PUB. 180

SAILING DIRECTIONS (PLANNING GUIDE)

★

ARCTIC OCEAN

★

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NGA Maritime Safety Information Division Website (Special Warnings)
http://164.214.12.145warn/warn_j_query.html

Time Zone.—The Time Zone description(s), as well as information concerning the use of Daylight Savings Time, are included. The World Time Zone Chart is available on the Internet at the website given below.

World Time Zone Chart
http://www.odci.gov/cia/publications/factbook/reference_maps/pdf/time_zones.pdf

Winds.—Wind directions are the true directions from which winds blow.

Reference List

The principal sources examined in the preparation of this publication were:

British Hydrographic Department Sailing Directions.

Canadian Sailing Directions.

Danish Sailing Directions.

Norwegian Sailing Directions.

Russian Hydrographic Department Sailing Directions.

U.S. National Science Foundation journals, reports, and documents.

Fairplay Ports and Terminals, 2003.

The Statesman's Yearbook, 2005.

The World Factbook, 2004.

Reports from United States Naval and merchant vessels and various shipping companies.

Other U.S. Government publications, reports, and documents.

Charts, light lists, tide and current tables, and other documents in possession of the Agency.

Internet Web sites, as follows:

1. Calendar of All Legal Public Holidays.
   http://www.bank-holidays.com
2. Department of State/U.S. Embassies.
   http://usembassy.state.gov
3. World Factbook.
   http://www.odci.gov/cia/publications/factbook

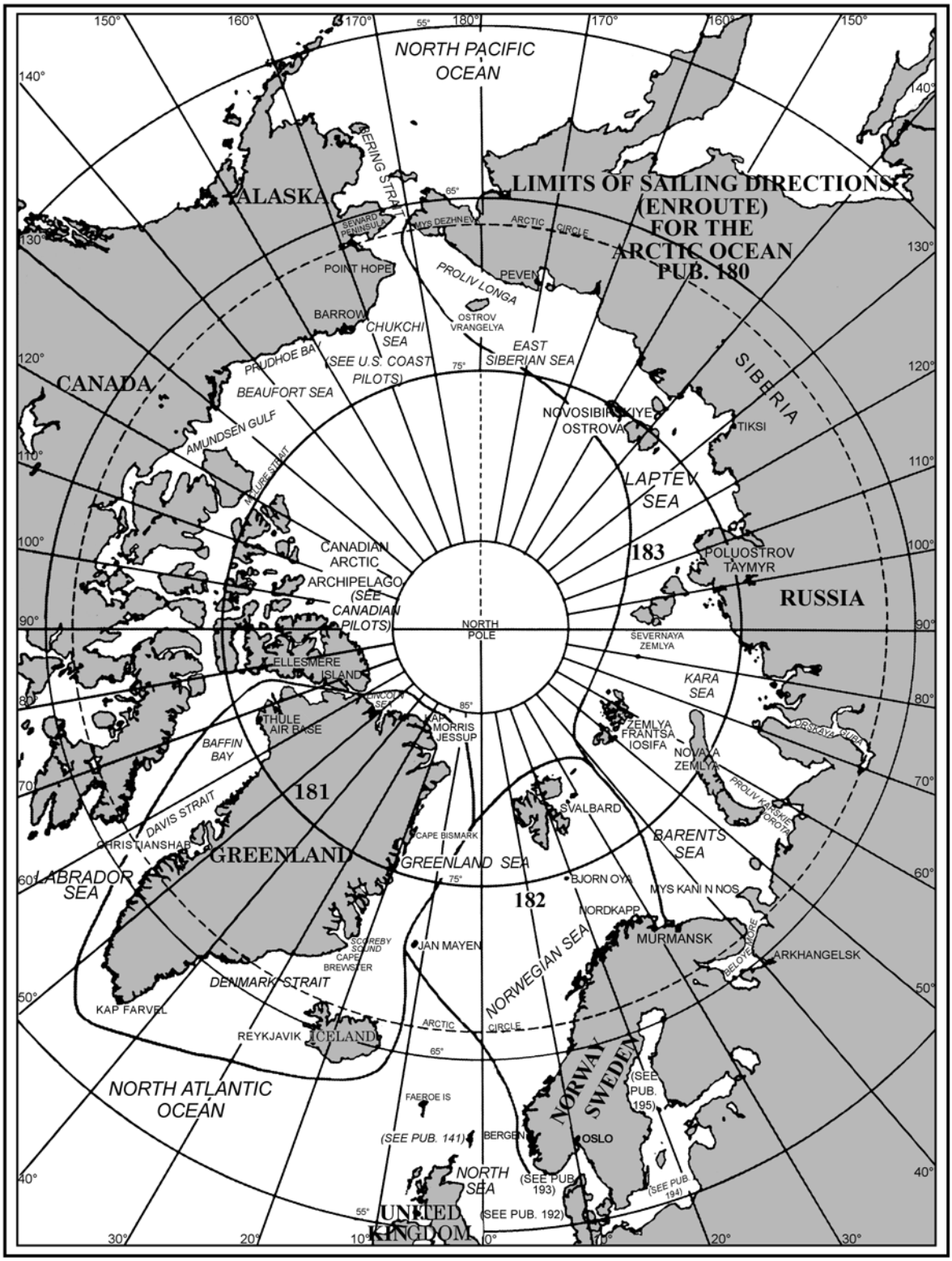
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OSLO
NORTH SEA
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Feet to Meters

Feet	0	1	2	3	4	5	6	7	8	9
0	0.00	0.30	0.61	0.91	1.22	1.52	1.83	2.13	2.44	2.74
10	3.05	3.35	3.66	3.96	4.27	4.57	4.88	5.18	5.49	5.79
20	6.10	6.40	6.71	7.01	7.32	7.62	7.92	8.23	8.53	8.84
30	9.14	9.45	9.75	10.06	10.36	10.67	10.97	11.28	11.58	11.89
40	12.19	12.50	12.80	13.11	13.41	13.72	14.02	14.33	14.63	14.93
50	15.24	15.54	15.85	16.15	16.46	16.76	17.07	17.37	17.68	17.98
60	18.29	18.59	18.90	19.20	19.51	19.81	20.12	20.42	20.73	21.03
70	21.34	21.64	21.95	22.25	22.55	22.86	23.16	23.47	23.77	24.08
80	24.38	24.69	24.99	25.30	25.60	25.91	26.21	26.52	26.82	27.13
90	27.43	27.74	28.04	28.35	28.65	28.96	29.26	29.57	29.87	30.17

Fathoms to Meters

Fathoms	0	1	2	3	4	5	6	7	8	9
0	0.00	1.83	3.66	5.49	7.32	9.14	10.97	12.80	14.63	16.46
10	18.29	20.12	21.95	23.77	25.60	27.43	29.26	31.09	32.92	34.75
20	36.58	38.40	40.23	42.06	43.89	45.72	47.55	49.38	51.21	53.03
30	54.86	56.69	58.52	60.35	62.18	64.01	65.84	67.67	69.49	71.32
40	73.15	74.98	76.81	78.64	80.47	82.30	84.12	85.95	87.78	89.61
50	91.44	93.27	95.10	96.93	98.75	100.58	102.41	104.24	106.07	107.90
60	109.73	111.56	113.39	115.21	117.04	118.87	120.70	122.53	124.36	126.19
70	128.02	129.85	131.67	133.50	135.33	137.16	138.99	140.82	142.65	144.47
80	146.30	148.13	149.96	151.79	153.62	155.45	157.28	159.11	160.93	162.76
90	164.59	166.42	168.25	170.08	171.91	173.74	175.56	177.39	179.22	181.05

Meters to Feet

Meters	0	1	2	3	4	5	6	7	8	9
0	0.00	3.28	6.56	9.84	13.12	16.40	19.68	22.97	26.25	29.53
10	32.81	36.09	39.37	42.65	45.93	49.21	52.49	55.77	59.06	62.34
20	65.62	68.90	72.18	75.46	78.74	82.02	85.30	88.58	91.86	95.14
30	98.42	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.80	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.16	180.45	183.73	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.54	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.28	298.56	301.84	305.12	308.40	311.68	314.96	318.24	321.52	324.80

Meters to Fathoms

Meters	0	1	2	3	4	5	6	7	8	9
0	0.00	0.55	1.09	1.64	2.19	2.73	3.28	3.83	4.37	4.92
10	5.47	6.01	6.56	7.11	7.66	8.20	8.75	9.30	9.84	10.39
20	10.94	11.48	12.03	12.58	13.12	13.67	14.22	14.76	15.31	15.86
30	16.40	16.95	17.50	18.04	18.59	19.14	19.68	20.23	20.78	21.33
40	21.87	22.42	22.97	23.51	24.06	24.61	25.15	25.70	26.25	26.79
50	27.34	27.89	28.43	28.98	29.53	30.07	30.62	31.17	31.71	32.26
60	32.81	33.36	33.90	34.45	35.00	35.54	36.09	36.64	37.18	37.73
70	38.28	38.82	39.37	39.92	40.46	41.01	41.56	42.10	42.65	43.20
80	43.74	44.29	44.84	45.38	45.93	46.48	47.03	47.57	48.12	48.67
90	49.21	49.76	50.31	50.85	51.40	51.95	52.49	53.04	53.59	54.13

The following abbreviations may be used in the text:

Units

˚C	degree(s) Centigrade	km	kilometer(s)
cm	centimeter(s)	m	meter(s)
cu.m.	cubic meter(s)	mb	millibars
dwt	deadweight tons	MHz	megahertz
FEU	forty-foot equivalent units	mm	millimeter(s)
grt	gross registered tons	nrt	net registered tons
kHz	kilohertz	TEU	twenty-foot equivalent units

Directions

N	north	S	south
NNE	northnortheast	SSW	southsouthwest
NE	northeast	SW	southwest
ENE	eastnortheast	WSW	westsouthwest
E	east	W	west
ESE	eastsoutheast	WNW	westnorthwest
SE	southeast	NW	northwest
SSE	southsoutheast	NNW	northnorthwest

Vessel types

LASH	Lighter Aboard Ship	ro-ro	Roll-on Roll-off
LNG	Liquified Natural Gas	ULCC	Ultra Large Crude Carrier
LPG	Liquified Petroleum Gas	VLCC	Very Large Crude Carrier
OBO	Ore/Bulk/Oil		

Time

ETA	estimated time of arrival	GMT	Greenwich Mean Time
ETD	estimated time of departure	UTC	Coordinated Universal Time

Water level

MSL	mean sea level	LWS	low water springs
HW	high water	MHWN	mean high water neaps
LW	low water	MHWS	mean high water springs
MHW	mean high water	MLWN	mean low water neaps
MLW	mean low water	MLWS	mean low water springs
HWN	high water neaps	HAT	highest astronomical tide
HWS	high water springs	LAT	lowest astronomical tide
LWN	low water neaps		

Communications

D/F	direction finder	MF	medium frequency
R/T	radiotelephone	HF	high frequency
GMDSS	Global Maritime Distress and Safety System	VHF	very high frequency
LF	low frequency	UHF	ultra high frequency

Navigation

LANBY	Large Automatic Navigation Buoy	SPM	Single Point Mooring
NAVSAT	Navigation Satellite	TSS	Traffic Separation Scheme
ODAS	Ocean Data Acquisition System	VTC	Vessel Traffic Center
SBM	Single Buoy Mooring	VTS	Vessel Traffic Service

Miscellaneous

COLREGS	Collision Regulations		
IALA	International Association of Lighthouse Authorities	No./Nos.	Number/Numbers
		PA	Position approximate
IHO	International Hydrographic Office	PD	Position doubtful
IMO	International Maritime Organization	Pub.	Publication
loa	length overall	St./Ste.	Saint/Sainte

Warning on the Use of Floating Aids to Navigation in General to Fix a Navigation Position

The aids to navigation depicted on charts comprise a system consisting of fixed and floating aids with varying degrees of reliability. Therefore, prudent mariners will not rely solely on any single aid to navigation, particularly a floating aid. An aid to navigation also refers to any device or structure external to a craft, designed to assist in determination of position. This includes celestial, terrestial, and electronic means, such as the Global Positioning System (GPS) and Differential GPS (DGPS). Here, too, the prudent mariner will not rely solely on any single aid to navigation.

The buoy symbol is used to indicate the approximate position of the buoy body and the sinker, which secures the buoy to the seabed. The approximate position is used because of practical limitations in positioning and maintaining buoys and their sinkers in precise geographical locations. These limitations include, but are not limited to, inherent imprecisions in position fixing methods, prevailing atmospheric and sea conditions, the slope of and the material making up the seabed, the fact that buoys are moored to sinkers by varying lengths of chain, and the fact that buoy and/or sinker positions are not under continuous surveillance but are normally checked only during periodic maintenance visits which often occur more than a year apart. The position of the buoy body can be expected to shift inside and outside the charting symbol due to the forces of nature. The mariner is also cautioned that buoys are liable to be carried away, shifted, capsized, sunk, etc. Lighted buoys may be extinguished or sound signals may not function as the result of ice or other natural causes, collisions, or other accidents. Many of these factors also apply to articulated lights. For the foregoing reasons, a prudent mariner must not rely completely upon the position or operation of floating aids to navigation, but will also utilize bearings from fixed objects and aids to navigation on shore. Further, a vessel attempting to pass close aboard always risks collision with a yawing buoy or with the obstruction the buoy marks.

Use of Foreign Charts

In the interest of safe navigation, caution should be exercised in the use of foreign charts not maintained through U.S. Notice to Mariners.

Foreign produced charts are occasionally mentioned in NIMA Sailing Directions when such charts may be of a better scale than U.S. produced charts. Mariners are advised that if or when such foreign charts are used for navigation it is their responsibility to maintain those charts from the Notice to Mariners of the foreign country producing the charts.

The mariner is warned that the buoyage systems, shapes, colors, and light rhythms used by other countries often have a different significance than the U.S. system.

Mariners are further warned about plotting positions, especially satellite-derived positions such as from GPS, onto foreign charts where the datum is unknown or the conversion from WGS-84 is unknown.

Chart Notes Regarding Different Datums

Particular caution should be exercised during a passage when transferring the navigational plot to an adjacent chart upon a different geodetic datum or when transferring positions from one chart to another chart of the same area, which is based upon a different datum. The transfer of positions should be done by bearings and distances from common features. Notes on charts should be read with care, as they give important information not graphically presented. Notes in connection with the chart title include the horizontal geodetic datum which serves as a reference for the values of the latitude and longitude of any point or object on the chart. The latitudes and longitudes of the same points or objects on a second chart of the same area, which is based upon a different datum, will differ from those of the first chart. The difference may be navigationally significant. Additionally, datum changes between chart editions could significantly affect the positions of navigational aids found in the List of Lights and other NIMA publications.

Positions obtained from satellite navigation systems, such as from GPS, are normally referred to the World Geodetic System 1984 (WGS-84) Datum. The differences between GPS satellite-derived positions and positions on some foreign charts cannot be determined: mariners are warned that these differences MAY BE SIGNIFICANT TO NAVIGATION and are therefore advised to use alternative sources of positional information, particularly when closing the shore or navigating in the vicinity of dangers.

