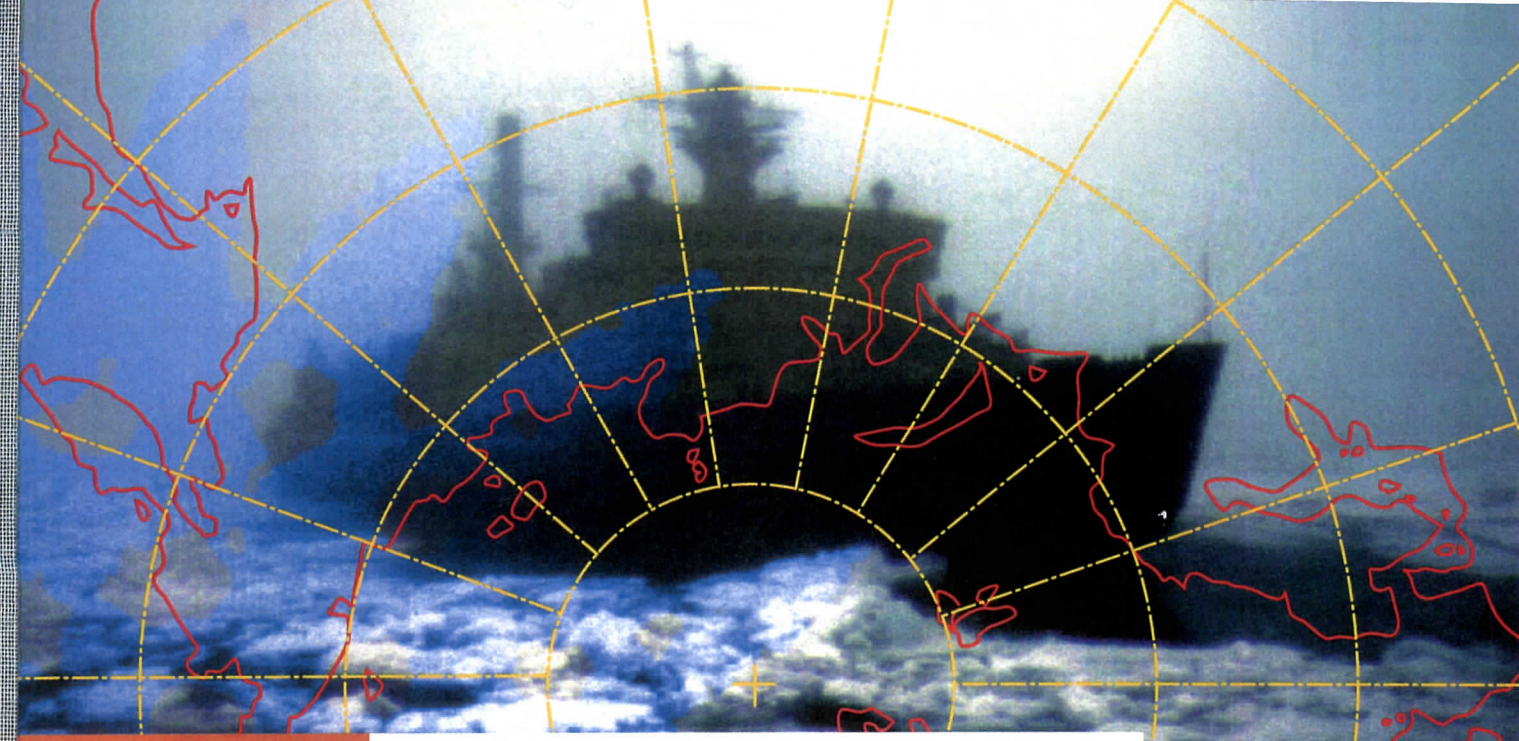

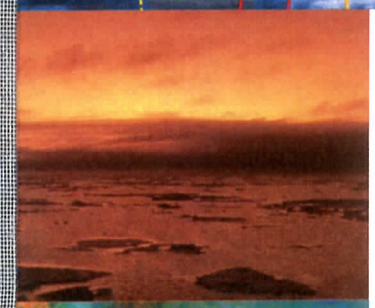

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Navigating the Straits of the Northern Sea Route

By Geir B. Hønneland

INSROP International Northern Sea Route Programme

Central Marine Research & Design Institute, Russia

The Fridtjof Nansen Institute, Norway

Ship and Ocean Foundation, Japan

International Northern Sea Route Programme (INSROP)

Central Marine Research & Design Institute, Russia

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FOREWORD - INSROP WORKING PAPER

INSROP is a five-year multidisciplinary and multilateral research programme, the main phase of which commenced in June 1993. The three principal cooperating partners are **Central Marine Research & Design Institute (CNIIMF)**, St. Petersburg, Russia; **Ship and Ocean Foundation (SOF)**, Tokyo, Japan; and **Fridtjof Nansen Institute (FNI)**, Lysaker, Norway. The INSROP Secretariat is shared between CNIIMF and FNI and is located at FNI.

INSROP is split into four main projects: 1) Natural Conditions and Ice Navigation; 2) Environmental Factors; 3) Trade and Commercial Shipping Aspects of the NSR; and 4) Political, Legal and Strategic Factors. The aim of INSROP is to build up a knowledge base adequate to provide a foundation for long-term planning and decision-making by state agencies as well as private companies etc., for purposes of promoting rational decisionmaking concerning the use of the Northern Sea Route for transit and regional development.

INSROP is a direct result of the normalization of the international situation and the Murmansk initiatives of the former Soviet Union in 1987, when the readiness of the USSR to open the NSR for international shipping was officially declared. The Murmansk Initiatives enabled the continuation, expansion and intensification of traditional collaboration between the states in the Arctic, including safety and efficiency of shipping. Russia, being the successor state to the USSR, supports the Murmansk Initiatives. The initiatives stimulated contact and cooperation between CNIIMF and FNI in 1988 and resulted in a pilot study of the NSR in 1991. In 1992 SOF entered INSROP as a third partner on an equal basis with CNIIMF and FNI.

The complete series of publications may be obtained from the Fridtjof Nansen Institute.

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Preface

The NSR Pilot Project, originally planned to be implemented in 1994, has been postponed several times. The main cause has been the fact that Russian charts, on which the investigation was to be based, were classified as secret material.

My own involvement in the project started out with a translation and adaptation of the charts - when they were eventually released - and resulted in the finalisation of the present working paper. I wish to emphasise that the work was done in comparatively short time limits, and should be regarded as a compilation of new data from the charts as well as some existing knowledge. Its intention is rather to serve as an easily accessible overview of the straits along the NSR, than as a detailed guide for navigation.

Maps are used with the kind permission of Woods Hole Oceanographic Institution and Associate Professor Lawson W. Brigham. The map on page 14 was originally adapted by Mr. Brigham from Butler (1978) (see literature list). It is acknowledged that the paper could be substantially improved by using more detailed maps, and GIS maps will be prepared under phase 2 of INSROP and included in the paper at a later stage.

The work was undertaken at the request of, and in close collaboration with, Research Fellow Douglas Brubaker, my colleague at the Fridtjof Nansen Institute. I would like to extend my thanks to him and to reviewer Lawson W. Brigham for useful comments. Thanks also to Dr. Yuriy Ivanov and retired admiral of the Russian navy Dr. Anatoliy Yakovlev for corrections and reference to Russian sources.

Lysaker, May 1997

Geir B. Hønneland

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Navigating the Straits of the Northern Sea Route

By Geir B. Hønneland[1]

1 Introduction

This paper gives an overview of the straits along the Northern Sea Route (NSR). The most important ones, dividing the five seas along the route, are well-known in the literature. Others are presented here for the first time outside Russia. The presentation is based mainly on an investigation of Russian charts, used for navigation along the NSR.[2] Existing literature is occasionally used to supplement this material. The main objective of the paper is, however, to examine to what extent this new material can *supplement*, and possibly *correct*, the existing literature.

The paper sets out to describe some general geographical characteristics of the seas and most important straits of the NSR. Their legal status is, however, not touched upon. An overview is then given of the less important and previously partly unknown straits. The overview is not a *complete* list of *all* the straits along the route, but a presentation of all straits from the Norwegian boundary in the west to the Bering Strait in the east *which are mentioned by name on the charts used for navigation by Russian vessels*. Their mention by name is, however, probably an indication of their importance in a navigation context. Although many of the straits mentioned here are situated close to the shore and would thus not normally be used for navigation along the NSR, the important question is if it would be *possible at all* to use the actual strait for navigation if such a route were chosen. Furthermore, it is considered of importance to make the list of straits along the NSR as complete as possible in order to improve the background material for the discussion of jurisdictional aspects of the route.

Sailing directions are given in section 5 mainly to indicate which of the main straits are to be preferred to others in given situations. With this limitation of ambition in mind, it should be clear that the current paper does *not* intend to present a detailed guide for navigation; rather, it aims at serving as a general overview. For more detailed sailing directions, confer the newly published - and translated - Russian "Guide to Navigation through the Northern

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[1] The author is presently a research fellow at the Fridtjof Nansen Institute, specialising in international politics of the European north. He has, however, several years of experience as a lieutenant and Russian interpreter in the Norwegian Coast Guard, operating mainly in the Barents Sea.

[2] See the literature list for an overview of the charts.

Sea Route" (1996).

The existing literature on Russian straits - as all texts with transliterations of Russian words - contains a confusing variety of translations, transliterations, and interpretations.[3] In this paper, Russian names for islands and straits will be translated to English in those instances where they have an obvious and clear-cut meaning, and there already is a tradition for rendering them by their English translations.[4] However, as far as the straits are concerned, their Russian transliterations are given in parenthesis when they are mentioned for the first time in the text. In order to facilitate recognition of the Russian words, the "everyday" transliteration standard is used instead of the linguistic one.[5]

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[3] Some authors (like Michailichenko & Yakovlev 1994), e.g., refer to the main passage from the Barents to the Kara Sea as *Karskiye Vorota Strait* (i.e. partly a transliteration, partly a translation of the Russian words), while others (like Butler 1978) call it the *Kara Gates Strait* (i.e. a literal translation of the Russian name of the strait).

[4] *Ostrova Arkticheskogo Instituta*, e.g., will be referred to as the Arctic Institute Islands, and *Peter Strait* and *Nightingale Strait* will be used instead of *proliv Petra* and *proliv Naytingeyl*, respectively.

[5] This presents a problem in rendering the Russian "short-i", so common at the end of adjectives and names. In such instances, *-yy* is used in endings - to indicate the presence of a "short-i" - instead of the all more common variant with just one *y*, like in *Grozny*. Furthermore, for the sake of consistency, *y* will be used for "short-i" also in words where the latter's rendering by *i* is quite common in English. E.g. *Taymyr* will be used instead of *Taimyr*. Neither is in effect fully correct, as English does not contain an adequate substitute for "short-i".

2 The Seas of the NSR - Geographical Characteristics and Ice Conditions[6]

The waters north of the Russian mainland are subdivided into five segments - or seas - by peninsulas and archipelagoes constituting an extension of the Eurasian continent towards the North Pole. In the west, a continuation of the Ural Mountains produces the Novaya Zemlya archipelago, and further to north-west, the Franz Josef and Svalbard archipelagoes, which comprise the eastern boundaries of the *Barents Sea* (*Barentsevo more*). To the east of these archipelagoes, the *Kara Sea* (*Karskoye more*) stretches towards the Severnaya Zemlya archipelago, which is a prolongation of the Taimyr Peninsula. The ocean area between Severnaya Zemlya and the New Siberian Islands (Novosibirskiye Ostrova) is called the *Laptev Sea* (*More Laptevykh*), while further to the east, Wrangel Island divides the *East Siberian Sea* (*Vostochno-Sibirskoye more*) from the *Chukchi Sea* (*Chukhotskoye more*).

