure and the development of natural resources exploitation that fuel the present strong growth.

Similarly, traffic is dominated in Siberia by Russian shipping companies, and by Canadian companies in the Canadian Arctic, for natural resources transportation as well as for the community resupply market. Canadian shipping companies in particular have adapted to the poor infrastructure of the Canadian Arctic villages and to the numerous barriers of entry to this niche market [47]. If natural resources exploitation picks up in Canada, it could prove more attractive for foreign corporations.

This is in line with the past Russian declarations to the effect they did not expect transit traffic along the NSR to develop to large volumes [48], and with the past analyses of shipping companies' strategies. These showed that cost per transit may prove to be lower, depending on the origin/destination couple, but that this factor is not paramount in the decision to develop shipping in the Arctic: this business decision rather rests on the

perceived strategic opportunity perceived by shipping companies.

The melting of sea ice may act as an enabler, but it is not in itself sufficient to trigger the development of massive traffic along Arctic seaways, nor of single-voyage cost-effectiveness: it does not drive the expansion of Arctic shipping since its evolution is contrasted between regions and between market segments, except for a few market niches like community resupply in Canada where

demand is consequent. Shipping companies display a very limited interest for transit traffic but are more interested for the natural resources market. They stress that entering the Arctic market is a strategic diversification move that implies much broader considerations. It continues to be seen as a risky choice, both operationally and commercially, and implies business strategy choices, which involve the global picture of the positioning of the company in its regional or global market.

Endnotes

- 1 In 1997, the Finnish tanker *Ulikku* traveled the commercial route from northern Murmansk to Pevek before exiting through the Bering Strait. It took up fuel and made the journey in the opposite direction to Murmansk. The Russian authorities state that a Latvian tanker also made a full transit in 1997.
- 2 Maersk conducted a trial transit along the NSR with a 3500 TEU container ship, the *Venta Maersk*, in September 2018. The ship is designed to be exploited in

Baltic waters and Maersk underlined the voyage was meant to gather experience in icy waters, and still does not consider Arctic shipping as a viable commercial alternative. “Maersk concludes trial passage of Northern Sea Route”, Maersk Press Releases, September 28, <http://www.maersk.com/en/news/2018/09/28/maersk-concludes-trial-passage-of-northern-sea-route> (accessed 7 December 2018).

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