THE ARCTIC OCEAN



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General

The Arctic Ocean contains all the waters surrounding the North Pole, and bounded by the continents at the N shores of Alaska, Canada, Greenland, Norway, and Russia. The Arctic Ocean also includes associated waters such as the Canadian Arctic Archipelago, Baffin Bay, the Lincoln Sea, the Greenland Sea, the Norwegian Sea, the Barents Sea, Beloye More (White Sea), the Kara Sea, the Laptev Sea, the East Siberian Sea, the Chukchi Sea, and the Beaufort Sea.

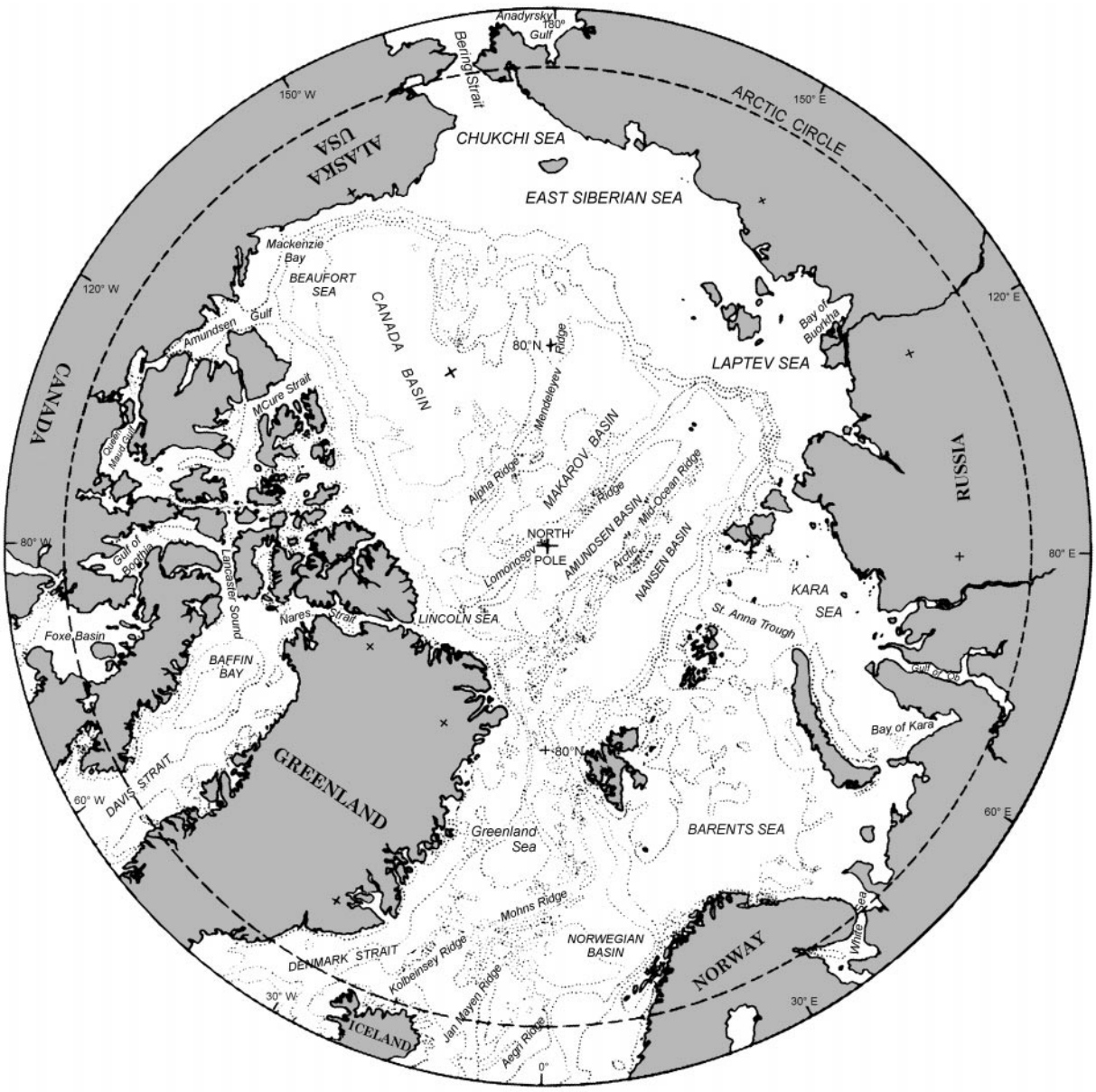
Little is known of the conditions in the Arctic Ocean N of Spitsbergen and the N end of Greenland, but soundings indicate great depths.

The Denmark Strait separates Iceland from Greenland; the general depths are between 180 and 540m. A depth of 110m was reported to lie in the middle of the strait in position 65˚53'N, 29˚40'W.

The N polar region, the Arctic, consists of an elongated central water area a little smaller than the United States, almost completely surrounded by land. Some of this land is high and rugged with permanent ice caps, but part of it is low and marshy when thawed. Underlying permafrost prevents adequate drainage, resulting in large numbers of lakes and ponds and extensive areas of muskeg, soft spongy ground with characteristic growths of certain types of moss and tufts of grass or sedge. There are also large areas of tundra, low treeless plains with vegetation consisting of mosses, lichens, shrubs, willows, etc., and usually having an underlying layer of permafrost. The northernmost point of land is Kap Morris Jessup, Greenland, which lies about 380 miles from the pole. The central part of the Arctic Ocean is a basin with an average depth of 3,657m. However, the bottom is not level, having a number of seamounts and deeps. The greatest depth is probably a little more than 4,876m.

At the North Pole, the depth is 4,312m. Surrounding the polar basin is an extensive continental shelf, broken only in the area between Greenland and Svalbard (Spitsbergen). The many islands of the Canadian Archipelago are located on this shelf. The Greenland Sea, E of Greenland; Baffin Bay, W of Greenland; and the Bering Sea, N of the Aleutians, each has its independent basin. In a sense, the Arctic Ocean is an arm of the Atlantic.

The total area of the Arctic Ocean has been estimated to be about 5,427,000 square miles. The Arctic or North Polar Sea which extends from the pole to about 80˚N contains two basins, each with depths over 3,962m, separated by a ridge or system of ridges, one of which, the Lomonosov Ridge, extends from the N of Greenland to the New Siberian Islands. The Marvin Ridge lies a little to the W of the Lomonosov and parallel to it, in the region between the North Pole and Ellesmere Island. These enormous submarine features rise from the floor depth to between 1,005 and 1,371m below the surface. The Greenland Sea and the Norwegian Sea, each over 2,987m deep, are separated by a ridge about 1,981m deep, and the



The Arctic Basin

northernmost of the two (Greenland Sea) is separated from the North Polar Sea by the Nansen Ridge, about 1,524m deep.

The S boundary of the Norwegian Sea is formed by the Wyville Thompson Ridge which projects from Scotland to Iceland with an extension lying between Iceland and Greenland. A similar ridge extends across the Davis Strait, W of Greenland, forming the S boundary of Baffin Bay. This extensive ridge system, only about 609m below the surface, effectively divides the Arctic Ocean system from the North Atlantic proper.

The Arctic Ocean has three deep basins separated by parallel ridges.

The Nansen Basin (Eurasian Basin) (Nansen Deep) (85˚N., 50˚E.) adjoins the continental shelves of the Barents Sea and the Kara Sea. It deepens gradually to the N and reaches depths of more than 3,500m. The **Arctic Mid-Ocean Ridge** (Gakkel Ridge) (86˚N., 40˚E.) lies N of the Nansen Basin. This ridge is believed to be a continuation of the Mid-Atlantic Ridge and is similarly seismically active. Rather than being a ridge in the true sense, it consists of a series of seamounts and fracture zones, with a maximum relief of about 1,000m separated by a rift valley which forms a 4,000m cleft along the centerline.

The **Amundsen Basin** (Fram Deep) (88˚N., 40˚E.), with depths of more than 4,200m, lies farther N. The North Pole is situated in this basin just before the steep rise to the **Lomonosov Ridge** (89˚N., 160˚E.), which bisects the Arctic Ocean from N Greenland to Novo Sibirskiye Ostrova and rises to depths of less than 1,000m.

The **Makarov Basin** (Makarov Deep) (85˚N., 170˚E.), with a depth of 4,000m, lies between the Lomonosov Ridge and the East Siberian Sea. It is bounded on the E side by the the **Mendeleyev Ridge** (Alpha Ridge) (80˚N., 178˚E.) which rises to a depth of 1,200m and is joined to the continental shelf, near the E limit of the area covered by this volume, by a broad, triangular plateau.

The bottom deposits consist of mainly mud in the deep basins, with sand predominating on the ridges.

Baffin Bay has a maximum depth of just over 1,980m and the waters between the Canadian Arctic Islands have depths of 487m or less. Hudson Bay has a general floor depth of about 198m; Hudson Strait has a depth at its E end of a little over 396m. The continental shelf off the N Siberian coast is up to 435 miles wide; elsewhere it is quite narrow, with the exception of Hudson Bay and Foxe Basin, which are of shelf depths entirely.

The water masses in this system are the Arctic water; the Atlantic water; the Pacific water; and the deep water of the several basins. The coastal water and upper layer of the North Polar Sea are strongly influenced by drainage from the land.

The Arctic water is formed in the North Polar Sea from three sources: Atlantic water; drainage from the land; and water from the melting of ice. The result is a layer of water of generally negative temperatures and salinities below 34 grams of salt per kilogram of seawater. This layer is generally between 91m and 274m thick. Below it is a thicker layer of Atlantic water, entering the North Polar Sea between Spitsbergen and Greenland, with positive temperatures up to 3˚C but generally much lower, 0.5˚ to 1.5˚C. This layer reaches down to depths of 701 to 792m, below which is the mass of Arctic bottom water extending to floor depths, again with negative temperatures and salinities close to, but just below, 35 parts per thousand. Recent research seemed to show that these three layers are not so distinct as formerly thought.

Cautions

Oil Rigs—Well Heads

Drilling rigs are used to drill test wells if surveys confirm the possibility that oil or gas may be profitably extracted. Rigs are marked by lights; fog signals are sounded from them; and on some, flares burn at times to dispose of waste gases. But buoys, lighters and other obstacles, which may not be marked by lights or fog signals, are often moored near rigs. Wires often extend up to 1 mile from drilling rigs; mariners are advised to give rigs a wide berth.

There are four major types of drilling rigs in use at present on offshore fields:

1. Jack-up rigs are towed into position where their steel legs are lowered to the sea bed; the drilling platform is then jacked up clear of the water. They are used in depths up to about 100m.
2. Semi-submersible rigs consist of a platform on columns which rise from caissons submerged deep enough to avoid much of the effects of sea and swell. These rigs use 8-point anchoring systems, with anchor chain extending up to 0.75 mile from the rig. Large buoys, usually unlit, are moored above the anchors. Vessels are cautioned not to transit between the rig and the buoys.
3. Large semi-submersible rigs are self-propelled and may proceed unassisted by tugs at speeds up to 6 knots. Semi-submersible rigs may have displacements up to 25,000 tons and are used for drilling in depths up to about 180m, or in the case of self-propelled ones, up to about 300m.
4. Drillships are built with a tall drilling rig amidships, and usually with a helicopter deck near the stern. A typical drillship has a displacement of 14,000 tons, a length of 136m, and a maximum speed of 14 knots. Drillships working in depths of less than about 200m use an 8-point anchoring system. When drilling in deeper water, the position is maintained by gyro compasses and sonar linked to a dynamic station-keeping system of eleven computer-controlled propellers. Drillships are used in depths up to about 2,000m, and in favorable conditions can drill to a depth of 6,000m below the sea bed.

In the course of exploratory work, numerous wells are drilled. Wells which will not be required again are sealed with cement below the sea bed and abandoned. Suspended wells, which may be required at a later date, have their wellheads capped and left with a pipe and other equipment projecting from the sea bed. Such well heads are sometimes marked by buoys to assist recovery and warn vessels that they are a hazard to navigation or fishing.

Production platforms are required to develop an oil or gas discovery. Many of these platforms, which may be manned or unmanned, are built to last the lifetime of the field which may be as long as 30 years, and are of massive construction. They are marked by lights; fog signals are sounded from them; and on some flares burn at times.

Mooring buoys, usually uncharted, are often moored as much as 1 mile from production platforms. Mariners are advised to give production platforms a wide berth.

Standby boats, used for routine servicing and emergency evacuation, are moored in the vicinity of the manned rigs and platforms. They are on call 24 hours and are subject to movement at any time.

The mariner is cautioned that, at times, the lights on some of the installations may be extinguished or obscured from a certain direction. This is especially true of unmanned platforms or well heads, where maintenance may not be routinely carried out.

Under International Law, a coastal state may establish safety zones around such installations and devices as it may have constructed on the continental shelf to explore and exploit its natural resources. These installations include moveable drilling rigs, production platforms, well heads, and single point moorings that may lie either inside or outside the state's territorial waters. An installation or device may be surrounded by a safety zone to a distance of 0.275 mile, measured from its outer edge. Ships of all nations are required to respect these safety zones.

Entry into these zones is prohibited, except in the following cases:

1. To repair a submarine cable or pipeline near the zone.
2. Either to provide services for an installation within the zone, or to transport persons or goods to or from it, or, with proper authorization, to inspect it.
3. To save life or property.
4. On account of stress of weather.
5. When in distress.

Draft Clearance

Deep-draft ships face the problem of navigating for considerable distances with a minimum depth below the keel in offshore areas.

Though considerable international effort has been expended recently in surveying a number of routes for these vessels, it should be realized that in certain critical areas depths may change quickly, and that present hydrographic resources are insufficient to allow these long routes to be surveyed frequently.

When planning a passage through a critical area, vessels should take full advantage of such co-tidal and co-range charts as are available. Possible occurrences of negative surges and possible reductions of depth below the keel due to settlement or squat should be considered.

Hydrographic surveys have inherent technical limitations, due partly, in offshore areas, to uncertainties in the tidal reductions. Furthermore, in some areas the shape and the depth of the ocean floor is constantly changing. Nautical charts can seldom be absolutely reliable in their representation of depth, and when tidal predictions are applied to the charts as if they were actual tide levels, the uncertainties are clearly compounded.

Ocean Data Acquisition System (ODAS)

The term Ocean Data Acquisition System (ODAS) covers a wide range of devices for collecting weather and oceanographic data. However, the devices of most concern to vessels consist of buoy systems which support instruments. These buoy systems may be expected to become more numerous each year and may be found in polar waters.

The buoy systems vary considerably in size and are either moored or free-floating. As far as possible, positions of the former will always be widely promulgated, and if considered to be of permanent enough nature, will be charted. In both types, the instruments may be either in the float or attached at any depth beneath it.

The buoys are colored yellow and marked ODAS with an identification number. The moored buoys are usually display a yellow light, showing a group of five flashes every 20 seconds.

ODAS buoys may be encountered in unexpected areas and often in deep water where navigational buoys would not be found. It should be noted that valuable instruments are often suspended beneath these systems or attached to the mooring lines. In some cases, the moorings have been cut loose beneath the buoy by unauthorized salvors, with the consequent loss of the most valuable part of the system.