2.1 Climatic Conditions in the Area

The region as a whole is characterised by harsh climatic conditions, including a long and cold winter with constant winds and snowstorms, and in summertime, frequent fogs with subsequent reduced visibility. Only from mid-July to mid-September does the temperature as a rule rise sufficiently to melt ice and provide a navigable channel along the central and eastern Eurasian coast. Further west, larger ocean areas are navigable for somewhat longer periods.

Wind speeds are in general lower and gales less frequent in the Laptev and East Siberian Seas than in the Barents and Kara Seas. The entire area is usually very overcast, especially in summer. Cloud covers tend to be heavier near the edge of floating ice than near the coast. Furthermore, visibility is affected by the polar night, which in winter means that areas north of 75° N are completely dark at mid-day. South of that latitude, only twilight conditions prevail. Even in conditions with sufficient light, the general snow cover produces a lack of contrast which aggravates the task of distinguishing and identifying objects.

In the period from July to September, most of the precipitation occurs, August usually being the month with the maximum fall. Precipitation is lowest from December to April, and the Laptev and East Siberian Seas in general enjoy a lower rate of precipitation than the other seas along the NSR. Most precipitation takes the form of snow. During the summer, it is common for rain and snow to alternate along the coast.

[6] This presentation is based mainly on Butler (1978).

2.2 The Barents Sea

The Barents Sea is the westernmost of the Arctic waters along the northern coast of Russia. It is bordered to the west, north, and east by the Svalbard, Bear, Franz Josef, Novaya Zemlya, and Vaygach islands, and to the south by the Norwegian and Russian mainland. The area between Kolguev Island and Novaya Zemlya is sometimes called the *Pechora Sea*, but this is considered a part of the Barents Sea. There are few islands in the Barents Sea, Kolguev Island being the largest. In the passage from the Norwegian mainland to Spitzbergen, the largest island in the Svalbard archipelago, the only island encountered is the small Bear Island (*Bjørnøya* in Norwegian; *ostrov Medvezh'iy* in Russian).[7] The average depth of the Barents Sea is approximately 200 meters.

Ice conditions in the Barents Sea differ from the other polar seas due to the warm waters of the North Cape current flowing in as a branch of the North Atlantic current along the Norwegian coast. Most ice in the Barents Sea is of local origin; ice movement out of the sea or into it from the polar basin or the Kara Sea appears to be modest. The ice encountered is nearly always less than one year old and relatively thin. The western parts of the Barents Sea, from North Cape to Svalbard, are navigable all the year round. Its eastern parts are usually free of ice up to 75°N by mid-June. By early July, the entire western coast of Novaya Zemlya is ice-free, and then the entire Barents Sea south of a line joining South Cape (the southernmost point on Spitzbergen) and Cape Zhelaniya on Novaya Zemlya is navigable. In some years with favourable ice conditions, navigation along the western coast of Novaya Zemlya has been possible as early as February.

April is usually the worst month for navigation as far as ice conditions are concerned. The mean limit of unnavigable ice then extends from off the southwestern coast of Svalbard to Bear Island, southeast of which the limit runs eastward to about 40°E longitude and 73°30'N latitude. The limit then continues southeastward, crossing the 70th parallel at about 44°E, thereafter curving down to the Cape Svyatoy Nos off the Murmansk coast at about 40°E. In some years, the extreme southward ice limit may approach the western part of the Murmansk coast as close as 80 nautical miles.

The most favourable month in this respect is September. The mean ice limit then moves to the northeast from the southeastern coast of Svalbard and intersects 40°E at about 79°30'N, moving east-southeastward to a position about 40 nautical miles north of Cape Zhelaniya. Navigation to the Franz Josef islands is normally possible in July and August, and on occasion, also in June. Although many of the channels and fjords are permanently ice-bound, the larger ones are generally free of ice at some period each season.

In October, new ice usually starts to form in the shallower areas of the Barents Sea, such

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[7] Bear Island, situated approximately midway between North Cape on the Norwegian mainland and South Cape on Spitzbergen, also belongs to the Svalbard archipelago.

as the southern coasts of Svalbard, the southeastern shores of Franz Josef Land, off the coast of Novaya Zemlya, and in the Gulf of Pechora. By November, the western coast of Novaya Zemlya is enclosed by ice, and much of the sea north of 75°N is frozen by December. The mean ice limits then gradually extend southward until the March-April conditions are re-established.

The ice movements of the Barents Sea are to a large extent influenced by winds and sea currents. In the period from February to April, strong southwesterly winds drive the ice in a northeastern direction, and as a consequence, the southern Barents Sea is usually ice-free in May-June. However, ice accumulates on the coast, in the straits linking the Barents and Kara Seas, and in shoal waters. As late as in early July, ice may be found both north and south of Kolguev Island. It is usually cleared by mid-July, but may remain in the Gulf of Pechora until August, sometimes affecting the southern straits.

2.3 The Kara Sea

The Kara Sea is located between Novaya Zemlya, the eastward side of Franz Josef Land, and the Severnaya Zemlya archipelago. It differs from the Barents Sea in several respects. First, there are thousands of islands in the Kara Sea, and, second, it is shallower than the western basin. Its average depth is 90 meters, and 40% of its total area is less than 50 meters deep.

The climate of the Kara Sea alters between that of the Barents Sea and the polar seas further to the east. Its southwestern parts experience nearly twice as many days of temperatures above zero as its northeastern parts, but also have highly variable wind and snowstorms. There is generally less ice in the western parts,[8] but the incidence of fog is consequently higher. The circulation of the Kara Sea is strongly influenced by the summer outflow from the Ob' and Yenisey rivers. The considerable outflow of fresh river waters into the sea appears to affect three surface currents. The westernmost flows from the Ob' delta northeastward towards Novaya Zemlya, continues southward along the eastern coast of the archipelago, and then completes the circle by moving northward as the Yamal Current along the Yamal Peninsula. The central current flows directly northward into the Arctic Ocean, and the easternmost current moves in a northeasterly direction and then towards Vil'kitskiy Strait and the New Siberian Islands, flowing into the Laptev Sea. Kara Sea water also enters the Laptev Sea via the Shokal'skiy Strait along its eastern coast.

Much of the Kara Sea is ice-covered throughout the year, and ice may be encountered at any time during the navigation season. Ice conditions vary extensively from year to year, and it is thus difficult to give general directions. In some years, the northern parts are more

[8] Although the counter-clockwise current in the southwestern Kara Sea also brings ice into that part, especially in summer, when the current is strongest.

favourable for navigation, while in others, the southern straits are to be preferred.[9] On an average, the entire Kara Sea is open to navigation from early August to late September, or even early October. In the most favourable years, the season runs from late July to mid-October. With ice-breaker assistance, the southern Kara Sea is navigable in June. The worst navigation conditions generally occur in the vicinity of the Nordenskjöld Archipelago, where heavy concentrations of ice between the islands may persist during the entire season. When this happens, vessels have to adhere to the inner route along the coast.

2.4 The Laptev Sea

The Laptev Sea is situated along the Siberian coast, the Taymyr Peninsula and Severnaya Zemlya in the west, and the New Siberian Islands in the east. Its average depth is 578 meters, but 53% of the seabed has depths of less than 50 meters. The continental shelf of the Laptev Sea has depths varying from 10 to 40 meters. It is traversed by five large and deep submarine valleys.

A cold current carrying large icebergs from the Arctic Ocean flows southeastward down the eastern coasts of Severnaya Zemlya, moves southward along the eastern coast of the Taimyr Peninsula towards the Khatanga estuary, where it is joined by the Lena and Khatanga rivers along the coast. Thereafter, it flows northeastward and divides, part of it moving northward up the western coast of the New Siberian Islands, and part of it flowing into the East Siberian Sea.

Ice conditions in the Laptev Sea are not as difficult as in the other polar seas. Much of the sea is usually ice-free and open for navigation during August and most or all of September. During this period, ice from the Arctic Ocean is often encountered in the northwestern part of the sea. The sea begins to freeze in late September or early October and is frozen over by November. In winter, the entire coastal region and southern part of the sea is ice-covered. The substantial outflow of river waters in spring causes belts of open water to appear early, and these are of great importance for navigation in the area. Ice conditions are usually more favourable in the eastern part of the sea at the beginning of the navigation season. The worst areas are the eastern approaches to the Vil'kitskiy Strait and around the New Siberian Islands.

2.5 The East Siberian Sea

The East Siberian Sea is located between the New Siberian Islands in the west and the Wrangel Island in the east. It is an extremely shallow sea, having depths generally of less than

[9] This will be further elaborated on in section 5.

40 meters. It is one of the flattest areas of comparable size on this planet. There are several groups of islands in the sea.

Depressions moving in from the southeast make winters less severe and thaws more frequent than in the Laptev Sea. The western part of the sea from the New Siberian Islands to the Kolyma river is practically ice-free in summer, whereas in the eastern area over to Wrangel Island, ice is almost always present. The thaw usually starts in May, with ice breaking up in the Kolyma river delta and western area of the sea in early July. By mid-November, the entire sea is normally frozen again. During the navigation season, ice conditions depend on wind directions. Offshore winds may open a path close to the shore, thus making navigation possible. However, the eastern part of the East Siberian Sea is generally one of the most difficult passages of the entire NSR.

2.6 The Chukchi Sea

The Chukchi Sea borders both Russian and American coasts. It lies within a line drawn between Cape Krigugon in Asia and Cape York in Alaska with its westward boundary following a line drawn between Cape Yakun on the northeastern Siberian coast and Cape Blossom on Wrangel Island. To the east, its boundary follows the meridian passing through Point Barrow in Alaska.

In early July, the ice immediately north of the Bering Strait begins to clear as the pack ice breaks off from the shore ice and moves northward. The Chukchi Sea is mainly free of ice to about the 70th parallel in late August or early September. There are, however, substantial annual variations. The main factor in the clearing of ice is the flow of warmer water northward through the Bering Strait. After mid-September, the ice extends rapidly southward, and by mid-October, the entire Chukchi Sea is usually ice-bound. In most years, the Chukchi Sea is one of the more difficult parts of the NSR.

3 The Main Straits of the NSR

This section presents the main straits linking the five seas of the NSR. Starting in the west, the straits in the Novaya Zemlya area connect the Barents and the Kara Seas. The latter is linked to the Laptev Sea by the straits of Severnaya Zemlya, which in turn is connected to the East Siberian Sea by the straits passing through the New Siberian Islands. In the east, the Long Strait between Wrangel Island and the Chukchi Peninsula on the Siberian mainland separates the East Siberian Sea from the Chukchi Sea.

3.1 The Straits Connecting the Barents and Kara Seas

There are three straits connecting the Barents and Kara Seas: the *Yugorskiy Shar Strait* (*proliv Yugorskiy Shar*), the *Kara Gates Strait* (*Karskiye Vorota*), and *Matochkin Shar Strait* (*proliv Matochkin Shar*). While the two former create passages to the south and north of the Vaygach Island, located between Novaya Zemlya and the mainland, the latter divides the long Novaya Zemlya archipelago into two main islands.

3.1.1 The Yugorskiy Shar Strait

The Yugorskiy Shar Strait - which is between 21 and 22 nautical miles long, has a least width of 1.5 nautical miles and a least width of its fairway of 0.9 nautical miles - separates the Vaigach Island from the mainland. There are several shoals in the strait, but in the fairway there is a minimum depth of 13.4 meters. Anchorage is possible in almost any part of the strait despite occasionally strong tidal streams, but ice from the Kara Sea can be driven quickly into the strait by northerly winds. The strait is well marked by leading lines and beacons, and the channel is buoyed, although ice has been known to carry some of the buoys away.

The strait usually freezes solid in winter, and is not clear of ice until late July. Unless Kara Sea ice drifts into the strait during the summer, the strait often does not freeze over until December. If, however, the strait is blocked with Kara Sea ice when freezing starts in the autumn, the entire strait may be ice-bound by late October. Navigation has been possible as early as mid-June, but in a bad season, the strait may be blocked throughout the summer.

In general, navigation through the Yugorskiy Shar Strait is risky because of strong and uncertain currents as well as poor visibility owing to frequent fogs. The most dangerous part for navigation is the western entrance of the strait from the Varneka Bay to Cape Stvornyy.

3.1.2 The Kara Gates Strait

The Kara Gates Strait separates Vaygach Island from Novaya Zemlya. It is approximately 21 nautical miles long,[10] and has a least width of 22 nautical miles (24.3 according to the official Russian source GUNIO). The least depth of the strait is 15 meters. The northeastern entrance contains a large number of islands and islets and thus constitutes the most difficult part for navigation. The strait is not well marked, but according to Butler (1978) navigation is not risky due to the depth and width of the fairway. The "Guide to Navigation through the Northern Sea Route" states, however, that navigation in the strait is difficult due to strong currents, frequent fogs, the presence of drifting ice, and several other navigational hazards. It is impossible to anchor in the strait because of its great depths and the difficulty of navigating the skerries along the more shallow approaches to the shores.

The strait does not freeze solid except in particularly hard winters; even then it freezes only for a brief period. However, ice can be encountered in the strait all year round, and in winter, it is covered with drifting ice. Ice conditions during the navigation season depend primarily on conditions in the southwestern Kara Sea and the eastern coast of Novaya Zemlya. With wind coming from north and east, ice quickly moves into the strait and occasionally forms a wall off its northeastern entrance. At the opening of the navigation season, considerable amounts of ice frequently pass through the strait into the Barents Sea, part of it working its way westward along the Novaya Zemlya coast.

In a normal winter, the strait fills with pack ice, though an open channel remains in its central part. The ice usually breaks up in late June and disappears by early August. Brash ice appears towards the end of October, pack ice by mid-November, fast ice about late November, and complete freezing, if it occurs, in January.

3.1.3 The Matochkin Shar Strait

The Matochkin Shar Strait divides Novaya Zemlya into two parts about 155 nautical miles from the southern extremity. It is about 55 nautical miles long, passing through high and generally rugged mountains. With a minimum width amounting to 4-5 cables and an average width of one nautical mile, it is the narrowest of the Novaya Zemlya straits. The western part of the strait contains a large number of reefs, banks and shallows, and has a minimum depth of 12 meters. The eastern part, on the other hand, is deep and fjord-like.

When ice conditions are favourable, vessels of any size can transit the strait, but both entrances can be difficult to identify in fog since the strait lies between mountains of uniform appearance. Ice conditions differ substantially between the eastern and western parts of the

[10] According to Butler (1978: 19), it is 17.5 nautical miles long.

strait. The appearance of ice in the western part during the navigation season is exceptional, whereas its presence in the eastern part depends wholly on ice in the Kara Sea. Whenever ice is accumulated off the eastern coasts of Novaya Zemlya, it will be driven by easterly winds into the Matochkin Shar Strait by the westward tidal stream. Occasionally, the ice will close the eastern entrance and a considerable part of the strait itself for as long as the wind lasts. Once the wind changes to westerly, however, the strait is quickly cleared of ice.

In winter, the entire strait freezes over except for favourable years when there may be open water in the narrows. Navigation depends on the quantity and compactness of the ice. A vessel proceeding in the strait against the tidal stream, will receive heavy blows from the ice, but if the tidal stream runs against the wind, the ice will be loosened. The steep shores of the strait facilitate navigation in ice because a vessel may closely approach them.

3.2 The Straits Connecting the Kara and Laptev Seas

There are four main straits connecting the Kara and Laptev Seas: the *Vil'kitskiy Strait* (*proliv Vil'kitskogo*), the *Shokal'skiy Strait* (*proliv Shokal'skogo*), the *Rad Army Strait* (*proliv Krasnoy Armii*), and the *Yungshturm Strait* (*proliv Yungshturma*). The two former run south and north of the Bolshevik Island, separating it from Taymyr Peninsula on the mainland and the October Revolution Island, respectively. The Red Army strait divides the northern coast of October Revolution Island from the Komsomolets and Pioneer Islands. The mentioned islands constitute the main members of the Severnaya Zemlya (*Northern Land*) Archipelago.

3.2.1 The Vil'kitskiy Strait

This is the southernmost of the straits linking the Kara and Laptev Seas, passing eastward between the Taimyr Peninsula on the mainland and the southern side of Bolshevik Island. This is the shortest, best-marked and best-known route from the Kara to Laptev Sea, about 60 nautical miles long and with a least width of 29 nautical miles (29,7 according to GUNIO). The depths vary from 40 to 230 meters. In the southern parts of the straits, there are some shoals with depths from six to eight meters.

The strait freezes solid in winter and on rare occasions remains obstructed by ice throughout the navigation season. Offshore winds can, however, cause temporary stretches of open water near the coast. Ice conditions in the strait itself and its approaches are generally very complex and changeable even within a day. The strait is practically never free from compact ice. The drift of ice and its concentration in different sectors of the strait depend on

the direction and strength of the wind. Furthermore, fog is heavy in the area during summer.[11] In general, the southern part of the strait close to the Taymyr Peninsula is preferred for sailing.

3.2.2 The Shokal'skiy Strait

The Shokal'skiy Strait, about 80 nautical miles long and with a least width of 10.5 nautical miles in its central part, is a typical deep-water strait with steep coasts surrounding it. Its least depth is 102 meters, and there are no navigation dangers in its middle sector.

Ice conditions here are more complex than in the Vil'kitskiy Strait, and they are aggravated by large icebergs dangerous to navigation. On the approach to the strait from the Laptev Sea, there is almost always fast ice from the Taymyr ice massif present.[12] Ice is usually thick along the eastern coast of Severnaya Zemlya and the Taymyr Peninsula even up to mid-September, and in some instances is a serious impediment to navigation. On the western side of the strait itself, a glacier extends and forms an ice tongue about 2.5 nautical miles wide.

3.2.3 The Red Army and Yungshturm Straits

These two straits are practically never used for transit navigation due to difficult ice conditions. The Red Army Strait is about 80 nautical miles long. Its southwestern part is 7-10 nautical miles wide, but it narrows in the central area to about 1.5 nautical miles. The Yungshturm Strait is 30 nautical miles long, 12 nautical miles wide at its western entrance, but narrows to about three nautical miles.

There are numerous islets in these straits, as well as glaciers descending to them, making navigation extremely difficult.

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[11]As Butler (1978: 29) comments, it is illustrative of the fog conditions in the strait that although it was explored and transited at least as early as 1878-79, only in 1913 was land discovered to the north of it.

[12] The term *ice massif* refers to a "concentration of sea ice covering hundreds of square kilometers which is found in the same region every summer" (Barnett 1991).

3.3 The Straits Connecting the Laptev and East Siberian Seas

There are several straits traversing the New Siberian archipelago, situated between the Laptev and East Siberian Seas. The most important for navigation are, however, the *Dmitriy Laptev Strait* (*proliv Dmitriya Lapteva*) and the *Sannikov Strait* (*proliv Sannikova*).

3.3.1 The Dmitriy Laptev Strait

This is the southernmost of the passages connecting the Laptev and East Siberian Seas, separating the Bol'shoy Liakhovskiy Island from the mainland. The strait is about 70 nautical miles long[13] and has a least width of 27 nautical miles, passage being limited to vessels drawing not more than 22 feet by shoal waters in its eastern approach. There are several shoals with a depth of 10 meters in the middle of the strait, the least depth of the fairway being 10-11 meters. The strait is generally navigable for vessels with a draught of up to 9 meters. Navigation dangers are banks and shallows lying close to the recommended course. Bondarenko (1995) notes that the strait is normally not used by loaded vessels.

According to Michailichenko & Yakovlev (1994), ice conditions in the strait are quite complex. For a large part of the year, the strait has a consolidated ice sheet, blocking it sometimes for the entire navigation period. Usually, however, the strait is ice-free in August and September. The straits begins to freeze at the beginning of October - sometimes at the end of September - and at the beginning of November, it covers with compact landfast ice.

Vessels passing from west to east are instructed to keep between 73°N and the five-fathom line on the western side of the strait so as to avoid shoals. The eastern approach is difficult because the fairway passes out of sight of the land between shoals extending northward from the mainland and eastward from Bol'shoy Lyakhovskiy Island.

3.3.2 The Sannikov Strait

The Sannikov Strait is located between Kolel'nyy and Malyy Lyakhovskiy Islands. It is about 217 nautical miles long and has a least width of 31 nautical miles. There are several shoals with a depth of less than nine meters in the strait, but its fairway has a minimum depth of 14 meters.[14] Vessels of any draft may use the strait, and it is often used even when ordinary

[13] 63 nautical miles according to Butler (1978).

[14] Here again, existing data diverge: according to Butler (1978), the fairway has depths from 7 to 15 meters.

underkeel clearance cannot be obtained and the speed consequently has to be reduced in parts of the strait.

Passage from west to east is fairly easy, but transit in the opposite direction is sometimes made difficult by fluctuating water levels caused by prevailing offshore winds. Moreover, a sloping coastline on the New Siberian Islands makes it difficult to discover land visually and on radar.

Most favourable navigation conditions in the strait are in September. Freeze-up begins in early October, and the definitive freezing of the strait occurs in the second half of this month. From late October to mid-July, steady landfast ice keeps in the strait. The break-up of landfast ice occurs, on average, around 20 July, being accelerated in the period of strong eastern winds which favour ice clearance of the strait. Winds from the west usually bring into the strait much ice from the Laptev Sea. The dates of final clearing of ice depend on ice conditions in the western part of the East Siberian Sea, and vary between early August and late September. In unfavourable years, the strait does not entirely clear of ice.

3.4 The Passage from the East Siberian Sea to the Chukchi Sea

These two easternmost seas along the NSR are linked by the *Long Strait* (*proliv Longa*), situated between the Chukchi Peninsula on the Siberian mainland and Wrangel Island. About 76 nautical miles wide (79 according to GUNIO), it is the widest strait in the NSR area. The relief of the bottom is fairly uniform, with prevailing depths of 40-50 meters. There are, however, shoals with a depth of down to 17 meters in the western part of the strait.

Ice conditions in the strait are very severe, depending largely on the state and position of the Wrangel and Ionskiy ice massifs.[15] The edge of ice in the Long Strait almost invariably forms a curve reaching from the mainland close up to the island. Vessels encountering an ice field pressed against the mainland coast are advised therefore not to endeavour to pass northward of it, as it will almost certainly extend the entire width of the strait. In such cases, a captain is counselled to seek an inshore lead, sounding continuously to avoid shallow depths.