The moored buoys may be up to 7.5m in diameter and 2 to 3m in height. The free-floating buoys are usually much smaller, 2m wide, and do not display a light.

Currents

The general surface water circulation are the predominant currents of the area throughout the year. However, currents are bound to vary significantly in direction and rate, since they are dependent on oceanographic and meteorological factors with variables. In addition, currents flowing close into the fjords and other fresh water outlets will considerably strengthen run-offs during the summer months, and the rates may exceed 3 knots.

The flow of water is mainly determined by two major currents. The Norwegian Atlantic Current sets NNE off the coast of Norway; in about 70˚N it divides into the West Spitsbergen Current and the North Cape Current. The East Greenland Current, the major outlet for cold water from the Arctic basin, sets in a generally SW direction along the coast of East Greenland with constancy.

North of 80˚N

The flow of water in this area is directed towards the SW, outwards from the Arctic basin. It constitutes the downstream extremity of the wide Transpolar Drift, which commences in East Siberian Sea and mainly emerges from the Arctic through the broad channel between Greenland and Svalbard, where it becomes the East Greenland Current.

Two other minor outlets for Arctic water are the East Spitsbergen Current, which sets SSW on the E side of Svalbard, and the Bear Island Current.

South of 80˚N and E of 5˚E

The West Spitsbergen Current, the W branch of the Norwegian Atlantic Current, sets NNW off Svalbard and at about 80˚N it submerges beneath the ice-bearing Arctic water because of its higher salinity. The Spitsbergen Current is the main supplier of warm water into the Arctic basin.

The North Cape Current, the E branch of the Norwegian Atlantic Current, sets E into the Barents Sea.

The Bear Island Current emerges from the Arctic basin through the channel between Zemlya Frantsa Iosifa and Severnaya Zemlya. The main part merges with the remainder of the East Spitsbergen Current, and then converges with a branch of the North Cape Current to form an eddy in the W part of the Barents Sea.

The remainder of the Bear Island Current converges with another branch of the North Cape Current to form an eddy in the E part of the Barents Sea.

The rates of the currents in this area are mostly low, probably less than 0.5 knot, but close to the coasts of Svalbard the current may sometimes run up to 2 knots.

South of 80˚N and between 5˚E and 20˚W

The Jan Mayen Current leaves the East Greenland Current at about 76˚N,and converges with a recurved branch of the West Spitsbergen Current to form a large permanent eddy centered at about 76˚N on the prime meridian.

The East Iceland Current leaves the East Greenland Current at about 71˚N, and mixes with the Irminger Current off Langanes. Branches from the E flank of the East Iceland Current, together with branches from the W flank of the Norwegian Atlantic Current, form a series of semi-permanent eddies on the meridian of 5˚W.

The Irminger Current is a warm current, derived from the North Atlantic Current, which is again derived from the Gulf Stream. Off the S coast of Iceland, the Irminger Current sets N to NW; a part encircles the island in a clockwise direction, and mixes with the East Iceland Current as previously described. The combined flow then sets S to converge with the N sets off the SE coast of Iceland. This convergence often being marked by a sharp discontinuity of sea surface temperature. The mean rates of the currents in this area are also low, probably 0.25 to 0.5 knot; S and SE of Iceland the current is variable in

direction, with rates from 0.25 to 1 knot. The East Greenland Current, of which the axis of strongest flow lies just seaward of the 200m contour, and the E set off the N coast of Iceland, may sometimes run at 1 to 2 knots.

South of 80˚N and W of 20˚W

The main current in this area, the East Greenland Current, occupies the NW half of Denmark Strait, and then hugs the SE coast of Greenland. Ice edge movements suggest that a minor branch from the main current sets SE across Denmark Strait to join that part of the Irminger Current which encircles Iceland. The remainder of the Irminger Current, S of about 66˚N turns W across the S approaches to the Denmark Strait, and then turns SW to run alongside the East Greenland Current. The positions of the ice edge S of the Denmark Strait suggest that little mixing occurs between these two currents. Instead, the Irminger Current forms a fairly sharp E boundary to the East Greenland Current and to the drift ice which it bears for most months of the year. Farther S this flow of water forms the NE sector of an elongated counter-clockwise eddy centered off Kap Farvel.

The East Greenland Current and the Irminger Current probably run on average about 0.5 knot, though both currents may attain rates of 1 to 2 knots. Elsewhere, the mean rate is probably less than 0.5 knot.

Geophysical Features

Tundra Belt

The S shores of the Arctic Ocean are fringed by a belt of barren country, sometimes steep, rocky, and descending in less abrupt cliffs to the sea, but more often sloping down gently in mudbanks and sandhills. In Russia and by the scientific community, this belt is known as the tundra, and it is the region beyond the limit of forest growth. By far the greater part of the tundra is a gently undulating peaty plain, full of lakes, rivers, swamps, and bogs.

Mountains

The Ural Mountains extend approximately along the meridian of 60˚E from the Arctic Ocean nearly to the Caspian Sea and roughly separate Russia, in Europe, from Siberia. Kryazh Paykhoy is quite independent of the Urals proper, from which it is separated by a marshy tundra some 30 miles wide. It has a NW trend along the S shores of Kara Sea, and although this range is cut through by Proliv Yugorskiy Shar, it is continued in Ostrov Vaygach and Novaya Zemlya. Its dome-shaped summits, which are over 500m high, are completely destitute of trees, and its stony crags are separated by broad marshy tundras. The Obdorsk or Northern Urals, which begin within a few miles of the head of Karskaya Guba (69˚18'N., 64˚59'E.) and extend SW as far as the 64th parallel, form a distinct range, stony and craggy, sloping steeply and gently SE towards the marshes of European Russia. In some parts the main chain has on its W side two or three secondary chains, formed by the upheaval of sedimentary rocks, and it is towards the S extremity of one of these that the tallest peaks of the Urals occur, Sablia, 1667m high, at 64˚47'N and Toll-pos-is, 1,687m high, at 63˚55'N.

Kryazh Byrrang approaches the sea in the vicinity of **Gavan Dikson** (73˚30'N., 80˚28'E.), on the E side of the entrance of Yeniseyskiy Zaliv.

Rivers

The principal rivers flowing into the Arctic Ocean from Russia are the Ob, Yenisey, Pyasina, Lena, Yana, Indigirka, and Kolyma.

Straits

Davis Strait is bound on the N by the parallel of 70˚N, the S limit of Baffin Bay; on the E by the SW coast of Greenland; on the S by the parallel of 60˚N between Greenland and Labrador; and on the W by Baffin Island, to the S of 70˚N, and the E limit of Hudson Strait.

Davis Strait, at its narrowest part, which occurs near where the strait is crossed by the Arctic Circle, is about 180 miles wide. This part, being on the Davis Strait Ridge, is also the shallowest. Here there are occasional soundings of less than 365m, whereas the depths increase rapidly both to the N and to the S. The deepest water is found in the southern entrance, where there are depths of over 329m.

On the Greenland side, the bottom rises steeply to a continental shelf that is narrow in its S part. This shelf broadens to the N, where the strait is narrowest. The N portion is divided into two principal banks, Lille Hellefiskebanke and Store Hellefiskebanke. Along the SW part of the coast, the 200m curve lies from 15 to 30 miles offshore, with a number of small banks lying just outside and with occasional deeps extending into or near the shore. Off Store Hellefiskebanke, the N bank, the 200m curve lies from 65 to 70 miles offshore. At the entrance of Baffin Bay, the deepest part of Davis Strait lies nearer to Baffin Island than to the Greenland shore.

The S part of the W coast of Greenland forms the E shore of Davis Strait and its S approach. This may be considered to include all of the coastline between Kap Farvel and Disko Island, a distance of more than 600 miles. This coastal region consists of a narrow strip of ice-free land, behind which rises the Inland Ice, the great ice mass that covers the interior of Greenland. The ice-free strip of the stretch of coast bordering Davis Strait is very narrow in the S part, and broadens to the N, attaining a width, in the vicinity of Holsteinsborg, of about 100 miles. The land fringe is cut by numerous fjords and inlets and broken up into islands of varying sizes.

Baffin Bay is bound on its E side by the W shore of Greenland and on its W side by Baffin Island, Devon Island, Ellesmere Island, and several smaller islets. This bay projects NNW from its S limit at 70˚N for about 530 miles to Nares Strait, which leads to the Arctic Ocean, about 300 miles NE.

Nares Strait, a channel leading NNE from Baffin Bay to the Arctic Ocean, passes between the W side of the N part of Greenland and the E coast of Ellesmere Island in Canada. Nares Strait, from S to N, consists of Smith Sound, Kane Basin, Kennedy Channel, Hall Basin, and Robeson Channel. The N end of Robeson Channel opens out into a portion of the Arctic Ocean named the Lincoln Sea. Nares Strait is about 300 miles long from the S end of Smith Sound to the N end of Robeson Channel, and varies in width from about 10 to 25 miles except in Kane Basin, where it opens out to a width of about 85 miles. Deep water to within a short distance of the

contiguous shores is found throughout the channels and basins forming the waterway, except on the E side of Kane Basin.

The land on the W, or Ellesmere Island, coastline rises precipitously from the frozen sea to irregular mountains whose partly rounded peaks are generally marked by ice caps. Great glaciers fill the valleys and discharge icebergs into the various bays and fjords. Only the projecting rocky headlands and some of the lower points in the bays are free of snow and ice so that at least nine tenths of the surface is permanently covered by ice. This is in marked contrast to the Greenland coast where all the outer cliffs and shores are comparatively free from snow and ice. The cause of this remarkable difference is probably due to the currents along the respective coasts; on the coast of Ellesmere Island the Arctic current with its continuous current of ice blocks the bays and fjords, while on the Greenland coast the N flowing current is comparatively free of ice and allows the open water to raise the general temperature. The prevailing E winds also carry more moisture to the W side, which is masked at times by fog when there is brilliant sunshine on the Greenland coast.

Vesterisgrunnen (73˚30'N., 9˚10'W.) is a seamount, over which the least depth is 163m.

Denmark Strait separates Iceland from Greenland; the general depths are between 180 and 540m. A depth of 113m was reported near the middle of the strait (65˚53'N., 29˚40'W.).

The Northwest Passage spans the North American Arctic from Davis Strait and Baffin Bay in the E to Bering Strait in the W, and has four potentially feasible routes. The E entrance or exit for all routes lies through Lancaster Sound. Ice conditions may be forced to choose the alternative passage by way of Fury and Hecla Strait, but too difficult to be seriously considered.

The islands of the Canadian Arctic Archipelago form the emerged part of the continental shelf that extends poleward from the North American mainland and joins it to Greenland. Except for Baffin Bay and Davis Strait, all the channels lie on this shelf, which is deeper than most continental platforms, especially in the E part of the archipelago. This fact, together with the many old, raised beach lines and other evidence of emergence found throughout the formerly glaciated parts of the Canadian Arctic, supports the widely accepted theory that the whole area has been depressed, presumably as the result of glaciation, and is now gradually rising again.

Ice

Formation and Growth

In temperate and tropical latitudes the ocean acts as a storehouse of radiant heat from the sun. The visible and infra red wave lengths are largely absorbed in the surface layers, and the heat so stored is given off to the air at night and at other periods when the air is colder than the sea surface. In higher latitudes, as the nights begin to grow longer in the autumn, insufficient heat is stored in the short daylight period to compensate for the losses at night, and the temperature of the surface waters is therefore lowered. As the season progresses the altitude of the sun becomes lower day by day, less radiation is received, and more is reflected from the sea surface owing to the low angle of incidence of the rays. Finally, the water reaches the freezing point and further loss of heat results in the formation of ice.

Conditions then become even less favorable for the retention of radiant heat from the sun since ice reflects much more of the visible radiation than does water. Cooling of the air in contact with the ice is accelerated, and as this cold air spreads, more ice is formed.

Influence of Salinity

Fresh water freezes at 0˚C, but the salt present in sea water causes it to remain liquid until a lower temperature is reached. The greater the salinity, the lower the freezing point. Ordinary sea water, with a salinity 35 parts per 1,000, does not begin to freeze until it has been cooled to -1.9˚C.

Salinity may also affect the rate of freezing through its influence on the density of the water. Fresh water contracts on cooling and thus sinks below the surface until a temperature of 4˚C is reached. On further cooling it expands, so that its density decreases. If the cooling takes place at the surface with no other process of mixing at work, the coldest water stays there in a layer. It is then necessary for only this surface later to be cooled to the freezing point for ice to form. Water with a salinity of 5 parts per 1,000 has its greatest density at 2.8˚C, so the entire body of water must be cooled to that temperature before density currents cease. The temperature of maximum density decreases faster than the freezing point with increasing salinity. The two temperatures coincide at a salinity of 24.7 parts per 1,000. This means that with a salinity of 24.7 parts per 1,000 greater, density currents operate until the freezing point is reached, and theoretically the entire body must be cooled to this temperature before ice can form on the surface.

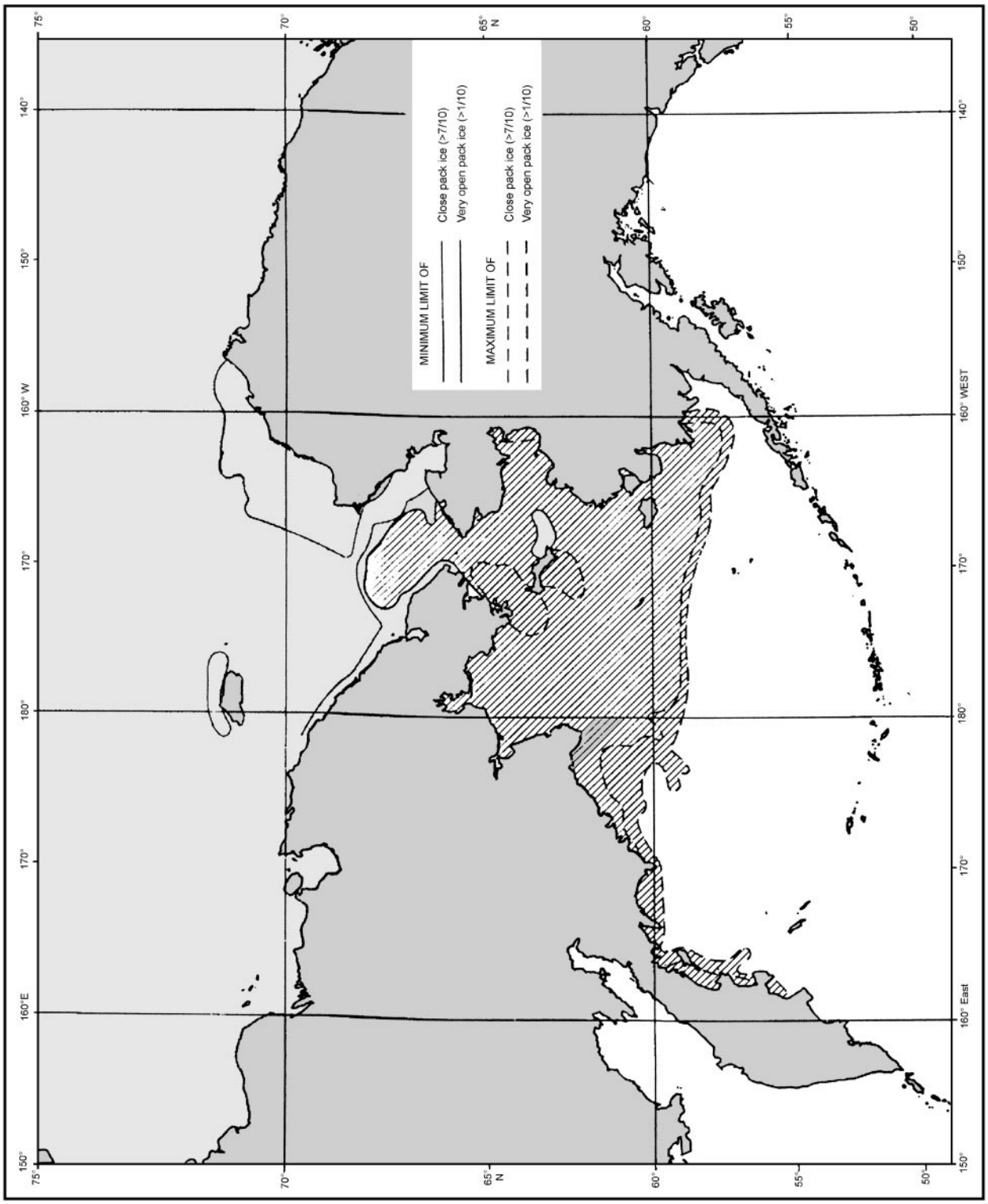
In nature, however, rapid cooling of still water often occurs under conditions where heat is removed from the surface layers faster than it can be supplied from the deeper layers through convection currents, so that ice will form on the surface before the deeper layers have approached the freezing point. Salinity gradients in the sea may also diminish the thermal convection currents. Because of discharge from rivers or melting of ice, the top layers have a lower salinity and the difference of density may be so great that the surface layer, although cooled to the freezing point, will be too light to sink below the warmer but more saline water underneath.