In favourable years with respect to ice conditions, the strait clears from compact ice, whereas drifting ice continues to present a navigation danger for vessels. The speed of the drifting ice motion in the strait is particularly high.

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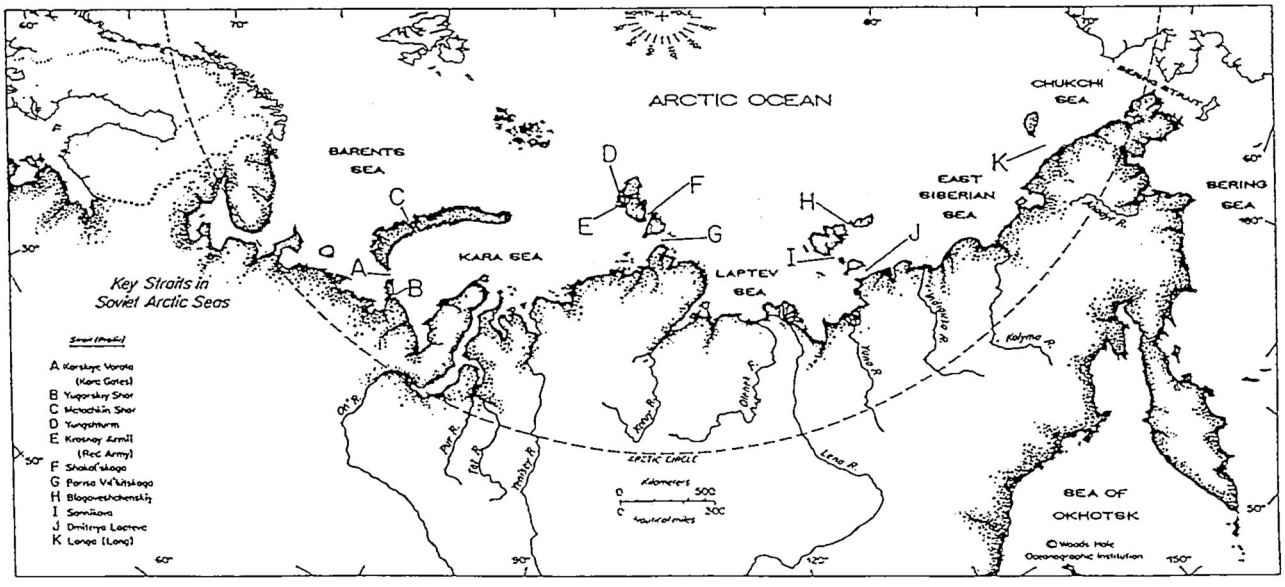
[15] See footnote 12 for a definition of the term *ice massif*.

Table 3.1: The main straits connecting the seas along the NSR:

Strait:	Least Width:	Location:
Yugorskiy Shar Strait	1.5 nautical miles	Barents-Kara Sea
Kara Gates Strait	22 nautical miles	Barents-Kara Sea
Matochkin Shar Strait	0.5 nautical miles	Barents-Kara Sea
Vil'kitskiy Strait	29 nautical miles	Kara-Laptev Sea
Shokal'skiy Strait	10.5 nautical miles	Kara-Laptev Sea
Red Army Strait	1.5 nautical miles	Kara-Laptev Sea
Yungshturm Strait	3 nautical miles	Kara-Laptev Sea
Dmitriy Laptev Strait	27 nautical miles	Laptev-East Siberian Sea
Sannikov Strait	30 nautical miles	Laptev-East Siberian Sea
Long Strait	76 nautical miles	East Siberian-Chukchi Sea
Bering Strait	46 nautical miles	Chukchi-Bering Sea

Map 3.1: Main straits along the NSR (adapted from Brigham (1991)):



4 Other Straits of the NSR

In this section, the smaller straits along the NSR - according to their indication on Russian charts - are presented. A few straits mentioned by Butler (1978) are not found on the charts, or rather: they are left unnamed there. These straits are included in the presentation, but in each instance, their lacking mention is indicated in a footnote. On the other hand, a variety of straits found on the maps are not included in Butler's (1978. 40-41) list. These are marked by a * in the tables. Also for those straits which are mentioned by Butler, information on location and least width is sometimes improved here.

4.1 The Straits of the Barents and White Seas

There are a few smaller straits along the coastline of the Barents Sea and the western coast of Novaya Zemlya. In addition, the White Sea - a gulf extending from the Barents Sea south of the Kola Peninsula - contains a number of islands and straits. Eventually, the Franz Josef Land archipelago can be traversed through three main straits running in a north-south direction.

4.1.1 The Straits of Franz Josef Land

The Franz Josef Land archipelago (*Zemlya Frantsa Iosifa*), situated east of Svalbard and north of Novaya Zemlya, contains a wide range of smaller straits, the three most important being the *British Canal Strait* (*proliv Britanskiy Kanal*), *Markam Strait* (*proliv Markama*)[16], and the *Austrian Strait* (*Avstriyskiy proliv*). The former is entered proceeding northward through one of three straits: the *Nightingale Strait* (*proliv Naytingeyl*) in the west, *Meyers Strait* (*proliv Mayersa*) in the middle and *De-Bruyn Strait* (*proliv De-Bryuyne*) in the east. The Nightingale Strait separates Bell, Meybel, and Bruce Islands from Zemlya Georga, and is about 23 nautical miles long with a least width of six nautical miles. Ice usually breaks up earlier here than in the other two straits in the southern part of the British Canal Strait. Meyers Strait, on its part, is 14 nautical miles long and has a least width of about four nautical miles. It separates Bell, Meybel, and Bruce Islands from Nortbruk Island. Ice usually breaks up in mid-July, but drift ice is encountered even then. De-Bruyn Strait between Nortbruk and Hooker Islands, is the most convenient approach to the British Canal Strait. Its least width is 15 nautical miles. The British Canal Strait itself is about 40 nautical miles long

[16] Butler's (1978: 12, 13, 40) transliteration *Markham Strait* is obviously incorrect.

and has a least width of 17 nautical miles.

Markam Strait connects the northern part of the British Canal Strait with the *Austrian Strait*. The former is about 45 nautical miles long and has a least width of 4.5 nautical miles. The latter, separating the central and eastern group of islands of the archipelago, extends about 40 nautical miles northward, and has a least width of five nautical miles at its southern entrance.

Table 4.1: The Franz Josef Land Straits:

Strait:	Least width:	Location:
British Canal Strait	17 nautical miles	Franz Josef Land
Markam Strait	4.5 nautical miles	"
Austrian Strait	5 nautical miles	"
Nightingale Strait	6 nautical miles	"
Meyers Strait	4 nautical miles	"
De-Bruyn Strait	15 nautical miles	"

4.1.2 The Straits of the White Sea

The White Sea (*Beloye more*) is an extensive arm of the Barents Sea to the south of a closing line drawn between Cape Svyatoy Nos on the Kola Peninsula and Cape Kanin Nos on the Kanin Peninsula. The entrance to the White Sea along this imagined line is about 80 nautical miles. The sea falls roughly into three segments: a northern part of some 60 to 100 nautical miles wide opening into the Barents Sea, a southern basin about 120 nautical miles wide, and a narrower central area called the *Gorlo* (the Russian word for *throat*), which is a strait with a least width of about 25 nautical miles. Ice conditions depend heavily on prevailing winds and can vary substantially from year to year. The Gorlo is usually clear of ice by the end of May and freezes again in mid-November.

The main approach to the White Sea from the Barents Sea is close to the eastern side of the Terskiy coast via the *Orlovskaya Salma Strait* (*proliv Orlovskaya Salma*), stretching between the mainland and a range of shoals known as *Bol'shaya Srednyaya Koshka*. The strait is about 15 nautical miles long and has a least width of 9 nautical miles. Only vessels with local knowledge and a moderate draft can go further eastward due to the multitude of shoals found here.

The Gorlo is about 35 nautical miles wide at its northern entrance, 50 nautical miles at its southern entrance, and 25 nautical miles at the least width. Within the Gorlo, just outside the

tip of the Kola Peninsula, Sosnovets Island is separated from the mainland by the *Sosnovskaya Salma Strait* (*proliv Sosnovskaya Salma*), about 1.5 nautical miles wide with its navigable part reduced to 0,5 nautical mile by a shoal.

Below the Gorlo, the White Sea branches into three large arms: the Dvina, Onega, and Kandalash Gulfs. The Onega Gulf in particular has dozens of islands at its entrance, and passing vessels must transit one of several straits. The widest and freest of dangers is the *Vostochnaya Solovetskaya Salma Strait* (*proliv Vostochnaya Solovetskaya Salma*), which separates the Solovetskiy and Bol'shaya Muksalma Islands from the Onega coast. It is about 14 nautical miles long and 12 nautical miles wide at its narrowest between the Bol'shaya Muksalma Island and Cap Letniy Orlov on the mainland. The *Zapadnaya Solovetskaya Salma Strait* (*proliv Zapadnaya Solovetskaya Salma*) runs between the Solovetskiy Island and the eastern Karelian coast. It is about 17 nautical miles long, and has a minimum width of some 11 nautical miles between Solovetskiy Island and the small Nemetskiy Kuzov Island closer to the coast. The *Anzerskaya Salma Strait* (*proliv Anzerskaya Salma*), on its part, separates Solovetskiy Island from the Anzerskiy Island, both belonging to the Solovetskiye Islands archipelago. Anzerskaya Salma Strait is approximately 10 nautical miles long, and has a minimum width of somewhat less than three nautical miles. Its least fairway width is, however, only three quarters of a nautical mile.

Further eastward in the White Sea, the *Zhizhginskaya Salma Strait* (*proliv Zhizhginskaya Salma*) separates Zhizhginskiy Island from Cape Ukhtnavalok at the tip of the peninsula between Onega and Dvina Gulfs. It is very short, a little bit less than a nautical mile, and has a least width of nearly three nautical miles.

In the Mezenskiy Gulf, at the eastern side of the northern entrance to the Gorlo, the *Morzhovskaya Salma Strait* (*proliv Morzhovskaya Salma*) separates Morzhovets Island from the Abramovskiy Coast on the mainland. The strait is about nine nautical miles long and 10 nautical miles wide.

Table 4.2: The White Sea Straits:

Strait:	Least width:	Location:
Gorlo Strait	25 nautical miles	The central part of the White Sea
Orlovskaya Salma Strait	9 nautical miles	White Sea entrance
Sosnovskaya Salma Strait	1.5 nautical miles	Gorlo
Vostochnaya Solovetskaya Salma Strait	12 nautical miles	Onega Gulf
Zapadnaya Solovetskaya Salma Strait	11 nautical miles	Onega Gulf
Anzerskaya Salma Strait	3 nautical miles/ 0.75 in fairway	Onega Gulf
Zhizhginskaya Salma Strait	3 nautical miles/ 1/8 nautical miles in fairway	Onega/ Dvina Gulf
Morzhovskaya Salma Strait*	10 nautical miles	Mezenskiy Gulf

4.1.3 The Straits along the Barents Sea Coastline

The Kil'din Island is the largest off the Murmansk coast and is separated from the mainland by the *Kil'din Strait* (*proliv Kil'din*), which is ten nautical miles long and half a nautical mile wide at its narrowest. The strait never freezes, but is on occasion blocked by ice carried through in winter by tidal currents.

The *Pomorskiy Strait* (*proliv Pomorskiy*), about 32 nautical miles at its narrowest, runs between Kolguev Island and the Timinskiy coastline. In the eastern part of this strait, the *Sengeyskiy Strait* (*proliv Sengeyskiy*) separates Sengeyskiy Island from the mainland. It is about 17 nautical miles long, and has a least width of approximately one and a half nautical miles. Its western and eastern entrances are formed by the *Verkhniy Shar* (*proliv Verkhniy Shar*) and *Nizhniy Shar* (*proliv Nizhniy Shar*) *Straits*. These are both very short, and have least widths of somewhat less than a half and a little more than one nautical mile, respectively.

Further to the east, the *Glubokiy Shar Strait* (*proliv Glubokiy Shar*), about five nautical miles long and four nautical miles wide at its narrowest, separates the Lovetskiy and Zelyonyy Islands in the Pechora Gulf.

Within the Novaya Zemlya archipelago, the *Nikol'skiy Shar Strait* (*proliv Nikol'skiy Shar*) separates Kuzova Zemlya, an island at the southwestern end of the northwestern coast of the

Kara Gates Strait, from the Priritovyy Peninsula of Novaya Zemlya. It is about seven nautical miles long, and has a least width of less than one half of a nautical mile. The *Kostin Shar Strait* (*proliv Kostin Shar*) separates the northern and eastern shores of Mezhdusharskiy Island from Novaya Zemlya. It is about 55 nautical miles long and has a least width of two thirds of a nautical mile. Navigation is made difficult by a large number of islands and islets in the strait. Eventually, the *Krotov* (*proliv Krotova*) and *Kazakov* (*proliv Kazakova*) *Straits* divide Mityushev Island from the mainland.[17] These straits are about 1.75 and 2.75 nautical miles wide, respectively, and are deep and clear of dangers in the fairway.

Table 4.3: The Barents Sea coastline straits:

Strait:	Least width:	Location:
Kil'din Strait	0.5 nautical miles	Murmansk coast
Pomorskiy Strait*	32 nautical miles	Pechora Gulf
Sengeyskiy Strait*	1.5 nautical miles	"
Verkhniy Shar Strait*	0.5 nautical miles	"
Nizhniy Shar Strait*	1 nautical mile	"
Glubokiy Shar Strait*	4 nautical miles	"
Nikol'skiy Shar Strait	0.5 nautical miles	Novaya Zemlya
Kostin Shar Strait	2/3 nautical mile	"
Krotov Strait	1.75	"
Kazakov Strait	2.75	"

4.2 The Straits of the Kara Sea

The Kara Sea can roughly be divided into two main segments: the western part forms a separate basin to the west of a line from Cape Zhelaniya at the northern tip of Novaya Zemlya and White Island (*ostrov Belyy*) north of the Yamal Peninsula. There are relatively few islands and straits in this part of the sea. To the east of this line, however, there are several islands and archipelagoes, with the Dikson, Sverdrup, Arctic Institute, Izvestiy TsIK, Uyedineniye, and Geyberg Islands counting among the most important. Most of them are located so far off the coast that the ocean area between them and the mainland are not labelled

[17]These two straits are not mentioned by name on the Russian charts used for this investigation; they are, however, mentioned by Butler (1978: 14).

as straits. Some of them are, however, internally divided by straits that may be used for navigation.

4.2.1 The Straits of the Western Kara Sea

On the eastern coast of Novaya Zemlya, the *Petukhovskiy Shar Strait* (*proliv Petukhovskiy Shar*) separates the Bol'shoy Oleniy Island from the southern side of the Rusanov Peninsula.[18] It is about five and a half nautical miles long. Its western entrance is about half a nautical mile wide, and the eastern entrance only two to three cables.

Close to the eastern entrance of the Yugorskiy Shar Strait, the *Morozov Strait* (*proliv Morozova*), three nautical miles long and with a least width of half a nautical mile, runs between Mestnyy Island and Yugorskiy Shar Peninsula.

Off the western shore of the Yamal Peninsula, the *Mutnyy Shar Strait* (*proliv Mutnyy Shar*) divides the Sharapovy Koshki rocks from the mainland. The strait is about 24 nautical miles long. Its least width is about five nautical miles.[19] On the northern tip of the Yamal Peninsula, the *Malygin Strait* (*proliv Malygina*) separates the mainland from White Island (*ostrov Belyy*). This strait is 32 nautical miles long. Its narrowest part is at its western entrance, where it is somewhat less than five nautical miles wide. Light draft vessels bound for the Yugorskiy Shar Strait can save up to 50 nautical miles by using the strait instead of passing around White Island.

Somewhat further to the east, just across the outlet of the Ob Gulf (*Obskaya guba*), the *Gydanskiy Strait* (*Gydanskiy proliv*), a little more than two nautical miles wide at its narrowest, separates Shokal'skiy Island (*ostrov Shokal'skogo*) from the Yavay Peninsula, the tip of the larger Gydanskiy Peninsula. West of the Yenisey Gulf (*Yeniseyskiy zaliv*), stretching from the outlet of the Yenisey River to the town Dikson, the *Ovtsyn Strait* (*proliv Ovtsyna*) divides Sibiryakov Island from the mainland.[20]

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[18] This strait is not named on the Russian charts, but is mentioned by Butler (1978).

[19] Butler (1978: 26) notes that the Mutnyy Shar Strait is the entrance to the *Sharapov Shar Straits*. This is not named on the Russian charts.

[20] Neither Gydanskiy nor Ovtsyn Straits are marked by name on the Russian navigation charts. The latter is, however, mentioned by Butler (1978). Furthermore, they are found in the Russian Arctic Atlas (*Atlas Arktiki*).

Table 4.4: The western Kara Sea straits:

Strait:	Least width:	Location:
Petukhovskiy Shar Strait	0.25 nautical mile	Novaya Zemlya
Morozov Strait	0.5 nautical mile	Yugorskiy Shar Strait
Mutnyy Shar Strait*	5 nautical miles	Yamal coast
Malygin Strait	5 nautical miles	"
Gydanskiy Strait*	2 nautical miles	Gydanskiy Peninsula
Ovtsyn Strait	22 nautical miles	Yenisey Gulf

4.2.2 The Straits of the Eastern Kara Sea

Dikson Island is separated from the mainland by the narrow *Lena* and *Preven Straits* on the north, and by the *Vega Strait*, about 1.5 nautical miles wide, on the south.[21] Dikson Island is a key point in the Northeast Passage. Vessels bound from northern European ports in Russia to Khatanga Bay and the estuaries of the Lena, Indigirka, or Kolyma Rivers call there, as do vessels transiting the Northeast Passage in either direction.

In the archipelago Izvestiy TsIK Islands, the *Kalinin Strait* (*proliv Kalinina*) stretches between the Poloshi-Sergeyev and Troynoy Islands. It is about seven nautical miles long and has a least width of two and a half nautical miles. The *Kurochkin Strait* (*proliv Kurochkina*) in the Pyasinskiy Gulf south of the Arctic Institute Islands, separates Morzhovo Island from the Peter Chichagov coast on the mainland. The strait is about 4.5 nautical miles wide.

The *Khmyznikov Strait* (*proliv Khmyznikova*) separates the Plavnikovyye and Oleniy Islands in the Minin Skerries, situated on the western side of the Taymyr Peninsula to the south-east of the Arctic Institute Islands. This strait has a minimum width of a little more than two nautical miles. The Khmyznikov strait is the only one in the Minin Skerries named on the Russian maps; Butler (1978: 27) additionally mentions a number of small straits between these skerries[22]: The *Dubravin Strait*, about two nautical miles wide, lies between Kosterin and Northern Karzar Islands; the *Glubokiy Strait*, with a fairway of 33 to 42 feet, between Kosterin, Kruglyy and Granityy Islands; the *Stalinets Strait*, with a least width of 0.75 nautical miles, between the mainland and the northeastern group of skerries; and, eventually,

[21] The original Russian names of these straits are not included since they could not be checked on the charts.

[22] Butler (1978), on his part, does not mention the Khmyznikov Strait.

the *Iney Strait*, about one nautical mile wide at either entrance, is also in the area.[23]

The most important straits in the eastern Kara Sea are those of the Nordenskiöld Archipelago. The archipelago, situated near the shores of the Taymyr Peninsula between the meridians of 94°E and 98°E and extending north for about 65 nautical miles, is composed of more than 70 islands. The *Matisen Strait* (*proliv Matisena*) serves as the main route for vessels proceeding through the archipelago towards the Vil'kitskiy Strait. It runs between Petersen Island and some other small islands unnamed on the map in the north and the Moiseyev, Pilot Alekseyev and Nansen Islands in the south, the three latter islands being situated to the north of the larger Taymyr Island.[24] The least width of the strait, about three nautical miles, is found in its south-western part. The bottom on recommended routes in the strait is even. Depths are 40-55 meters at the western entrance and increase to 60-70 meters further to the east. Navigation is possible in any visibility and at any time of the day. A sufficient number of light-beacons and radar reflectors are established on the adjacent islands. The period of navigation without ice-breaker assistance lasts for about 60 days.

The *Lenin Strait* (*proliv Lenina*), also traversing the Nordenskiöld Archipelago, separates the Pakhtusov Islands, including the Petersen, Dobrynya Nikitich and Krasin Islands, from the Yermolev, Tri Brata and Bianka Islands. Its minimum width is six nautical miles, and is found in the north-western part. It can be used by vessels of any draught.

The Matisen and Lenin Straits are the only straits in the Nordenskiöld Archipelago marked on the Russian maps. In addition, Butler (1978:27) mentions:[25] the *Fram Strait*, 1.5 nautical miles wide at its narrowest, between Nansen Island and Yeremeyev Peninsula; the *Sverdrup Strait* between Bonevyy and Nansen Islands; the *Zarya Strait*, 1.5 nautical miles wide at its entrance, between Bonevyy Island and the mainland; the *Palander Strait*, with a least width of 2.5 nautical miles, between the Nansen, Bonevyy, and Taymyr Islands; the *Toros Strait*, 1-2 nautical miles wide, separating Taymyr and Pilot Makhotkin Islands from Moiseyev and Pilot Alekseyev Islands; and, eventually, the *Vostochnyy Strait*, about one nautical mile wide, situated between the Trud Peninsula and Pilot Makhotkin Island.[26]

The *Mikheyev Strait* (*proliv Mikheyeva*), at the western entrance to the Vil'kitskiy Strait separates the Zapadnyy and Severnyy Islands in the north and Sredniy Island in the south, all of which belong to the Heiberg Islands (*ostrova Geyberga*). The minimum width of the strait

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[23]Again, transliterations are omitted since it has not been possible to check the Russian spelling on the charts.

[24] Butler (1978: 28) is obviously wrong in locating the Matisen Strait between the Nordenskiöld Archipelago and the Pilot Makhotkin Island.

[25] Curiously, Butler does not mention the more important Lenin Strait.

[26] Cf. footnote 21.

is approximately four nautical miles.