A practical outcome of the foregoing is that if a body of water originally of uniform density is losing heat at the surface, ice will be formed most readily in fresh water, less readily in sea water of low salinity, and least readily in sea water of high salinity. The greater heat removal required to freeze sea water is due not only to its relatively low freezing point, but also to the increased tendency of the cooled surface water to sink as the temperature of maximum density decreases.

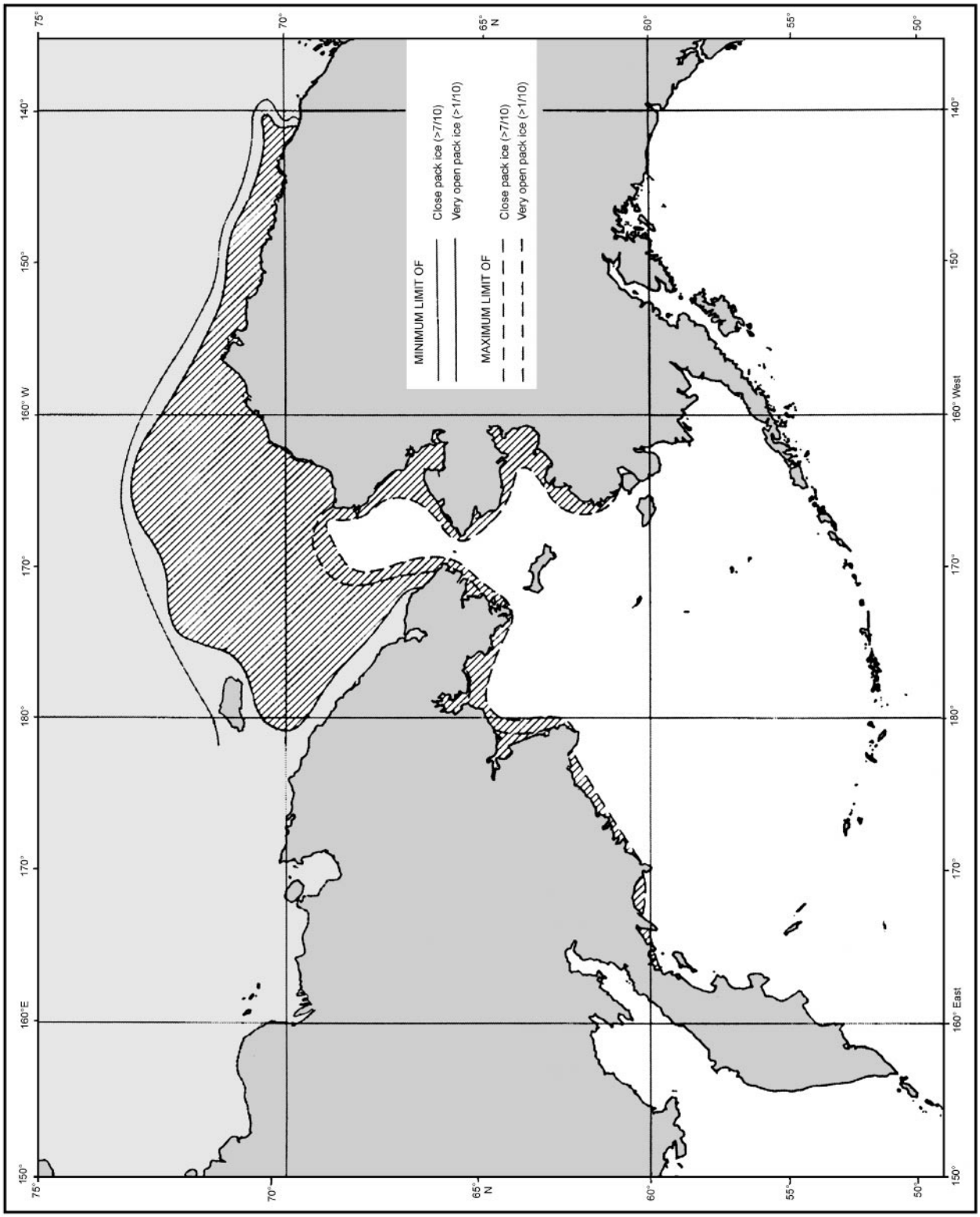
Ice-forming Process

Due to its fairly high specific heat and low thermal conductivity, water loses heat slowly, so that the surface temperature of a large body of water will lag behind the rise and fall of the mean air temperature. In the Murmansk White Sea (65˚N to 70˚N), rivers usually freeze about 3 weeks after the mean air temperature falls below 0˚C. This phenomenon is probably representative of many similar regions.

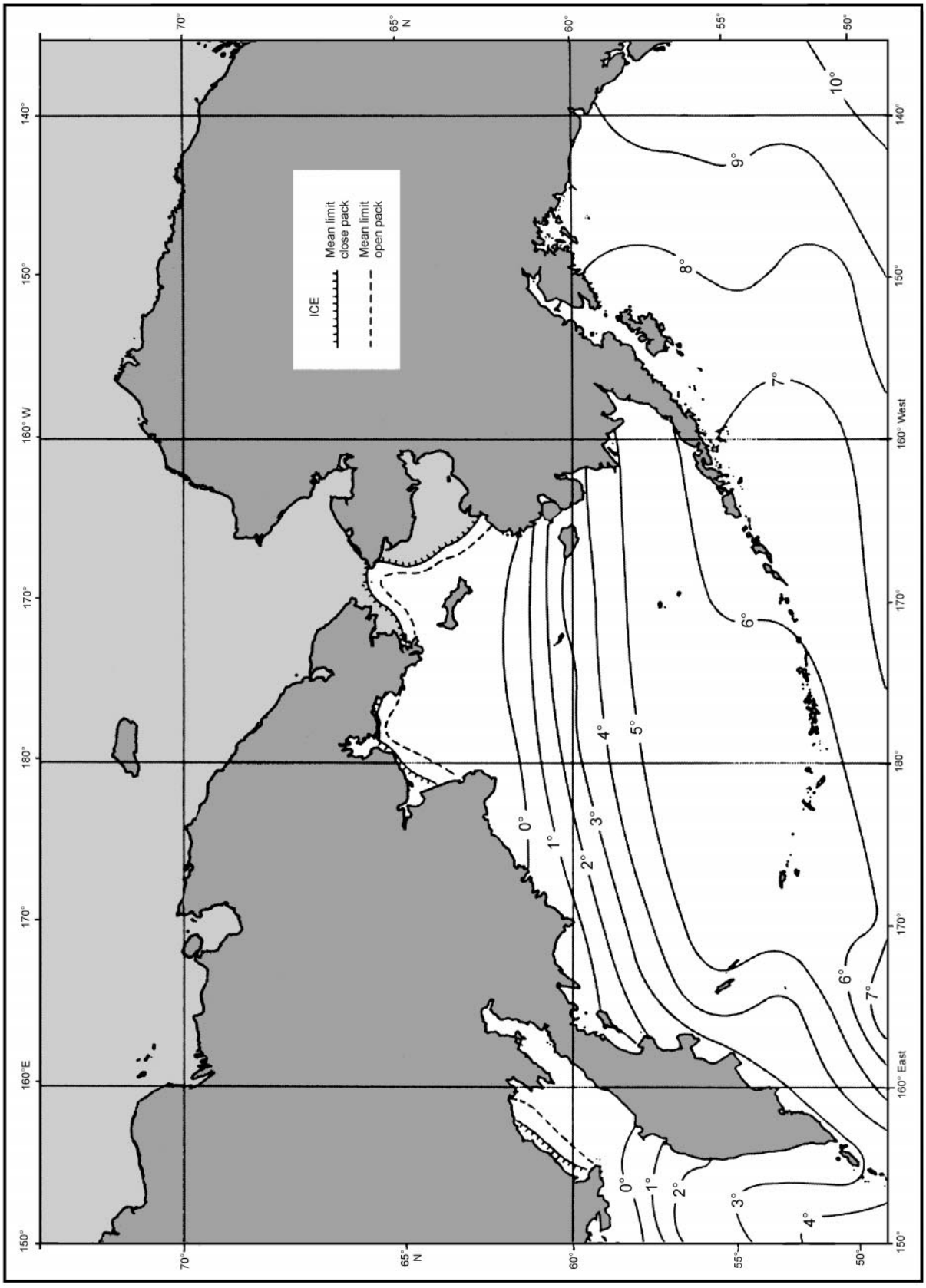
Bergy water—An area of freely navigable water in which glacier ice is present in concentrations less than 10 per cent. There maybe sea ice present, although the total concentration of all ice shall not exceed 10 per cent.



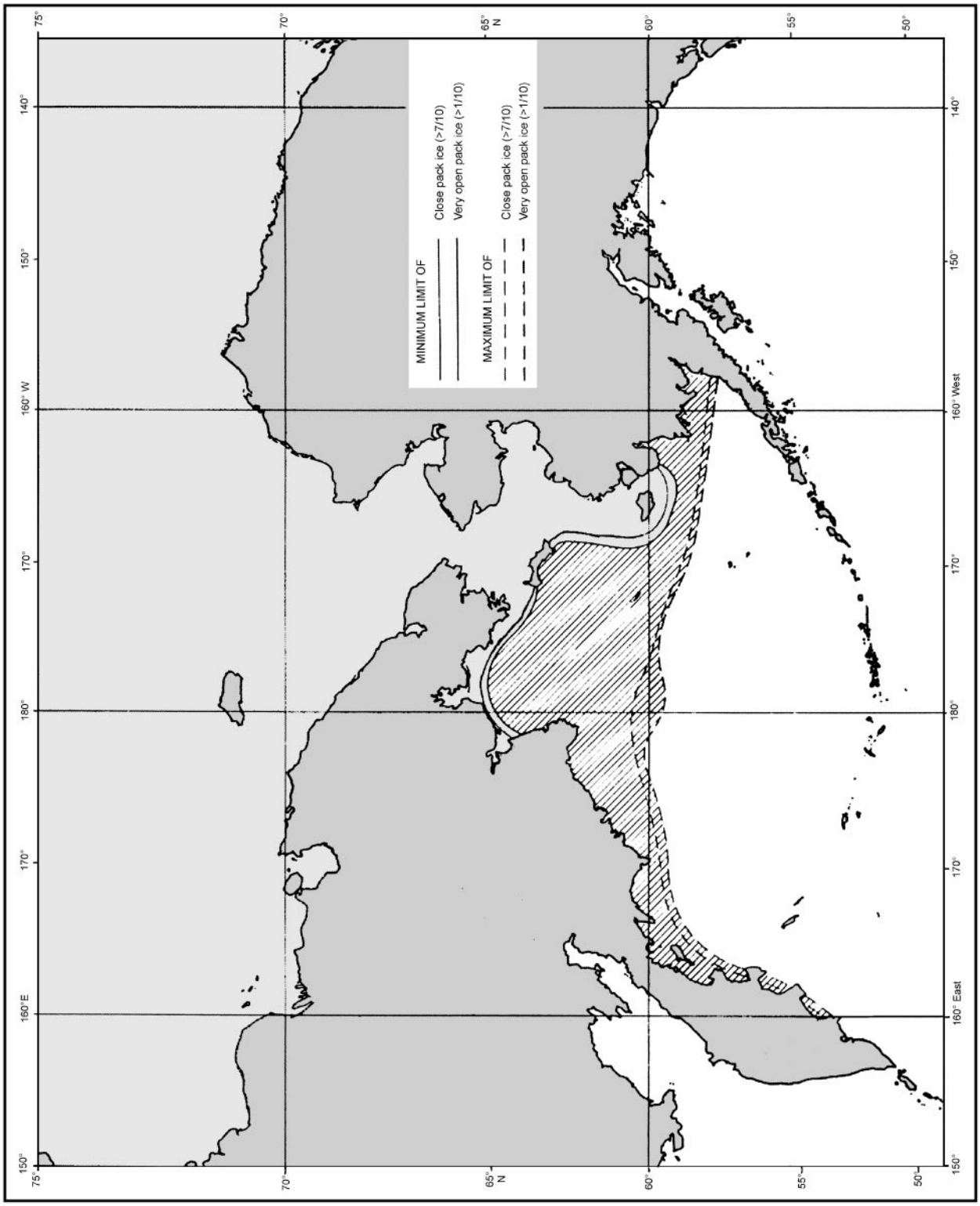
Limits of Sea Ice at the End of May



Limits of Sea Ice at the End of October



Mean Sea Surface Temperature (˚C) and Mean Sea Ice Limits—November



Limits of Sea Ice at the End of December

Ice forms first in shallow water, near the coast or over shoals and banks, particularly in bays, inlets, and straits in which there is no current, and in regions with reduced salinity, such as those near the mouths of rivers. It spreads from these areas as centers. Such ice, broken up and carried seaward by winds or currents, starts further ice formation in deeper water, where floating ice that has not melted during the previous season also acts in the same way. Wave action ordinarily hinders the formation of ice to some extent by mixing the waters of the upper layers. Old ice damps sea or swell and, at the same time, by cooling and freshening the water and providing nuclei of ice crystals, assists the beginning of the freezing process. Quickly recurring fresh winds with raised sea will hinder ice formation, breaking it up several times. The greater the depth, with water of salinity greater than 24.7 parts per 1,000, the later is the time of freezing. As a matter of fact, complete freezing may never occur, as in the case of the central part of the White Sea; hence the necessity for following the deep water route in order to reach high latitudes during the season of ice formation.