Table 4.5: The eastern Kara Sea straits:

Strait:	Least width:	Location:
Lena Strait	(narrow)	Dikson Island
Preven Strait	(narrow)	"
Vega Strait	1.5 nautical miles	"
Kalinin Strait*	2.5 nautical miles	Izvestiy TsIK Islands
Kurochkin Strait*	4.5 nautical miles	Pyasinskiy Gulf
Khmyznikov Strait*	2 nautical miles	Minin Skerries
Dubravin Strait	2 nautical miles	"
Glubokiy Strait	(narrow)	"
Stalinets Strait	0.75 nautical miles	"
Iney Strait	1 nautical mile	"
Matisen Strait	3 nautical miles	Nordenskiöld Archipelago
Lenin Strait*	6 nautical miles	"
Fram Strait	1.5 nautical miles	"
Sverdrup Strait	(narrow)	"
Zarya Strait	1.5 nautical miles	"
Palander Strait	2.5 nautical miles	"
Toros Strait	1 nautical mile	"
Vostochnyy Strait	1 nautical mile	"
Mikheyev Strait*	4 nautical miles	Heiberg Islands

4.3 The Straits of the Laptev Sea and New Siberian Islands

Moving eastward along the NSR, the number of islands and straits is gradually reduced. In the Laptev Sea, they are mostly found in the western part, along the eastern coast of the Taymyr Peninsula. Furthermore, the New Siberian Islands contain a few more straits than those already mentioned.

4.3.1 The Straits off the Eastern Taymyr Coastline

North of the eastern entrance to the Vil'kitskiy Strait, the *Yevgenov Strait* (*proliv Yevgenova*), about 19 nautical miles wide, separates the Bol'shevik and Starokadomskiy Islands. The latter is divided from Malyy Taymyr Island by the *Malyy Strait* (*proliv Malyy*), approximately four nautical miles wide.

Further south along the eastern Taymyr coast, the *Dikson Hydrographs' Strait* (*proliv Diksonskikh Gidrografov*) stretches between Samuila Island and the Komsomol'skaya Pravda Islands at a minimal width of almost eight nautical miles. The *Peter Strait* (*proliv Petra*), an extremely narrow strait with a minimal width of less than half a nautical mile, separates Severnyy Island from the Pronchishchev coast of the Taymyr mainland. The *Maud Strait* (*proliv Mod*), about 7.5 nautical miles wide, divides the Severnyy and Yuzhnyy Islands from Bezymyannyy Island. Eventually, the *Murmanets Strait* (*proliv Murmanets*), with a least width of five nautical miles, runs between Yuzhnyy and Borisovskiy Islands.[27]

Table 4.6: The eastern Taymyr coastline straits:

Strait:	Least width:	Location:
Yevgenov Strait*	19 nautical miles	Eastern Taymyr coast
Malyy Strait*	4 nautical miles	"
Dikson Hydrographs' Strait*	8 nautical miles	"
Peter Strait*	0.5 nautical mile	"
Maud Strait	7.5 nautical miles	"
Murmanets Strait	5 nautical miles	"

4.3.2 The Straits of the New Siberian Islands

In addition to the Dmitriy Laptev and Sannikov Straits, commented on in section 3.3, the New Siberian Islands contain a handful of less important straits. The *Eterikan Strait* (*proliv Eterikan*) lies between Bol'shoy Lyakhovskiy and Malyy Lyakhovskiy Islands, separating the

[27]The two latter measures differ quite substantially from those of Butler (1978: 41), who indicates that the minimal width of the Maud Strait is 1.5 nautical miles, and that of the Murmanets Strait 7.5 nautical miles. The other straits along the eastern Taymyr coastline are not mentioned by him at all.

Dmitriy Laptev and Sannikov Straits. It has a least width of seven nautical miles.[28] In the northwestern part of the archipelago, the *Zarya Strait* (*proliv Zarya*), being about ten nautical miles wide at its narrowest part, divides the Bel'kovskiy and Kotel'nyy Islands. To the northeast, the *Blagoveshchensk Strait* (*Blagoveshchenskiy proliv*) separates Fadeyevskiy and Novaya Sibir' Islands. It is about 25 nautical miles wide.

Table 4.7: The New Siberian Islands Straits:

Straits:	Least width:	Location:
Eterikan Strait	7 nautical miles	New Siberian Islands
Zarya Strait	10 nautical miles	"
Blagoveshchensk Strait	25 nautical miles	"

4.4 The Straits of the East Siberian and Chukchi Seas

Northwest of the Kolyma River outlet, there is a group of small islands, the Medvezh'i Islands. The *Kolymskaya Strait* (*proliv Kolymskoy*) has a least width of 15 nautical miles and separates the Krestovskiy Island from the mainland.[29] The *Melekhov Strait* (*proliv Melekhova*) divides the Krestovskiy Island from the Lushkarev, Leont'yev, and Lysov Islands, and is about 10.5 nautical miles wide.[30] The *Vostochnyy Strait* (*proliv Vostochnyy*), with a least width of 8.75 nautical miles, stretches between the two latter islands and Chetyryokhstolbovoy Island.

Somewhat further to the east, at the main outlet of the Chaunsk Gulf, the *Sredniy Strait* (*proliv Sredniy*) separates the Ayon Island to the west from the mainland with the town Pevek to the east. This strait has a minimum width of five nautical miles. West of the Chaunsk Gulf, the narrow *Malyy Chaunskiy Strait* (*Malyy Chaunskiy proliv*) separates Ayon Island from the Kyttyk Peninsula on the mainland.[31]

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[28] Butler (1978: 39) lists the width of the Eterikan Strait as "unknown". He also gives imperfect information on its location, in omitting the word *Lyakhovskiy* in Bol'shoy Lyakhovskiy and Malyy Lyakhovskiy Islands.

[29] It is probably this strait Butler (1978: 41) refers to as the "unnamed (Kolyma River) Strait" - of unknown least width - in the East Siberian Sea.

[30] The Melekhov Strait is mentioned by Butler (1978: 41), but its least width is given as "unknown".

[31] This strait is mentioned neither on the Russian navigation maps nor by Butler (1978), but is found in the Russian Arctic Atlas (*Atlas Arktiki*).

Table 4.8: The East Siberian and Chukchi Seas straits:

Strait:	Least width:	Location:
Kolymskaya Strait*	15 nautical miles	Medvezh'i Islands
Melekhov Strait	10.5 nautical miles	"
Vostochnyy Strait*	8.75 nautical miles	"
Sredniy Strait*	5 nautical miles	Chaunsk Gulf
Malyy Chaunskiy Strait*	0.75 nautical mile	"

5 Sailing Directions

This section gives a presentation of a few possible navigation routes through the North East Passage, as well as sailing directions for the most important straits of the route. Furthermore, information on navigation to some towns along the NSR, as well as their facilities, is presented.

5.1 Four Routes from the Barents Sea to the Bering Strait

The map "Overview of the Traditional (Coastal) and High-latitudinal Courses along the Northern Sea Route" presents four different routes from the eastern Barents Sea to the Bering Strait: one "traditional" along the coast (*traditsionnyy/ pribrezhnyy*), one "central" (*tsentral'nyy*), one "high-latitudinal" (*vysokoshirotnyy*), and, finally, one "close-to-the-pole" (*okolopolyusnyy*). Their distances are indicated in table 5.1.

Table 5.1: Distances of the four routes from the eastern Barents Sea to the Bering Strait:

Route:	Distance:
"Traditional"	3500 nautical miles
"Central"	3340 nautical miles
"High-latitudinal"	2890 nautical miles
"Close-to-the-pole"	2700 nautical miles

The "close-to-the-pole" variant is naturally obstructed for surface vessels by ice. So would also the "high-latitudinal" course be in most instances, although at least parts of this route are occasionally used for navigation. In the west, it starts from the north of Franz Josef Land, descends to the northern tip of Severnaya Zemlya, runs in a southeasterly direction well off the eastern shore of Taymyr Peninsula, turns northeastward again to pass north of the New Siberian Islands, then gradually descends southeastward north of Wrangel Island towards the Bering Strait.

The "central" route sets off in a northeasterly direction from the Kara Gates Strait. North of White Island, it turns southeastward towards Dikson, and from there passes well off the Minin Skerries and east of the Arctic Institute Islands in the direction of the Sergey Kirov Islands. Having passed to the south of the latter, it runs north of the Nordenskiöld Archipelago and south of the Heiberg Islands through the Vil'kitskiy Strait. Further eastward,

it descends towards the New Siberian Islands and passes through the Sannikov Strait. From there, it goes well off the Siberian mainland and the Medvezh'i Islands towards the town of Pevek, and further through the Long Strait to the Bering Strait.

The "traditional/ coastal" route also sets off from the Kara Gates Strait towards Dikson. In this stretch of the sea, it departs from the "central" route in going closer to White Island. It does not, however, prescribe transit of the Malygin or Gydanskiy Straits. From Dikson, it follows close to the coastline outside the Minin Skerries towards the Nordenskiöld Archipelago, where it traverses the Matisen Strait. On the other side of the Vil'kitskiy Strait, the route descends in a southeastward direction, avoiding the islands and straits off the eastern coastline of Taymyr Peninsula. From the Dmitriy Laptev Strait, it follows the Siberian mainland, traversing the Kolymskaya Strait between the Medvezh'i Islands and the mainland. In its last stretch towards the Bering Strait, the "traditional" route sticks close to the coastline.

5.2 Navigating the Main Straits and Seas of the NSR

In this section, sailing directions are given for the main straits and seas of the NSR. The main objective is *not* to give detailed directions for navigation, but to indicate which of the straits are normally used for navigation, and under which conditions alternatives are sought. The existing literature on this issue is compared to the newly published Russian "Guide to Navigation through the Northern Sea Route" (1996).

5.2.1 From the Barents to the Kara Sea

Vessels transiting the NSR generally proceed from Murmansk towards Novaya Zemlya passing north of Kolguev Island. In approaching Novaya Zemlya, it is necessary to ascertain from local radio stations or ice-breakers which strait is clear of ice. In recent years, Matochkin Shar Strait has no longer been an alternative for commercial navigation. It is closed for passage due to radioactive contamination in the area. When it comes to choosing between the two southern alternatives, recommendations are not uniform. Butler (1978) maintains that Yugorskiy Shar Strait is to be preferred since eastward ice in the Kara Sea, if present, is usually weaker and more passable here. Bondarenko (1995), on the other hand, states that the Kara Gates Strait is the preferable one, especially for larger vessels. This view seems to be supported by Michailichenko & Yakovlev (1994),[32] stressing the fact that the Kara Gates Strait is a deep-water strait which is navigable for all kinds of vessels. The official

[32]The argumentation of Bondarenko (1995) and Michailichenko & Yakovlev (1994) is supported by the fact that the two former have long experience as captains on ice-breakers along the NSR.

Russian "Guide to Navigation through the Northern Sea Route" (1996) states that "in June and July the optimum route passes most frequently through Proliv Karskiye Vorota and Proliv Yugorskiy Shar, and in September and October around Mys Zhelaniya (the northern tip of Novaya Zemlya; author's comment) (...). In August the two above variants are equally probable" (p. 63 in the English translation; p. 69 in the original).[33] As to the choice between the Kara Gates and Yugorskiy Shar Straits, it is, however, stated elsewhere in the official navigation guide that the Kara Gates Strait "is the main shipping channel connecting Barents (S)ea and Kara Sea" (p. 95 in the English translation; p. 108 in the original).

Table 5.2: Probability of use of alternative routes from the Barents Sea to the Kara Sea (probability values are given for the first 10 days of the month); Source: "Guide to Navigation through the Northern Sea Route" (1996):

Month:	Through Kara Gates Strait or Yugorskiy Shar Strait:	Around Novaya Zemlya:
June	80%	20%
July	65%	35%
August	60%	40%
September	45%	55%
October	20%	80%

5.2.2 The Kara Sea

Due to its physical and geographical conditions, the Kara Sea is the most difficult of the seas of the Russian Arctic for navigation. A range of factors make it unfavourable for navigation. Among these are the almost constant presence of ice; presence of a great number of submarine dangers and of numerous areas of scant depths; absence of sheltered anchorages in many areas; weather conditions which do not allow executing astronomical and visual position fixing; unreliable functioning of gyroscopic and magnetic compasses; insufficient knowledge of the currents; and finally, comparatively early freezing of river mouth areas.

The Kara Sea is under the responsibility of the West Arctic Region Marine Operations Headquarters ("Western Headquarters"), located in the port of Dikson. All vessels bound for any point of destination in the Kara Sea or in transit through the sea, should notify the

[33] According to Butler (1978), the route around Mys Zhelaniya is used only in years when the Yugorskiy Shar, Kara Gates and Matochkin Shar Straits are all obstructed.

Western Headquarters immediately after leaving the last port of call in the Barents Sea or White Sea. Henceforth, the vessels should strictly follow all instructions from the Headquarters. Only vessels of ice category are admitted for independent navigation in the Kara Sea ice.

The choice of courses in the southwestern part of the Kara Sea, from the Kara Gates or Yugorskiy Shar Straits to Belyy Island, is determined by the position of the Novozemel'skiy ice massif.[34] At the beginning of the navigation season, vessels usually pass east of the southern spur of this massif, and less often west of it. If the ice massif is pressed by eastward winds to Novaya Zemlya, navigation by the assistance of ice-breakers becomes possible from mid-June. Navigation without icebreaker assistance from the Kara Gates and Yugorskiy Shar Straits to Dikson Island normally becomes possible from 25-30 June.

In the stretch from Dikson Island to the entrance into the Laptev Sea, vessels usually navigate in a coastal strip up to 100 nautical miles wide, within which three main routes referred to as "coastal" (*pribrezhnyy*), "offshore" (*moristyy*) and "northern" (*severnyy*) can be recommended. At almost any point, the chosen route can be changed to another if ice or other conditions demand. The "coastal" route is mostly used after the first ice is broken and ice is driven off the shore by winds. It runs along the seaward edge of the Minin Skerries, either to the north or south of the Scott and Nansen Islands, passes the Ringnes, Kravkov, Belukh Islands and further through the Nordenskiöld Archipelago - usually through the Matisen Strait, though sometimes the Lenin Strait is used - between Ostrovok ("Little Island") Lishniy and Firnley Islands, and, passing closer to the southern shore of the Vil'kitskiy Strait, runs into the Laptev Sea. Navigation along this track is rather difficult as it leads through an area of irregular depths and a rocky ground. Position fixing conditions are good throughout, but possibilities of maneuver in case of ice pressure are limited.

The "offshore" route leads north of the Scott and Nansen Islands, the Yermak Bank and the Russkiy Island into the Vil'kitskiy Strait between the Firnley and Heiberg Islands, passing clear of the coastal dangers to navigation, but within the area of coverage by radiobeacons of medium range. Eventually, the "northern" route leads east or west of the Arctic Institute Islands and the Izvestiy TsIK Islands, then north of the Sergey Kirov Islands up to the turn near Voronin Island into the Vil'kitskiy Strait.

5.2.3 From the Kara to the Laptev Sea

As follows from the discussion in section 3.2, the Vil'kitskiy Strait is the obvious choice when passing from Kara to Laptev Sea. As noted by Bondarenko (1995), the Shokal'skiy Strait is only used on extremely rare occasions, and the Red Army and Yungshturm Straits

[34] See footnote 12 for a definition of the term *ice massif*.

are practically not in use for navigation at all. The "Guide for Navigation through the Northern Sea Route" (1996) indicates that the Vil'kitskiy Strait is used in 95-100% of the instances (p.63 in the English translation; p. 69 in the original).

Passage around the northern tip of the Severnaya Zemlya archipelago may on occasion also be open, primarily at the beginning of the navigation season.

Table 5.3: Probability of use of alternative routes from the Kara Sea to the Laptev Sea (probability values are given for the first 10 days of the month); Source: "Guide to Navigation through the Northern Sea Route" (1996):

Month:	Through the Vil'kitskiy Strait:	Around Severnaya Zemlya:
June	95%	5%
July	100%	0%
August	100%	0%
September	100%	0%
October	100%	0%

5.2.4 The Laptev Sea

The optimum route in the Laptev Sea and in the vicinity of the New Siberian Islands considerably changes by the season. Prior to the intensive rotting of ice of the Taymyr ice massif,[35] the optimum route passes along the southern peripheral part of this massif. In August and September, it passes through the massif, and in July, the two variants are equally probable.

Already in the eastern part of the Vil'kitskiy Strait, vessels normally set a course directly at the Sannikov Strait. If the Dmitriy Laptev Strait should be used instead of the Sannikov Strait (see next section), course is changed in the vicinity of Stolbovoy Island.

[35] See footnote 12 for a definition of the term *ice massif.*

Table 5.4: Probability of use of alternative routes along the Laptev Sea (probability values are given for the first 10 days of the month); Source: "Guide to Navigation through the Northern Sea Route" (1996):

Month:	Through Taymyrskiy ice massif:	Along the southern periphery of Taymyrskiy ice massif:
June	10%	90%
July	65%	35%
August	65%	35%
September	90%	10%
October	85%	15%

5.2.5 From the Laptev to the East Siberian Sea

While both the Dmitriy Laptev Strait and the Sannikov Strait may be used for navigation, the latter seems to be the preferable one on most occasions. As noted in section 3.3.2, the Sannikov Strait does not have the same draught limitations as the Dmitriy Laptev Sea. Furthermore, ice conditions are reportedly more favourable in the Sannikov Strait. The "Guide to Navigation through the Northern Sea Route" (1996) assesses that the Sannikov Strait is used with a probability from 50 to 85% in the period from August to October (p. 64 in the English translation; p. 69 in the original). In June and July, however, it states that the optimum route is to pass north of the New Siberian Islands.

Table 5.5: Probability of use of alternative routes from the Laptev Sea to the East Siberian Sea (probability values are given for the first 10 days of the month); Source: "Guide to Navigation through the Northern Sea Route" (1996):

Month:	North of the New Siberian Islands:	Through the Sannikov Strait:
June	100%	0%
July	100%	0%
August	50%	50%
September	15%	85%
October	30%	70%

5.2.6 The East Siberian and Chukchi Seas

From Dmitriy Laptev Strait to Kolyma River, the coast of the East Siberian Sea presents swamped tundra extending for 550 nautical miles and almost throughout is fringed by a broad shoal. The recommended tracks in this area pass out of sight of the shores. The approach to the shore is difficult even for very small vessels.

From Kolyma River to Chaynsk Gulf, the coast is mountainous, the characteristic feature of it being a large number of pillar-like rocks of different sizes and forms on the slopes of elevations. Ice conditions along the coast in the period of navigation are diverse. Owing to the significant inflow from the rivers Indigirka, Alazeya and Kolyma, the water area near their mouths clears of ice earlier than other coastal areas. As noted in section 2.5, ice is almost always present in the eastern part of the East Siberian Sea.

In the easternmost part of the NSR, the optimum route is relatively stable and passes along the landfast ice border, and after the landfast fracturing along the coast of the Chukchi Peninsula (*Chukhotskiy poluostrov*).

Table 5.6: Probability of use of alternative routes from the East Siberian Sea to the Chukchi Sea (probability values are given for the first 10 days of the month); Source: "Guide to Navigation through the Northern Sea Route" (1996):

Month:	Along the southern shore of Wrangel Island:	Along the coast of Chukchi Peninsula:
June	5%	95%
July	20%	80%
August	20%	80%
September	10%	90%
October	20%	80%

5.3 The Russian Arctic Ports - Navigation and Facilities[36]

The ports of Murmansk, Arkhangel'sk, Kandalaksha, Onega, Mezen', Naryan-Mar, and Igarka are currently open to foreign vessels. Furthermore, the Marine Transport Department of the Russian Federation has proposed to open the ports of Dikson, Tiksi, Pevek, and Dudinka for foreigners. Although there are open ports located at both ends of the NSR,

[36] This section is based mainly on Michailichenko & Yakovlev (1994).

emergency situations requiring vessels to call at other Arctic ports may arise. Such circumstances would be damage inflicted by ice, the need for urgent medical aid to the crew, as well as more trivial requirements such as replenishment of water and fuel.

In accordance with Article 9 of the law "On the State Frontiers of the Russian Federation" (*O gosudarstvennykh granitsakh Rossiyskoy Federatsii*) from 1993, foreign vessels - warships as well as non-warships - may enter Russian territorial waters in case of emergency. If this happens, the captain of the vessel should immediately inform the administration of the nearest Russian marine port, and subsequently act according to instructions.

When the captain of a foreign vessel makes a decision to call at a Russian Arctic port, he must take into account the local conditions for navigation as well as the facilities of the port in question. A short description of a few main ports along the NSR is given in the following.

5.3.1 The Port of Dikson

Dikson is located in the southeastern sector of the Kara Sea, close to the entrance of the Yenisey Gulf, south of the Sverdrup, Arctic Institute, and Izvestiy TsIK Islands. The port does not offer any pilot service, as the entrance to the port via the Preven Strait is safe in any weather, and at any degree of visibility. The internal roadstead is from 10 to 20 meters deep. The main moor can serve vessels with a draught of up to eight meters. Mooring is provided by roadstead tug-boats.

Among the port facilities, there are repair shops capable of conducting minor repair work. During summer navigation, port authorities usually have at their disposal a rescue boat, and a party capable of performing underwater emergency repairs.

The port of Dikson is within the jurisdiction of the Murmansk Marine Steamship Line. The headquarters of marine operations of the western sector of the Arctic are located here.

5.3.2 The Port of Tiksi

The port of Tiksi is situated in Tiksi Bay of the Laptev Sea. There is a natural channel leading to the port, navigable for vessels with a draught of up to five meters. After completing the planned work of deepening the bottom and constructing new moors, the port can serve vessels with a draught of up to 7.5 meters. When entering the port, one should be guided by special port regulations. Mooring of the vessels is provided by roadstead tug-boats.

The mechanical workshop of the port can provide minor ship-repair work. In the navigation period, rescue and emergency repairs are provided by the rescue-boat. Examination of the hull and underwater work are provided by the diving service.

The port is under the jurisdiction of the Republic of Sakha (Yakytiya), and is the base for

marine operations in the central Arctic sector.