The first sign of freezing is an oily or opaque appearance of the water, due to the formation of needle like spicules and thin plates of ice about one third of an inch across, known as frazil crystals. These consist of fresh ice, free of salt, and increase in number until the sea is covered by slush of a thick, soupy consistency.

Snow, falling into water, aids freezing by cooling and by providing nuclei for ice crystals. Except in sheltered waters, an even sheet of ice seldom forms immediately; the slush, as it thickens, breaks up into separate masses and frequently into the characteristic pancake form, the rounded shape and raised rim of which is due to the fragments colliding with each other. The formation of slush damps down sea or swell, and if the low temperature continues, the pancakes adhere to each other, forming a continuous sheet.

Rate of Ice Growth

Sea ice may grow to a thickness of 7 to 10cm in the first 24 hours, and from 5 to 8cm more in the second 24 hours. Ice is a poor conductor of heat and the rate of its formation drops appreciably after the first 10.2 to 15.2cm have formed; a snow cover, if present, still further reduces the conductivity. Once a layer of ice is formed, snow falling on the surface retards growth by its insulating power. This is particularly true of loosely packed snow.

A common assumption in the north is that heavy snow in the fall means a rapid break up in the spring. With the subsequent decreasing rate of growth, ice which has grown steadily throughout the winter is seldom more than 1.2m in thickness by the following summer.

Perennial sea ice may grow in thickness during the summer by refreezing of thaw water. Snow on the surface melts, and the water runs down through cracks and holes to form a layer of fresh water under the ice. Since the temperature of the underlying salt water is usually lower than the freezing point of fresh water, a layer of fresh water ice is formed on the bottom of the sea ice. In summer, therefore, a flow melts away on top, but at the same time may be growing slowly on its undersurface. By this process, mud, stones, seaweed, or shells originally frozen to the under side of grounded flows may work right up to the surface. Diatoms frozen to the under side will similarly rise. An autumn period follows, with lower temperature but without ice formation, the supply of fresh water being no longer renewed and the sea temperature not being low enough for the freezing of salt water to begin again. In the second winter, growth continues by salt water freezing. If the ice is unbroken through the second winter, its thickness may reach 2.1 to 2.4m at the most. Ice in the Arctic polar basin is seldom less than 1 to 1.4m thick, and Nansen reports a maximum thickness of 4.1m produced by about 4 years of normal growth.

The action of blocks and flows being forced over each other or turned on end by some form of pressure is called rafting. Ice of much greater thickness than ordinary flows can be formed by rafting, tidal overflow, or other types of flooding such as spray and splashing, but such areas will be of limited extent.

Paleocrystic Ice

The extreme development of sea ice is found in the channel between Grant Land and the NW coast of Greenland. Here the early explorers encountered ice masses so thick and irregular that they were assumed to be closely packed bergs of glacial origin. Later observations, however, indicate that this paleocrystic ice consists of remnants of Arctic pack that is blocked by the tip of Peary Land from drifting down the E coast of Greenland and instead is trapped along the N coast of Greenland and Grant Land. Intensive hummocking of this pack over a period of years produces tremendous flowbergs.

Arctic Ice versus Antarctic Ice

Differences in underlying factors specific to the region develop corresponding differences in the features of the ice. An example of one of these agencies is the low mean annual temperature of the Antarctic. The warmth of the Arctic summer has no parallel in the far S and, mainly because of this thermal difference, the ice sheets of the northern polar regions are unlike those of the southern. The margin of the Antarctic cap, overflowing its land support, is free to spread over the sea until fracture detaches huge strips, sometimes including 10 to 20 miles of its front. In Greenland, by contrast, the edge of the inland ice ends on land, and icebergs irregular in shape are formed. The tabular or box-shaped berg is therefore, characteristic of the Antarctic while the pinnacled, picturesque berg is typical of the North.

The Antarctic sea ice surrounds the continent, while the Arctic sea ice is a central mass surrounded by land. The ice moves around and outward from Antarctica and gathers in a belt formed by the meeting of SE and NW winds in the vicinity of 60˚S. There is a close correspondence in the formation of this belt of ice with that formed in the Arctic which follows down Davis Strait and eastward off Greenland. In the Antarctic it is unusual for sea ice to be more than 1 or 2 years old. The drift in both the Weddell and Ross Seas carries the pack out into the open oceans in a little over a year.

In the Arctic, flows of great age are frequent. Ice formed off the Siberian coast takes from 3 to 5 years to drift across the polar basin and down the eastern coast of Greenland. Ice of this age becomes pressed and hummocked to a degree unknown in ice formed in lower latitudes. The warmth of the Arctic summers also has its effect and the result is worn down, more or less even, flows of great thickness known as “polar cap ice.” During the summer, melting on the surface is considerable, as a rule about 0.6m, and pools of fresh water are formed on the

flows. This is not a very marked feature off the E coast of Greenland, N of latitude 72˚N, but in Baffin Bay the flows become covered with a maze of deep pools. In the Antarctic, surface pools on flows in the pack are almost unknown. The outstanding difference between Arctic and Antarctic ice, which is apparent to the navigator, is the softer texture of the latter.

Ice Distribution

The sea ice terms used in the description are those adopted by the World Meteorological Organization in 1968. A glossary of these terms and photographs of typical ice formations are published in Pub. No. 9, The American Practical Navigator, (Bowditch), which also contains information on the formation and movement of sea ice, and operations and navigation in ice.

Bering Strait-Bering Sea-Chukchi Sea-Beaufort Sea

During winter and spring, ice covers nearly the entire NE half of the Bering Sea. The S portion of the ice covered area of the Bering Sea contains thin first year ice 30 to 71cm near the end of the growth cycle. The N portion and immediate coastal areas N of 62˚N attain medium first year growth 71 to 122cm.

The Bering Strait is covered throughout the growth cycle with thin and medium first year ice.

North of the Bering Strait, in the Chukchi Sea, the ice cover is medium and thick first year growth (greater than 48 inches, or 122 centimeters) during most of the growth cycle.

The Beaufort Sea is covered with vast expanses of thick first year and multi-year ice, 300cm thick during most of the growth cycle. The first year ice is generally confined to an area within 100 miles of the N Alaskan coast. Some years it may be more than 200 miles.

By early summer, the Bering Sea is normally free of sea ice. Ice concentration in areas N of the Bering Strait continues to decrease as summer progresses, and the ice edge retreats N in the Chukchi Sea. At the same time, the area N of Canada between Mackenzie Bay and Amundsen Gulf begins to decrease in ice concentration, and the ice edge retreats from the coast as sea ice disintegration accelerates. During the summer months, June to October, the Columbia Glacier becomes unstable along its face due to glacial melting and runoff. A calving bay forms dumping ice into Columbia Bay. Tidal currents drift ice from the bay into Prince William Sound. Ice production and distribution generally reaches a maximum in August and has been on the increase.

The ice edge normally continues to retreat N in both areas and eventually merges into one continuous edge reaching a maximum N position during the latter half of September. An ice free passage around Point Barrow to Mackenzie Bay is then possible, except during moderate ice years when the ice does not retreat very far from the coast. Transiting the area E of Point Barrow is hazardous, for belts or patches of ice may break away from the main pack and pose a threat to vessels with unreinforced hulls. A strong N wind could force enough ice down to the coast to trap a vessel.

During fall, beginning in October, the pack edge reverses direction and begins to move S. The average ice drift during October and November is from Alaska toward Russia. Southwest or W drift in the Bering Sea and Bristol Bay area (between November and April) causes a seaward flow of ice from near the Alaskan coast. The ice cover adjacent to the fast ice or the coast does not grow as much as sea ice that has drifted farther seaward.

Canadian Arctic Archipielago

The Labrador coast line is dominated by the cold, S flowing Labrador Current. The coast is normally closed to all shipping from late December to early June by drift ice from the N and local fast ice. Fast ice begins to form in the N coastal indentations (late November) and slowly expands farther S. By late December, it has reached the S coastal limit. As the fast ice formation progresses S, it also progresses seaward. A normal ice year produces fast ice 20 to 30 miles seaward from the coast. Melting and break up is accomplished in the reverse order. Drifting ice brought S from Baffin Bay and Hudson Strait by the Labrador Current first appears off Cape Chidley in early December. By late December, drift ice has reached the S extremity of Labrador. Its concentration depends on the amount of ice being released from Baffin Bay, the speed of the Labrador Current, and the prevailing winds. North or W winds spread the ice, decreasing the concentration. South or E winds tend to “pack” the ice into high concentrations. Icebergs lie off the Labrador coast year around, with the amount depending upon the activity of glaciers in W Greenland and the previous winter’s conditions of Baffin Bay. The largest number of bergs are present during early spring.

The only significant weather around Newfoundland that affects the ice observer is the persistent fog that shrouds the E coast for long periods in summer. The fog is caused by prevailing SW winds blowing first across the Gulf Current and then the cold Labrador Current.

Ice conditions in the Davis Strait and Baffin Bay vary greatly due to wind, current, and the severity of winter effects. September is the month in which the least ice should be found in this area with scattered rotten remnants of the pack ice, small flows, bergs, bergy bits and growlers remaining. The freezing process for both fast and pack ice begins in October. An interesting feature of Baffin Bay is the North Open Water, a recurring polynya.

The constricting effect of Smith Sound shuts off the supply of ice from the N causing an ice jam in the vicinity of Cape Sabin. South of the ice jam, ice is removed by winds and currents, producing a zone of lower ice concentration; and the counterclockwise rotation of the water, meeting with the southerly current from Robeson Channel, creating an area of upwelling or turbulence that prevents ice formation. In any event, open water exists even in mid-winter. Frobisher Bay ice conditions are subject to great variation year to year. It is usually open to icebreaker entry by late July and unescorted entry by late August, closing to shipping in mid-October and to icebreakers by mid-November. The best month for transit is September. The determining factor for opening Frobisher Bay is not so much the fast ice or local bay ice, but sea ice drifting from Baffin Bay and Hudson Strait. Also, grounded flows of heavily hummocked ice linger in the area to block shipping. The ports close when fast ice, beached ice, and ice foot formations occur along the shore in the upper bay. The great tidal change (7.5 to 9m) aids in beaching ice.

The easternmost most islands of the Canadian Archipelago normally have 152.4cm of ice in the upper fjords by January or February while the central third of the fjords have about 63.5cm. A tidal range of 2.4 to 3.3m keeps the ice elastic.

Breakup begins in March and by May; the ice is heavily puddled and rotten. Throughout the Canadian Archipelago, the water moves S from the Arctic Ocean through the Queen Elizabeth Islands and joins the E flow through McClure Strait, Viscount Melville Sound, Barrow Strait, and Lancaster Sound into Baffin Bay. Most of the waterways are completely covered with ice except for short periods in the late summer or early fall. Many are never open to transit, even by an ice breaker.

Greenland

The W coast of Greenland is usually ice free as far N as Sondre Strom. There, fast ice will halt shipping by late December. The extent of both fast and pack ice increases to a maximum in March, extending as far S as Disco Bay. The ice in Baffin Bay is in continual motion, averaging 1.2 in thickness with the heaviest concentrations lying on the W side as far S as Cape Dyer. The disintegration begins in April. By mid-June, the pack ice S of 73˚N. is well puddled. Greenland coastal area is essentially ice free as far N as Upernavik. By mid-July, Thule is ice free and remains so through September. The route between Thule and Alert is never ice free, and is navigable only by icebreakers. In August, Smith Sound is usually 6 to 7 octas of ice. The wind speed/direction determines whether the lead will be along the E or W coast of the Robeson Channel.

The E Greenland coastal area is regarded as one of the most inaccessible areas in the world. This is because of the continual flow of multi year ice from the Arctic Ocean drifting with the East Greenland Current. Approximately 90 per cent of the total ice that is lost from the Arctic each year is carried S in this strong current. Throughout the year, drifting ice extends 100 to 300 miles off shore to the N of Scoresby Sound. To the S of Scoresby Sound, the maximum offshore extent is reached in April when the ice may extend nearly 200 miles offshore. The minimum is reached in August or September when only belts and patches are present. The drifting pack ice is at its maximum S extent from December through May when it rounds Kap Farvel. Fast ice may be found in protected coastal indentations, except S of Scoresby Sound. The fjords are cleared throughout the winter by the foehn effect. Icebreakers can usually enter Scoresby Sound between early August to mid-October if extreme caution is used. Kulusuk is resupplied each year from mid-August through September by icebreakers. The vast ice cap, measuring as thick as 3,048m in the interior, spills out through the mountainous rim down fjords as glaciers. This action generates numerous ice bergs that drift S and threaten shipping.

Russia

The N shore of Russia is dominated by winter ice, frozen fast from the Chukchi Sea to the Kara Sea until June. The influx of warm water from the North Atlantic Drift (an extension of the Gulf Current) and the run off from the Ob, Yenisei, Lena and Kolyma rivers causes the pack ice to melt rapidly. By mid-July, a narrow shore lead develops along the coastline. By August, there is a navigable area extending along the entire coast that remains open until October. In October, the N and NE winds push the Arctic pack onto the shore, closing the Chukchi and Laptev Seas. This is followed by the closing of the East Siberian Sea, and finally, the Kara Sea in November. By December, the strait between Novaya Zemlya and the mainland is closed by winter ice. In late December or early January, fast ice forms in the protected bays of the Barents Sea. The western edge of the Barents Sea is kept fairly ice free by the North Atlantic Drift.

Svalbard

Svalbard experiences heavy fast ice formation along its N and E coasts during the winter, with only a narrow band of fast ice or ice free areas along the S and W coasts. The N coast is usually navigable by late August or early September, but the E coast thaws slowly, if at all. Henlopen Strait has some ice throughout the summer.

Iceland

Due to the North Atlantic Drift, Iceland usually remains ice free throughout the year, except for some fast ice in its harbors on the N coast. Occasionally some weak fast ice will form in bays along the S coast. The heavy pack ice will drift to within 50 miles of the W coast of Iceland.

Ice Patrol Service

The sinking of the Titanic in 1912 prompted the maritime nations with ships transiting the Grand Banks area off Newfoundland, Canada, to establish an iceberg patrol in the area. Since 1913, the International Ice Patrol (IIP) has been responsible for monitoring the extent of iceberg danger. The Ice Patrol is funded by the twenty member nations signatory to the Safety of Life at Sea (SOLAS) Convention who reimburse the United States for this service. It has proven to be an outstanding example of effective international cooperation for the preservation of life and property at sea.

International Ice Patrol (IIP)

The IIP provides a service which monitors the extent of the iceberg danger in the vicinity of the Grand Banks of Newfoundland. Information on Limit of All Known Ice (LAKI) is broadcast to all shipping. The IIP uses reports from various sources. They include icebergs detected by IIP, Canadian reconnaissance flights, and reports of sighting made by the passing vessels.

The iceberg limits vary considerably through the ice season and between seasons. The number of icebergs crossing 48˚N have been tracked. This count has an advantage, by providing a single value for the season severity, but also the disadvantage that it runs loose (trackline deviation) from the predicted iceberg population that require mariners to keep clear of the danger zone. The size of the LAKI also dictates aircraft requirements for IIP reconnaissance.