5.3.3 The Port of Pevek

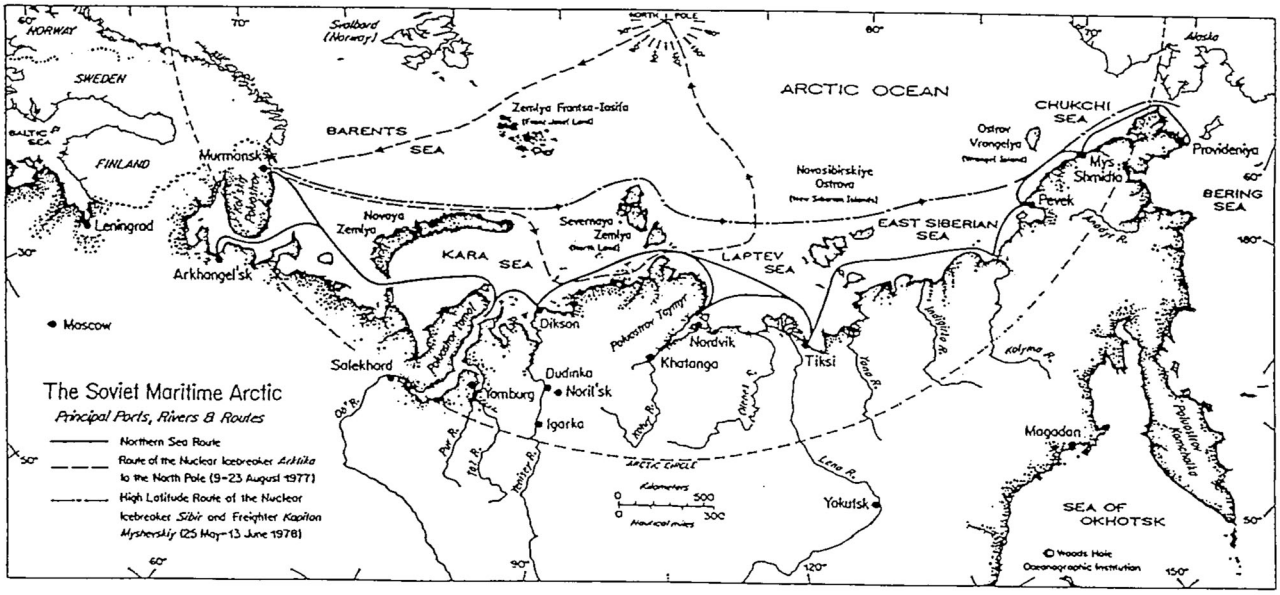
Pevek is located on the eastern coast of the Chaunsk Gulf of the East Siberian Sea. One can enter the port from either north or south, depending on ice conditions and wind direction (in case of strong wind). The port can handle vessels with a draught of up to nine meters. Pilotage is provided at the captain's request. Mooring is provided by roadstead tug-boats, and underwater repairs effected by diving teams.

The port belongs to the Far East Marine Steamship Line. It is the base of the Headquarters of marine operations in the eastern sector of the Russian Arctic.

5.3.4 The Port of Dudinka

Dudinka lies on the eastern bank of the Yenisey River at a distance of some 230 nautical miles from the river mouth. The port can handle vessels with a draught of up to seven meters. It is connected by railway with the town of Noril'sk. Due to the port's considerable distance from the NSR transit routes, it cannot be recommended as an emergency port of call for foreign vessels.

Map 5.1: Principal ports, rivers, and routes of the Soviet maritime Arctic (adapted from Brigham (1991)):



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GUNIO Issue of the Soviet Defense Ministry, 1980.

Michailichenko, V. & A. Yakovlev (1994): *Guide to Navigation through the NSR*, INSROP Discussion Paper.

Charts of the Russian Arctic Seas:

No.:	Scale:	Area/ year of publishing:
600	1:750 000	North Cape - Cape Kanin (1990)
601	1:750 000	The White Sea (1984)
650	1:750 000	Cape Orlov - Terskiy Tolstyy - Kara Gates Strait (1986)
695	1:250 000	Cape Oroliv - Kara Gates Strait - Yugorskiy Shar Strait (1987)
696	1:1 mill.	Novaya Zemlya (1988)
697	1:700 000	Eastern Novaya Zemlya - Dikson Island (1986)
698	1:200 000	Yenisey Gulf - Golchikha - Dikson Port (1989)

945	1:100 000	Yenisey River (six separate map sheets) (1984-86)
947	1:2 mill.	The Barents Sea (1990)
948	1:700 000	Dikson Port - Russkiy Island (1991)
949	1:700 000	Russkiy Island - Peter Island (1991)
950	1:200 000	Vil'kitskiy Strait (1991)
951	1:700 000	Anabarskiy Gulf - Tiksi - Buorkhaya Gulf (1991)
952	1:700 000	Buorkhaya Gulf - Ingirka River Delta (1991)
953	1:500 000	Sannikov Strait - Dmitriy Laptev Strait (1991)
954	1:700 000	Ingirka River Delta - Shalaurov Island (1991)
955	1:700 000	Shalaurov Island - Cape Golovniya - Point Hope, Alaska (1991)
1085	1:2 mill.	Bering Sea - Bering Strait (1978)
1089	1:50 000	Provideniya Bay (1979)

Skhema traditsionnogo (pribrezhnogo) i vysokoshirotnykh marshrutov severnogo morskogo puti ("Overview of the Traditional (Coastal) and High-latitudinal Courses along the Northern Sea Route")

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18 March 1997

REVIEW OF INSROP PAPER "NAVIGATING THE STRAITS OF THE NSR"

Douglas Brubaker
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N-1324 Lysaker NORWAY

Dear Douglas,

I received the paper "Navigating the Straits of the Northern Sea Route" only on 12 March and have been away for several days. However, I have had an opportunity to give it a thorough read and complete review.

I view this paper as a synthesis and concise guide to all the recently published material on the NSR - recently released charts and guides by the Russian Federation. It is a good interpretation by a Western (Norwegian) researcher and it is a highly readable document. I believe Geir Hønneland has provided a well-written guide that should be useful to planners and managers who might look at the NSR. I do have several editorial comments and suggested changes/additions that might make the paper more useful to a broad community.

Review Points:

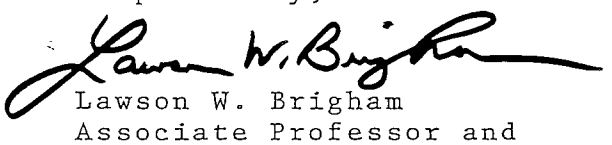
- Page 3 - "Climatic Traits" for the 2.1 heading should be altered to "Climatology" or "Climatic Conditions" (more precise terms).
- Throughout - all distance values should be in "nautical miles" vice "miles" (or converted to metric distances).
- Page 35 - "Russian Sea Maps" should be changed to read "Charts of the Russian Arctic Seas" (or something close to these words as these are published hydrographic charts).
- Throughout - "Ice massifs" requires a definition and perhaps a figure for the general reader of this paper; this is a rather specialized Russian term that many might not understand..... I recommend using a figure from a Russian guide or from The Soviet Maritime Arctic (page 135 of this edited volume, chapter 8)....a map and/or complete definition is an important requirement for the paper.

- Beginning with Table 5.2 - "Probability of different routes" and "first decade of the month" are somewhat confusing..... I recommend "Probability of route use" or "Probability of use of alternative route" and "First 10 days of the month" .....the Russian concept of the data in these tables is based on years of statistical ice information and traffic patterns.. ...however, it is not clear when the "probabilities" might be used in the future.....the new Guide to the NSR contains some of this information, but I believe it may be possible to present the data in alternative ways to make it more useful.

- My only real issue I have with the paper (besides the few changes mentioned) is the lack of any illustrations. Several maps or chartlets might be used from the Guide, The Soviet Maritime Arctic, or some other reference. At least one locator map for the seas and straits should be included early in the paper. Any figures would make the overall paper much more readable and usable.

Thank you for the opportunity to review this paper. I invite any discussion with the author and would be pleased to discuss the paper with you. I look forward to a second phase of INSROP.

Respectfully,



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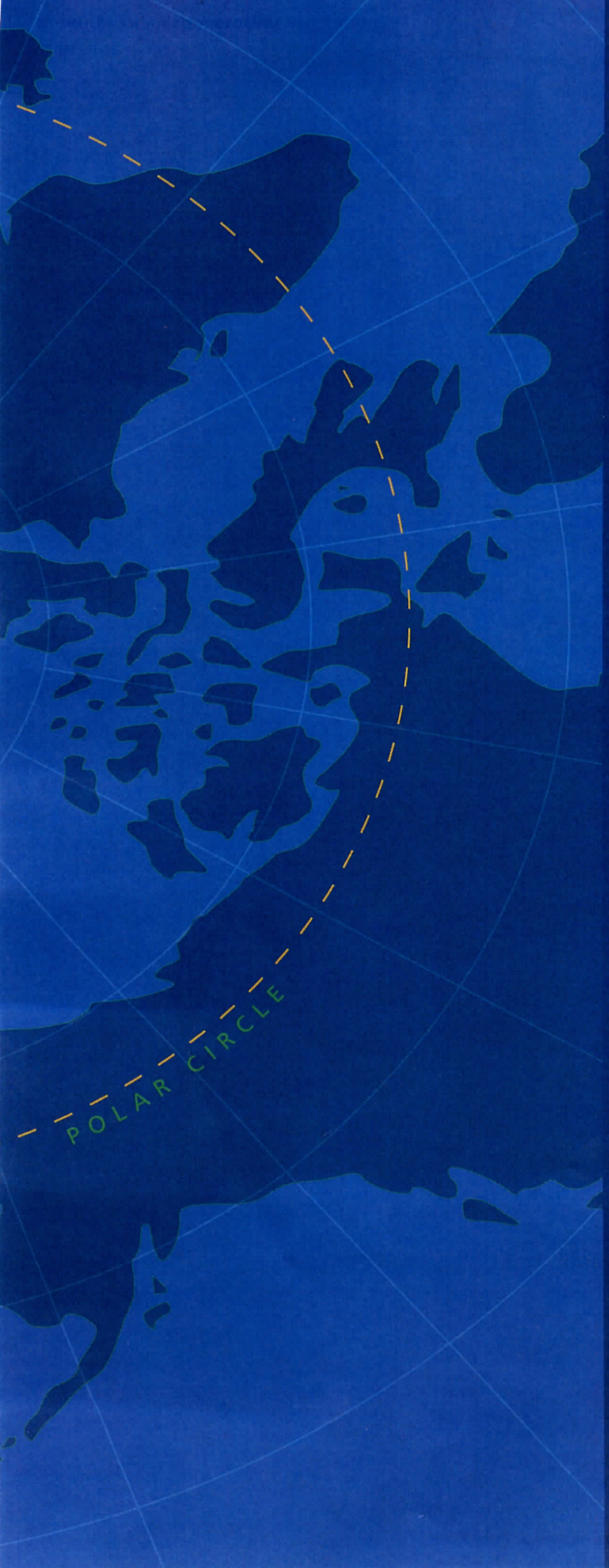
ONR Arctic Chair
Captain, U.S. Coast Guard (Ret.)



The three main cooperating institutions of INSROP

Ship & Ocean Foundation (SOF), Tokyo, Japan.

SOF was established in 1975 as a non-profit organization to advance modernization and rationalization of Japan's shipbuilding and related industries, and to give assistance to non-profit organizations associated with these industries. SOF is provided with operation funds by the Sasakawa Foundation, the world's largest foundation operated with revenue from motorboat racing. An integral part of SOF, the Tsukuba Institute, carries out experimental research into ocean environment protection and ocean development.

Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia.

CNIIMF was founded in 1929. The institute's research focus is applied and technological with four main goals: the improvment of merchant fleet efficiency; shipping safety; technical development of the merchant fleet; and design support for future fleet development. CNIIMF was a Russian state institution up to 1993, when it was converted into a stock-holding company.

The Fridtjof Nansen Institute (FNI), Lysaker, Norway.

FNI was founded in 1958 and is based at Polhøgda, the home of Fridtjof Nansen, famous Norwegian polar explorer, scientist, humanist and statesman. The institute spesializes in applied social science research, with special focus on international resource and environmental management. In addition to INSROP, the research is organized in six integrated programmes. Typical of FNI research is a multi-disciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.