The following describes icebergs reported to the IIP:

Name (Code)	Height	Length
Growler (G)	less than 1m	less than 6m
Smaller Iceberg (S)	1-15m	6-60m
Medium Iceberg (M)	16-45m	61-122m
Large Iceberg (L)	more than 45m	more than 122m

Shape Description	
Tabular (T)	Flat topped iceberg with a length/height ratio greater than 5:1.
Non Tabular (N)	Covers all icebergs that are not tabular shaped, as described above. This includes icebergs that are dome-shaped, sloping, blocky, and pinnacled.

Ice Terms

The following glossary of ice terms gives definitions of descriptive terms in general use for the many kinds of ice found at sea. The terms are based on the Ice Nomenclature established by the World Meteorological Organization (WMO).

Aged ridge—Ridge which has undergone considerable weathering. These ridges are best described as undulations.

Anchor ice—Submerged ice attached or anchored to the bottom, irrespective of its formation.

Area of weakness—A satellite observed area in which either the ice concentration or the ice thickness is significantly less than that in the surrounding areas. Because the condition is satellite observed, a precise quantitative analysis is not always possible, but navigation conditions are significantly easier than in surrounding areas.

Bare ice—Ice without snow cover.

Belt—A large feature of ice arrangement; longer than it is wide; from 1 km to more than 100 km in width.

Bergy bit—A large piece of floating glacier ice, generally showing less than 5m above sea level but more than 1m and normally about 100-300 m^2 in area.

Beset—Situation of a vessel surrounded by ice and unable to move.

Big flow—(also see flow).

Bight—Extensive crescent-shaped indentation in the ice edge, formed by either wind or current.

Brash ice—Accumulations of floating ice made up of fragments not more than 2m across, the wreckage of other forms of ice.

Bummock—From the point of view of the submariner, a downward projection from the underside of the ice canopy; the counterpart of a hummock.

Calving—The breaking away of a mass of ice from an ice wall, ice front, or iceberg.

Close pack ice—Pack ice in which the concentration of 70 to 80 per cent is composed of floes mostly in contact.

Compacted ice edge—Close, clear-cut ice edge compacted by wind or current; usually on the windward side of an area of pack ice.

Compacting—Pieces of floating ice are said to be compacting when they are subjected to a converging motion, which increases ice concentration and/or produces stresses which may result in ice deformation.

Compact pack ice—Pack ice in which the concentration is 100 per cent and no water is visible.

Concentration—The ratio expressed in tenths describing the amount of the sea surface covered by floating ice as a fraction of the whole area being considered. Total concentration includes all stages of development that are present, partial concentration may refer to the amount of a particular stage or of a particular form of ice and represents only a part of the total.

Concentration boundary—A line approximating the transition between two areas of pack ice with distinctly different concentrations.

Consolidated pack ice—Pack ice in which the concentration is 100 per cent and the flows are frozen together.

Consolidated ridge—A ridge in which the base has frozen together.

Crack—Any fracture of fast ice, consolidated ice or a single flow which has been followed by separation ranging from a few centimeters to 1m.

Dark nilas—Nilas which is under 5cm in thickness and is very dark in color.

Deformed ice—A general term for ice which has been squeezed together and in places forced upwards (and downwards). Subdivisions are rafted ice, ridged ice, and hummocked ice.

Difficult area—A general qualitative expression to indicate, in a relative manner, that the severity of ice conditions prevailing in an area is such that navigation in it is difficult.

Diffused ice edge—Poorly defined ice edge limiting an area of dispersed ice; usually on the leeward side of ice.

Diverging—Ice fields or flows in an area are subjected to diverging or dispersive motion, thus reducing ice concentration and/or relieving stresses in the ice.

Drift ice—Term used in a wide sense to include any area of sea ice other than fast ice no matter what form it takes or how it is dispersed. When concentrations are high, i.e. 70 per cent or more, drift ice may be replaced by the term pack ice.

Dried ice—Sea ice from the surface of which melt-water has disappeared after the formation of cracks and thaw holes. During the period of drying, the surface whitens.

Easy area—A general qualitative expression to indicate, in a relative manner, that ice conditions prevailing in an area are such that navigation is not difficult.

Fast ice—Sea ice which forms and remains fast along the coast, where it is attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs. Vertical fluctuations may be observed during changes of sea level. Fast ice may be formed in from sea water or by freezing of drift ice of any stage to the shore, and it may extend a few meters or several hundred kilometers from the coast. Fast ice may be more than 1 year old and may then be prefixed with the appropriate age category (second-year, or multi-year). If it is thicker than about 2m above sea level it is called an ice shelf.

Fast ice boundary—The ice boundary at any given time between fast ice and drift ice.

Fast ice edge—The demarcation at any given time between fast ice and open water.

Finger rafted ice—Type of rafted ice in which flows thrust “fingers” alternately over and under the other.

Finger rafting—Type of rafting whereby interlocking thrusts are formed, each flow thrusting "fingers" alternately over and under the other. Common in nilas and gray ice.

Firn—Old snow which has recrystallized into a dense material. Unlike snow, the particles are to some extent joined

together; but, unlike ice, the air spaces in it still connect with each other.

First-year ice—Sea ice of not more than one winter's growth developing from young ice; the thickness is 30cm to 2m. May be subdivided into thin first-year ice/white ice, medium first-year ice, and thick first-year ice.

Flaw—A narrow separation zone between pack ice and fast ice, where the pieces of ice are in a chaotic state; it forms when pack ice shears under the effect of a strong wind or current along the fast ice boundary.

Flaw lead—A passage-way between pack ice and fast ice which is navigable by surface vessels.

Flaw polynya—A polynya between pack ice and fast ice.

Floating ice—Any form of ice found floating in water. The principal kinds of floating ice are lake ice, river ice, and sea ice, which form by the freezing of water at the surface, and glacier ice (ice of land origin) formed on land or in an ice shelf. The concept includes ice that is stranded or grounded.

Floe—Any relatively flat piece of sea ice 20m or more across. Floes are subdivided according to horizontal extent as follows:

1.	Giant	Over 10 km across
2.	Vast	2-10 km across
3.	Big	500-2,000m across
4.	Medium	100-500m across
5.	Small	20-100m across

Flowberg—A massive piece of sea ice composed of a hummock, or a group of hummocks, frozen together and separated from any ice surroundings. It may protrude up to 5m above sea level.

Flooded ice—Sea ice which has been flooded by melt-water or river water and is heavily loaded by water and wet snow.

Fracture—Any break or rupture through very close ice, compact ice, consolidated ice, fast ice, or a single floe resulting from deformation processes. Fractures may contain brash ice and/or be covered with nilas and/or young ice. The length may vary from a few meters to many kilometers.

Fracture zone—An area with a great number of fractures.

Fracturing—Pressure process whereby ice is permanently deformed, and rupture occurs. Most commonly used to describe breaking across very close ice, compact ice, and consolidated ice.

Frazil ice—Fine spicules or plates of ice, suspended in water.

Friendly ice—From the point of view of the submariner, an ice canopy containing many large skylights or other features which permit a submarine to surface. There must be more than ten such features per 30 nautical miles (56 km) along the submarine's track.

Frost smoke—Fog-like clouds due to the contact of cold air with relatively warm water, which can appear over openings in the ice, or leeward of the ice edge, and which may persist while ice is forming.

Giant floe—(also see floe).

Glacier—A mass of snow and ice continuously moving from higher to lower ground or, if afloat, continuously spreading. The principle forms of glacier are: Inland ice sheets, ice shelves, ice streams, ice caps, ice piedmonts, cirque glaciers and various types of mountain (valley) glaciers.

Glacier berg—An irregularly shaped iceberg.

Glacier ice—Ice in, or originating from, a glacier, whether on land or floating on the sea as icebergs, bergy bits, or growlers.

Glacier tongue—Projecting seaward extension of a glacier, usually afloat. In the Antarctic, glacier tongues may extend over many tens of kilometers.

Grease ice—A later stage of freezing than frazil ice when the crystals have coagulated to form a soupy layer on the surface. Grease ice reflects little light, giving the sea a matte appearance.

Grey ice—Young ice 10 to 15cm thick. Less elastic than nilas and breaks on swell. Usually rafts under pressure.

Grey-white ice—Young ice 15 to 30cm thick. Under pressure, more likely to ridge than to raft.

Grounded hummock—Hummocked grounded ice formation. There are single grounded hummocks and lines (or chains) of grounded hummocks.

Grounded ice—Floating ice which is aground in shoal water (also see stranded ice).

Growler—Smaller piece of ice than a bergy bit or flowberg, often transparent but appearing green or almost black in color, extending less than 1m above the sea surface and normally occupying an area of about 20 m^2.

Hostile ice—From the point of view of the submariner, an ice canopy containing no large skylights or other features which permit a submarine to surface.

Hummock—A hillock of broken ice which has been forced upwards by pressure. May be fresh or weathered. The submerged volume of broken ice under the hummock, forced downwards by pressure, is termed a bummock.

Hummocked ice—Sea ice piled haphazardly one piece over another to form an uneven surface. When weathered, has the appearance of smooth hillocks.

Hummocking—The pressure process by which sea ice is forced into hummocks. When the flows rotate in the process it is termed screwing.

Iceberg—A massive piece of ice of greatly varying shape, protruding more than 5m above sea level, which has broken away from a glacier, and which may be afloat or aground. Icebergs may be described as tabular, domeshaped, sloping, pinnacled, weathered or glacier bergs.

Iceberg tongue—A major accumulation of icebergs projecting from the coast, held in place by grounding and joined together by fast ice.

Ice blink—A whitish glare on low clouds above an accumulation of distant ice.

Ice bound—A harbor, inlet, etc. is said to be ice-bound when navigation by ships is prevented on account of ice, except possibly with the assistance of an icebreaker.

Ice boundary—The demarcation at any given time between fast ice and drift ice or between areas of drift ice of different concentrations (also see ice edge).

Ice breccia—Ice of different stages of development frozen together.

Ice cake—Any relatively flat piece of sea ice less than 20m across.

Ice canopy—Drift ice from the point of view of the submariner.

Ice cover—The ratio of an area of ice of any concentration to the total area of sea surface within some large geographic locale; this locale may be global, hemispheric, or prescribed by

a specific oceanographic entity such as Baffin Bay or the Barents Sea.

Ice edge—The demarcation at any given time between the open sea and sea ice of any kind, whether fast or drifting. It may be termed compacted or diffuse (also see ice boundary).

Ice field—Area of floating ice consisting of any size of flows, which is greater than 10 km across (also see patch).

Icefoot—A narrow fringe of ice attached to the coast, unmoved by tides and remaining after the fast ice has moved away.

Ice-free—No sea ice present. There may be some ice of land origin present (also see open water).

Ice front—The vertical cliff forming the seaward face of an ice shelf or other floating glacier varying in height from 2 to 50m or more above sea level (also see ice wall).

Ice island—A large piece of floating ice protruding about 5m above sea level which has broken away from an Antarctic ice shelf, having a thickness of 30 to 50m and an area of from a few thousand square meters to 500 km^2 or more, and usually characterized by a regularly undulating surface which gives it a ribbed appearance from the air.

Ice isthmus—A narrow connection between two ice areas of very close or compact ice. It may be difficult to pass, while sometimes being part of a recommended route.

Ice jam—An accumulation of broken river ice or sea ice caught in a narrow channel.

Ice keel—From the point of view of the submariner, a downward-projecting ridge on the underside of the ice canopy; the counterpart of a ridge. Ice keels may extend as much as 50m below sea level.

Ice limit—Climatological term referring to the extreme minimum or maximum extent of the ice edge in any given month or period based on observations over a number of years. Term should be preceded by minimum and maximum (also see mean ice edge).

Ice massif—A variable accumulation of close or very close pack ice covering hundreds of square kilometers which is found in the same regions every summer.

Ice of land origin—Ice formed on land or in an ice shelf, found floating in water. The concept includes ice that is stranded or grounded.

Ice patch—An area of pack ice less than 10 km across.

Ice piedmont—Ice covering a coastal strip of low-lying land backed by mountains. The surface of an ice piedmont slopes gently seaward and may be anything from about 50m to 30 miles wide, fringing long stretches of coastline with ice cliffs known as ice walls. Ice piedmonts frequently merge into ice shelves.

Ice port—An embayment in an ice front, often of a temporary nature, where ships can moor alongside and unload directly onto the ice shelf.

Ice rind—A brittle shiny crust of ice formed on a quiet surface by direct freezing or form grease ice, usually in water of low salinity. Thickness to about 5cm. Easily broken by wind or swell, commonly breaking in rectangular pieces.

Ice shelf—A floating ice sheet of considerable thickness showing 2 to 50m or more above sea level, attached to the coast. Usually of great horizontal extent and with a level or gently undulating surface. Nourished by annual snow accumulation and often also by the seaward extension of land glaciers. Limited areas may be aground. The seaward edge is termed an ice front.

Ice stream—Part of an inland ice sheet in which the ice flows more rapidly and not necessarily in the same direction as the surrounding ice. The margins are sometimes clearly marked by a change in the direction of the surface slope but may be indistinct.

Ice under pressure—Ice in which deformation processes are actively occurring and hence a potential impediment or danger to shipping.

Ice wall—An ice cliff forming the seaward margin of a glacier which is not afloat. An ice wall is aground, the rock basement being at or below sea level (also see ice front).

Jammed brash barrier—A strip or narrow belt of new, young, or brash ice (usually 100 to 5,000m wide), formed at the edge of either drift or fast ice or at the shore. It is heavily compacted mostly due to wind action and may extend 2 to 20m below the surface but does not normally have appreciable topography. Jammed Brash Barrier may disperse with changing winds but can also consolidate to form a strip of unusually thick ice as compared to the surrounding pack ice.

Lake ice—Ice formed on a lake, regardless of observed location.

Large fracture—More than 500m wide.

Large ice field—An ice field over 20 km across.

Lead—Any fracture or passageway through sea ice which is navigable by surface vessels.

Level ice—Sea ice which is unaffected by deformation or contortion.

Light nilas—Nilas which is more than 5cm in thickness and rather lighter in color than dark nilas.

Mean ice edge—Average position of the ice edge in any given month or period based on observations over a number of years. Other terms which may be used are mean maximum ice edge and mean minimum ice edge (also see ice limit).

Medium first-year ice—First-year ice 70 to 120 cm thick.

Medium flow—(see flow).

Medium fracture—200 to 500m wide.

Medium ice field—An ice field 15 to 20 km across.

Moraine—Ridges or deposits of rock debris transported by a glacier. Common forms are: ground moraine, formed under a glacier; lateral moraine, along the sides; medial moraine, down the center; and end moraine, deposited at the foot. Moraines are left after a glacier has receded, providing evidence of its former extent.

Multi-year ice—Old ice up to 3m or more thick which has survived at least two summers' melt. Hummocks even smoother than in second-year ice, and the ice is almost salt-free. Color, where bare, is usually blue. Melt pattern consists of large interconnecting irregular puddles and a well-developed drainage system.

New ice—A general term for recently formed ice which includes frazil ice, grease ice, slush, and shuga. These types of ice are composed of ice crystals which are only weakly frozen together (if at all) and have a definite form only while they are afloat.

New ridge—Ridge newly formed with sharp peaks and slope of sides usually 40˚. Fragments are visible from the air at low altitude.

Nilas—A thin elastic crust of ice, easily bending on waves and swell under pressure, thrusting in a pattern of interlocking "fingers" (finger rafting). Has a matte surface and is up to 10

cm in thickness. May be subdivided into dark nilas and light nilas.

Nip—Ice is said to nip when it forcibly presses against a ship. A vessel so caught, though undamaged, is said to have been nipped.

Old ice—Sea ice which has survived at least one summer's melt, thickness up to 3m or more. Most topographic features are smoother than on first-year ice. May be subdivided into second-year ice and multi-year ice.

Open ice—Floating ice in which the concentration is 40 per cent to 60 per cent with many leads and polynyas, and the flows are generally not in contact with one another.

Open water—A large area of freely navigable water in which sea ice is present in concentrations less than 10 per cent. When there is no sea ice present, the area should be termed ice free.

Pack ice—Concentration of 70 per cent or more of drift (also see drift ice).

Pancake ice—Predominantly circular pieces of ice from 30cm to 3m in diameter, and up to about 10cm in thickness, with raised rims due to the pieces striking up against one another. It may be formed on a slight swell from grease ice, shuga, or slush or as a result of the breaking of ice rind, nilas, or under severe conditions of swell or waves, of gray ice. It also sometimes forms at some depth, at an interface between water bodies of different physical characteristics, from where it floats to the surface; its appearance may rapidly cover wide areas of water.

Pingo—A mound formed by the upheaval of subterranean ice in an area where the subsoil remains permanently frozen. Pingos are also found in Arctic waters, rising about 30m from an otherwise even seabed, with bases about 40m in diameter and surrounded by a shallow moat; they are then termed submarine pingos. Generally in the ocean, pingos are more or less a conical mound of fine, unconsolidated material characteristically containing an ice core.

Polynya—Any non-linear shaped opening enclosed in ice. Polynyas may contain brash ice and/or be covered with new ice, nilas, or young ice; submariners refer to these as skylights. Sometimes the polynya is limited on one side by the coast and is called a shore polynya or by fast ice and is called a flaw polynya. If it recurs in the same position every year, it is called a recurring polynya.

Puddle—An accumulation of melt-water on ice, mainly due to the melting of snow, but in the more advanced stages also to the melting ice. Initial stage consists of patches of melted snow.

Rafted ice—Type of deformed ice formed by one piece of ice overriding another (also see finger rafting).

Rafting—Pressure processes whereby one piece of ice overrides another. Most common in the new and young ice (also see finger rafting).

Ram—An underwater ice projection from an ice wall, ice front, iceberg, or flow. Its formation is usually due to a more intensive melting and erosion of the unsubmerged part.

Recurring polynya—A polynya which recurs in the same position every year.

Ridge—line or wall of broken ice forced up by pressure. May be fresh or weathered. The submerged volume of broken ice under a ridge, forced downwards by pressure, is termed an ice keel.

Ridged ice—Ice piled haphazardly one piece over another in the form of ridges or walls. Usually found in first-year ice (also see ridging).

Ridged ice zone—An area in which much ridged ice with similar characteristics has formed.

Ridging—The pressure process by which sea ice is forced into ridges.

Rime—A deposit of ice composed of grains more or less separated by trapped air, some adorned with crystalline branches, produced by the rapid freezing of super-cooled and very small water droplets.

River ice—Ice formed on a river, regardless of observed location.

Rotten ice—Sea ice which has become honeycombed and which is in an advanced state of disintegration.

Rubble field—An area of extremely deformed sea ice of unusual thickness formed during the winter by the motion of drift ice against, or around a protruding rock, islets, or other obstructions.

Sastrugi—Sharp, irregular ridges formed on a snow surface by wind erosion and deposition. On mobile floating ice the ridges are parallel to the direction of the prevailing wind at the time they were formed.

Sea ice—Any form of ice found at sea which has originated from the freezing sea water.

Second-year ice—Old ice which has survived only one summer's melt, thickness up to 2.5m and sometimes more. Because it is thicker than first-year ice, it stands higher out of the water. In contrast to multi-year ice, summer melting produces a regular pattern of numerous small puddles. Bare patches and puddles are usually greenish-blue.

Shearing—An area of ice is subject to shear when the ice motion varies significantly in the direction normal to the motion, subjecting the ice to rotational forces. These forces may result in phenomena similar to flaw.

Shear ridge—An ice ridge formation which develops when one ice feature is grinding past another. This type of ridge is more linear than those caused by pressure alone.

Shear ridge field—Many shear ridges side by side.

Shore ice ride-up—A process by which ice is pushed ashore as a slab.

Shore lead—A lead between drift ice and the shore, or between drift ice and an ice front.

Shore melt—Open water between the shore and the fast ice, formed by melting and/or due to river discharge.

Shore polynya—A polynya between drift ice and the coast, or between drift ice and an ice front.

Shuga—An accumulation of spongy white ice lumps, a few cm across; they are formed from grease ice or slush and sometimes from anchor ice rising to the surface.

Skylight—From the point of view of the submariner, thin places in the ice canopy, usually less than 1m thick and appearing from below as relatively light, translucent patches in dark surroundings. The undersurface of a skylight is normally flat. Skylights are called large if big enough for a submarine to attempt to surface through them (120m), or small if not.

Slush—Snow that is saturated and mixed with water on land or ice surfaces, or as a viscous floating mass in water after a heavy snowfall.

Small flow—See flow.

Small fracture—50 to 200m wide.

Small ice cake—An ice cake less than 2m across.

Small ice field—An ice field 10 to 15 km across.

Snow-covered ice—Ice covered with snow.

Snowdrift—An accumulation of wind-blown snow deposited in the lee of obstructions or heaped by wind eddies. A crescent-shaped snowdrift, with ends pointing downwind, is known as snow barchan.

Standing flow—A separate flow standing vertically or inclined and enclosed by rather smooth ice.

Stranded ice—Ice which has been floating and has been deposited on the shore by retreating high water.

Strip—Long narrow area of pack ice, about 1 km or less in width, usually composed of small fragments detached from the main mass of ice, and run together under the influence of wind, swell or current.

Submarine pingo—See pingo.

Tabular berg—A flat-topped iceberg. Most tabular bergs form by calving from an ice shelf and show horizontal banding (also see ice island).

Thaw holes—Vertical holes in sea ice formed when surface puddles melt through to the underlying water.

Thick first-year ice—First-year ice over 120cm thick.

Thin first-year ice/white ice—First-year ice 30 to 70cm thick. May sometimes be subdivided into first stage 30 to 50cm thick and second stage 50 to 70cm thick.

Tide crack—Crack at the line of junction between an immovable ice foot or ice wall and fast ice, the latter subject to rise and fall of the tide.

Tongue—A projection of the ice edge up to several kilometers in length, caused by wind or current.

Vast flow—See floe.

Very close pack ice—Pack ice in which the concentration is 90per cent to less than 100 per cent.

Very open pack ice—Pack ice in which the concentration is 10 per cent to 30 per cent and water preponderates over ice.

Very small fracture—1 to 50m wide.

Very weathered ridge—Ridge with peaks very rounded, slope of sides usually 20˚ to 30˚.

Water sky—Dark streaks on the underside of low clouds, indicating the presence of water features in the vicinity of sea ice.

Weathered ridge—Ridge with peaks slightly rounded and slope of sides usually 30˚ to 40˚. Individual fragments are not discernible.

Weathering—Processes of ablation and accumulation which gradually eliminate irregularities in an ice surface.

White ice—(see Thin first-year ice/white ice).

Young coastal ice—The initial stage of fast ice formation consisting of nilas or young ice, its width varying from a few meters up to 100 to 200m from the shoreline.

Young ice—Ice in the transition stage between nilas and first-year ice, 10 to 30cm in thickness. May be subdivided into gray ice and gray-white ice.

Ionospheric Disturbance

A Sudden Ionospheric Disturbance (SID) is caused by abnormal X-ray emissions from a solar optical flare. The flare radiation enters the earth's ionosphere, where it increases the ionization at heights of 40 to 55 km. The resultant radio wave attenuation is strongest directly under the sun, and gradually weakens as the sun's zenith angle decreases. The SID is therefore relatively weak at high latitudes. The radio wave attenuation reaches its maximum value within a few minutes after the start of the SID. The return to normal depends on the duration of the solar flare, and may take from several minutes up to as much as 3 to 4 hours.

In a Polar Cap Absorption (PCA) occurrence, as is the case in a sudden ionospheric disturbance, radio waves are absorbed in the lower ionosphere, and low frequencies are attenuated much more strongly than high frequencies. A PCA occurrence differs from an SID in several important respects; it occurs only in the polar regions, above the 50th to 60th parallel of north or south latitude; it lasts much longer than a SID and it affects a wider range of frequencies (about 0.2 to 100 MHz). During the 1949-59 sunspot cycle, about forty moderate to strong PCA occurrences took place, each with an average duration of two days. Nearly half of these PCAs occurred in 1957-59, near the peak of the sunspot cycle, but none during the sunspot minimum years of 1952 through 1955. High frequency radio links with transmitting and receiving terminals within the Arctic Circle may become inoperative during the daylight hours of a PCA occurrence; communication may be reestablished several hours after sunset, but a second blackout may occur the next day after sunrise. However, such re-establishment of communication would not be possible for links located in the high Arctic where the sun does not set during mid-summer months.

A PCA event is caused by sporadic emission of highly energetic charged particles from the sun, called "solar cosmic rays." As a result of their electrical charge, the earth's magnetic field deflects the solar cosmic rays from the equator toward the polar regions, where most of them are absorbed at heights of 50 to 100 km. The PCA events usually start within a few minutes or hours of a large solar flare, but they continue long after the initiating flare has died out, in some instances for five or six days. The radio wave attenuation depends not only on the flux of solar cosmic rays, but also on the intensity of sunlight in the lower ionosphere. The attenuation is maximum near noon, and often becomes quite weak at night.

Bearings

Natural landmarks are plentiful in some areas, but their usefulness is restricted by the difficulty in identifying them, or locating them on the chart. Along many of the coasts of the Arctic Ocean, the various points and inlets bear a marked resemblance to each other. In addition, the appearance of the coast is often very different when many of its features are masked by a heavy covering of snow or ice.

Bearings of landmarks are useful, but they have limitations. When bearings of more than two objects are taken, they may fail to intersect at a point because the objects may not be charted in their correct relation to each other. Even a two-point fix may be considerably in error since the objects used may be charted in correct relationship to one another, but in the wrong position geographically. However, in restricted waters, it is usually more important to know the position of the vessel relative to the nearby land and shoals than to know the accurate latitude and longitude. The bearings and distances of uncharted, locally known objects then become valuable.

When a position is established relative to nearby landmarks, it is good practice to use this to help establish the identity and

location of some prominent feature a considerable distance ahead. Through this practice, unidentifiable or uncharted features can be used to establish future positions.

In high latitudes, it is not unusual to make use of bearings of objects which are located a considerable distance from the vessel. Because of the rapid convergence of the meridians in these areas, such bearings are not correctly represented by straight lines on a Mercator chart. Therefore, if this projection is used, the bearings should be corrected in the same manner that radio bearings are corrected, because both can be considered to be great circles. However, neither visual nor radio bearings require a correction when plotting on a Lambert Conformal or a Polar Stereographic chart.

Magnetic Field

The dip poles, commonly referred to as the magnetic poles, are the points on the earth's surface at which the horizontal component (H) of the total magnetic field decreases to a minimum (approaches zero), and where the magnetic field is nearly all vertical. At such a point, a dip needle will stand straight up and down.

The magnetic poles should not be confused with the geomagnetic poles. Although the term geomagnetic pole does not have a rigorous definition and usage varies among different textbooks, the most common definition is a theoretical point at which the axis of a central dipole field intersects the earth's surface. However, the earth's magnetic field is not a pure dipole as it contains approximately 5 per cent quadrupole and external magnetic field components. Therefore, the two principal magnetic dipoles (North and South) do not correspond with the geomagnetic poles.

There is a misconception that the needle of a magnetic compass points to the magnetic pole. Actually, the direction indicated by such a needle is the local horizontal direction of the earth's magnetic lines of force. These lines eventually converge at the magnetic poles but wander considerably. A compass cannot be used in regions near the magnetic pole to find direction as it will remain in any direction in which it happens to be placed. In reality, a rather large area, in which a compass cannot be used, surrounds the magnetic pole because of the low magnitude of H. Where H is approximately 6,000 nanoteslas (nT) or less, the compass is frequently erratic. The magnetic compass is not reliable for underway navigation where H is 3,000 nT or less. In comparison with the North Magnetic Pole, the region surrounding the South Magnetic Pole, where the compass is unreliable, is much smaller.

Magnetic Poles

The computed location of the North Magnetic Pole on January 1, 2000 was 80˚48.6'N, 109˚22.2'W; the computed location of the South Magnetic Pole on the same date was 64˚40.2'S, 138˚18.6'E. These locations were computed using the 2000 Epoch World Magnetic Model, WMM-2000, which was used in the compilation of charts published by NGA begining in January 2000..

CONVERSION ANGLE TABLE FOR VISUAL BEARINGS IN POLAR WATERS

Mid Latitude	Difference of Longitude										Mid Latitude
˚	0˚	0.5˚	1˚	1.5˚	2˚	2.5˚	3˚	3.5˚	4˚	4.5˚	˚
	°	°	°	°	°	°	°	°	°	°	
61	0.0	0.2	0.4	0.7	0.9	1.1	1.3	1.5	1.7	2.0	61
62	0.0	0.2	0.4	0.7	0.9	1.1	1.3	1.5	1.8	2.0	62
63	0.0	0.2	0.4	0.7	0.9	1.1	1.3	1.6	1.8	2.0	63
64	0.0	0.2	0.4	0.7	0.9	1.1	1.3	1.6	1.8	2.0	64
65	0.0	0.2	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.0	65
66	0.0	0.2	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.1	66
67	0.0	0.2	0.5	0.7	0.9	1.2	1.4	1.6	1.8	2.1	67
68	0.0	0.2	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	68
69	0.0	0.2	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	69
70	0.0	0.2	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	70
71	0.0	0.2	0.5	0.7	0.9	1.2	1.4	1.7	1.9	2.1	71
72	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	2.1	72
73	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	2.2	73
74	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	2.2	74
75	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	2.2	75
76	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	1.9	2.2	76
77	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	1.9	2.2	77

CONVERSION ANGLE TABLE FOR VISUAL BEARINGS IN POLAR WATERS

Mid Latitude	Difference of Longitude										Mid Latitude
°	0°	0.5°	1°	1.5°	2°	2.5°	3°	3.5°	4°	4.5°	°
	°	°	°	°	°	°	°	°	°	°	
78	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	78
79	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	79
80	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	80
81	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	81
82	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	82
83	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	83
84	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	84
85	0.0	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	85

The table should be entered with the middle latitude and the difference in longitude (between the object and the vessel). The angles listed in the table (corrections) represent the difference between the great circle bearing and the rhumb line direction (Mercator). The sign of the correction to be applied is as follows:

Latitude of Vessel	Object/Landmark (direction from vessel)	Correction Sign
South	East	-
South	West	+
North	East	+
North	West	-

WMM-2000 is the product of a cooperative effort between the United States Geological Survey (USGS) and the United Kingdom's British Geological Survey (BGS). It is the official model for both the U.S. and U.K. defense establishments.

Magnetic Variation

Magnetic variation information printed on topographic maps and nautical charts is derived from a model, which must be redefined at least every 5 years.

The principal reason is that the earth's magnetic field changes appreciably in that period of time, and it has not been possible to predict the secular change with confidence more than a few years into the future.

Variation, also known as magnetic declination, is measured in angular units and named East or West to indicate the side of True North on which the N part of the magnetic meridian lies. East variation is positive and West variation is negative.The DoD publishes grid variation charts which illustrate the angle between the grid and magnetic meridians at any place.

Magnetic Anomalies

Significant magnetic anomalies may exist due to local magnetization in the earth's crust. These geologically produced magnetic fields cannot be modeled on a world-wide basis. Individual detailed geomagnetic surveys are required. Local conductivity anomalies will affect the way external magnetic fields generate currents in the crust, which in turn generate induced magnetic fields. These induction fields will also be local in character. Observations of erratic compass behavior should be reported with details of the particular circumstances at the time. Any disturbances to the geomagnetic field can also interfere with magnetic navigation. The flow of the solar wind (which contains electrons and protons) past the earth creates magnetic disturbances at the earth's surface. Some of these disturbances are known to be highly localized, while others occur over wide areas. Auroras are the visible result of a significant magnetic storm.

There are four different periodicities of magnetic disturbances. Although magnetic storms can occur at any time, they are most numerous during the period of maximum activity in the 11-year sunspot cycle. There is a weak semi-annual periodicity, where the level of disturbance is at a maximum in October and April. More prominently, magnetic storms tend to have a 27-day repetition period due to the synodic rotation period of the sun, that is, the apparent rotation period as seen from the earth. Magnetic storms typically last 2 to 3 days. The substorms which accompany them only last from 1 to 3 hours and tend to occur more frequently and more strongly at local midnight.

During a particularly intense magnetic storm, such as occurred in March 1989, electrical currents are generated in the magnetosphere and the ionosphere. The magnetic fields of these currents also induce fluctuating voltages in the earth and cause additional current. The total current can significantly alter the geomagnetic field observed at the earth's surface and change its direction as much as several degrees and its magnitude as much as 10 per cent.

In various parts of the world, magnetic ores on or just below the sea bed may give rise to local magnetic anomalies resulting in the temporary deflection of the magnetic compass needle when a ship passes over them. The areas of disturbance are usually small unless there are many anomalies close together. The amount of the deflection will depend on the depth of water and the strength of the magnetic force generated by the magnetic ores. However, the magnetic force will seldom be strong enough to deflect the compass needle in depths greater than about 1,500m. Similarly, a ship would have to be within 0.8 mile of a nearby land mass containing magnetic ores for a deflection of the compass needle to occur.

Local magnetic anomalies are depicted by a special symbol on charts and are mentioned in Sailing Directions (Enroute). The amount and direction of the deflection of the compass needle is also given, if known.

Deflections may also be due to wrecks lying on the bottom in moderate depths, but investigations have proved that, while deflections of unpredictable amount may be expected when very close to such wrecks, it is unlikely that deflections in excess of 7˚ will be experienced, nor should the disturbance be felt beyond a distance of 250m.

Greater deflections may be experienced when in close quarters of a ship carrying a large cargo such as iron ore, which readily reacts to induced magnetism.

Submarine power cables carrying direct current can cause deflection of the magnetic compass needle in vessels passing over them. The amount of the deflection depends on the magnitude of the electric current and the angle that the direction of the cable makes with the magnetic meridian.

Magnetic Anomalies—Northern Coast of Russia

Due to high latitudes the horizontal component of the earth's magnetic field is very small throughout this area. The effects of both local magnetic anomalies and of magnetic storms therefore create a much greater deflection of the compass needle compared to lower latitudes. Additionally, the area lies in or near the region of maximum auroral frequency, where there is a high level of magnetic disturbance. During a severe magnetic storm the resultant deflection of the compass may amount to several tens of degrees.

In the Kara Sea the average number of days per month on which the range of the deflection of the compass needle due to magnetic storms may reach a value of 4˚ may amount to 10. In the Laptev Sea severe magnetic storms occur not more than 4 or 5 days per month, but deflections of as much as 4˚ may occur on as many as 10 days per month. In the East Siberian Sea deflections of up to about 4˚ may occur about 10 to 12 days per month.

The magnetic variation in these regions also undergoes a diurnal fluctuation reaching its maximum about 0600 and 1800 hours, and its minimum about 1100 and 2300 hours. Under normal magnetic conditions the range of these fluctuations is about 11' at Proliv Matochkin Shar, 16' at Ostrov Dikson, 70' on a line between Mys Chelyuskina and Mys Anisiy, Ostrov Kotel'nyy, and 20' off the Lena delta. A report of much larger fluctuations was observed at Bukhta Ledyanaya.

From the above observations, although incomplete, it is found that the value of the magnetic variation changes rapidly from E to W, and the change is not uniform in many places. Navigators when in this area should:

1. Observe the behavior of the compass.
2. Check the compass error at frequent intervals.
3. Avoid using compass bearings until the vessel stabilizes on its new course.

Magnetic observatories have been established at Proliv Matochkin Shar, Ostrov Dikson, and Mys Chelyuskina. They will provide information regarding alterations in the earth's magnetic field on radio request.

During the navigational season, the Dikson radio station broadcasts information on the state of the earth's magnetic field. These broadcasts are primarily intended for the use of vessels bound between Proliv Yugorskiy Shar or Proliv Matochkin Shar and Ostrov Dikson; they will also provide an indication and occurrence of magnetic storms.

Observations of local magnetic anomalies have been made at the following places:

1. Proliv Yugorskiy Shar.
2. The Barents Sea.
3. Ostrova Barentsa.
4. Zaliv Russkaya Gavan.
5. Zemlya Vil'cheka.
6. Proliv Avstriyskiy.
7. Ostrov Mak Klintoka.
8. Sharapovy Koshki.
9. Obskaya Guba (N approach).
10. Obskaya Guba.
11. Gavan' Dikson approach.
12. Shkhery Minina.
13. Ostrov Torosovyy.
14. Between Mys Sterlegova and Mys Dubinskogo.
15. Ostrov Torosovyy.
16. Between Ostrov Pravdy and Zaliv Taymyrskiy.
17. Bukhta Ledyanaya.
18. Arkhipelag Nordenshel'da.
19. Ostrov Russkiy (NW coast).
20. Between Gafner Fjord and Mys Chelyuskina.
21. Proliv Shokal'skogo.
22. Bukhta Snezhnaya.
23. Ostrov Pioner.
24. Zaliv Kalinina.
25. Zaliv Krasnoy Armii.
26. Proliv Melyokov.

Magnetic Anomalies—East Coast of Greenland, Iceland, and Svalbard

The magnetic variation changes sufficiently, for example, a passage between Bjornoya (74˚30'N., 19˚00'E.) and Scoresby Sund (70˚20'N., 22˚00'W.) would experience a change of 33˚.

Local magnetic anomalies have been experienced in the fjords and off the coast of Iceland, in the vicinity of Jan Mayen and Bjornoya, and in the proximity of Spitsbergen.

Vessels navigating in these areas, especially when in depths of less than 90m, must keep a careful watch on the movements of the magnetic compass. Reports have been received that the permanent magnetism of vessels were temporarily affected, the disturbance can last for hours to several days. Strong disturbances have been noted in areas, especially in the vicinity of Iceland, in depths of 135m; disturbed areas may exist in other places in similar or greater depths. Vessels navigating in less depths, especially in the areas known to be affected,

should ascertain their positions by sextant angles or objects in transit.

Magnetic Anomalies—West Coast Greenland and the Canadian Arctic Archipelago

In 2000, the North Magnetic Pole was situated in the Arctic Ocean NNW of Ellef Ringnes Island; it is continuing to migrate NNW. In this area the magnetic compass becomes progressively sluggish and less reliable for navigation; however, there are other areas such as Hudson Bay where the magnetic variation also changes rapidly.

These adverse conditions may be accentuated by local magnetic anomalies, observed from time to time, in several places off the W coast of Greenland, in Hudson Strait, and in Hudson Bay; also in the NW corner of Foxe Basin, the NW part of Baffin Bay, the E part of Parry Channel and in Admiralty Inlet, in Amundsen Gulf, and in Coronation Gulf.

A careful watch must be kept on the magnetic compass behavior when vessels navigating the W Greenland and Canadian Arctic waters. Any magnetic disturbances experienced on a vessel at any part of the arctic region should be recorded in detail and reported.

Polar Navigation

Navigation by magnetic compass in polar regions is much less reliable than in equatorial and mid-latitudes. Low directive force on the compass card, the enhanced effects of magnetic storms near the magnetic poles, the relatively sparse knowledge of local anomalies in regions outside commercial traffic areas, and the slow drift of the actual magnetic pole positions all contribute. As a minimum, the most current magnetic information and charts should be carried. Any chart older than the current model should be replaced.

Charts of the geomagnetic field are available from the Department of Defense (DoD). Magnetic variation charts are published every 5 years. Charts of the total intensity, vertical intensity, horizontal intensity, and inclination (magnetic dip) are published every 10 years.

Meteorology

Weather-related Phenomena

This area is commonly affected by depressions which develop over the Atlantic and enter the Norwegian Sea via the Iceland-Faeroes-Scotland gap. Occasionally depressions approach the area from N of Iceland though this is more usual in summer. They generally travel on a broadly NE track passing to the W of Norway and then often turn E or ENE round Nordkapp into the Barents Sea. Sometimes still deepening as they reach Norwegian waters, depressions usually begin to fill as they move NE to the colder waters area. Occasionally, a secondary depression may form at the tip of the warm sector. While the secondary depression moves away in a general E direction, the main depression may become slow-moving and erratic.

Another class of depression reaches the area from more northern latitudes. Often called "polar depressions," they are characterized by a large and intense area of showers, usually of snow, which are bunched together to form a cyclonic circulation. The lows are carried along in cold NW to NE airstreams and may continue to S Norwegian waters or towards Finland and N Russia.

Superstructure Icing

In certain weather conditions, ice accumulating on hulls and superstructures can be a serious danger to vessels. Ice accumulation may occur because of fog with freezing conditions; freezing rain or drizzle; and sea spray or salt water breaking over vessels when the air temperature is below freezing (about -1.9˚C).

The most dangerous form of icing is caused by sea spray, sometimes known as "Glaze Ice," which has high density and great powers of adhesion.

In evaluating the potential for superstructure icing, two categories were subjectively selected. Moderate ice accumulation seems to occur when the air temperature is less than or equal to -2˚C and the wind is stronger than or equal to 13 knots. If the air temperature decreases to -9˚C or below and the wind reaches 30 knots or more, ice accumulation takes place at an accelerated rate. This category is termed severe. For example, on a small fishing vessel of 300 to 500 tons displacement, ice accumulation in the severe category would exceed about 4 tons per hour.

Radio and radar failures due to ice accumulating on aerials and insulators may be experienced soon after superstructure icing begins. The ice tends to form high up on vessels and a large amount of accumulation may result in a loss of freeboard and stability.

The probability of forecasting gales with freezing air temperatures is made difficult by the sparseness of meteorological and oceanographic information in the Antarctic region. For this reason, superstructure icing represents a serious hazard to navigation anywhere S of the Antarctic Circle.

Immersion Hypothermia

Immersion hypothermia is the loss of heat when a body is immersed in water. With few exceptions, humans die if their normal rectal temperature of approximately 37.6˚C drops below 25.8˚C. Cardiac arrest is the most common direct cause of death. Except in tropical waters warmer than 20˚ to 25˚C, the main threat to life during prolonged immersion is cold or cold and drowning combined.

Cold lowers body temperature, which in turn slows the heart beat, lowers the rate of metabolism, and increases the amount of carbon dioxide in the blood. Resulting impaired mental capacity is a major factor in death by hypothermia. Numerous reports from shipwrecks and accidents in cold water indicate that people can become confused and even delirious, further decreasing their changes of survival.

The length of time that a human survives in water depends on the water surface temperature and, to a lesser extent, on a person’s behavior. Body type can cause deviations, since thin people become hypothermic more rapidly than fat people. Extremely fat people may survive almost indefinitely in water near 0˚C if they are warmly clothed.

The cooling rate can be slowed by the person’s behavior and insulated gear. In a study which closely monitored more than 500 immersions in the waters around Victoria B.C. temperatures ranged from 4˚ to 16˚C. Using this information it was reasoned that if the critical heat loss areas could be protected, survival time would increase. The Heat Escape Lessening

Posture (HELP) was developed for those in the water alone and the Huddle for small groups. Both require a life preserver. HELP involves holding the upper arm firmly against the sides of the chest, keeping the thighs together, and raising the knees to protect the groin area. In the Huddle, people face each other and keep their bodies as close together as possible. These positions improve survival time in 9˚C water to 4 hours, approximately two times that of a swimmer and one and one half times that of a person in the passive position.

Near drowning victims in cold water (less than 21˚C) show much longer periods of revivability than usual. Keys to a successful revival are immediate cardiopulmonary resuscitation (CPR) and administration of pure oxygen. Do not bother with total rewarming at first. The whole revival process may take hours and require medical help.

Survival Time versus Water Temperature

Water Temperature	Exhaustion or Unconsciousness	Expected Time of Survival
0˚C	15 minutes	15-45 minutes
0˚-5˚C	15-30 minutes	30-90 minutes
5˚-10˚C	30-60 minutes	1-3 hours
10˚-15˚C	1-2 hours	1-6 hours
15˚-20˚C	2-7 hours	2-40 hours
20˚-25˚C	3-12 hours	3 hours-indefinite
25˚C	Indefinite	Indefinite

Windchill and Frostbite

When the body is warmer than its surroundings it begins to lose heat. The rate of loss depends on the barriers to heat loss such as clothing and insulation, the speed of air movement and the air temperature. Heat loss increases dramatically in moving air that is colder than skin temperature (33˚C). Even a light wind increases heat loss while a strong wind can actually lower the body temperature if the rate of loss is greater than the body's heat replacement rate. In the Arctic, windchill results from the intense cold and strong winds. This combination affects not only comfort but the morale and safety of the crew.

The equivalent windchill temperature relates a particular wind and temperature combination to whatever temperature would produce the same heat loss at about 3 knots, the normal speed of a person walking. At extremely cold temperatures, wind and temperature effect may account for only two thirds of the heat loss from the body. For example, in 4˚C temperatures about one third of the heat loss from the body occurs through the lungs in the process of breathing. On the other hand heat loss is not as great in bright sunlight.

When the skin temperature drops below 10˚C there is a marked constriction of the blood vessels leading to vascular stagnation, oxygen want, and some cellular damage. The first indication that something is wrong is a painful tingling. Swelling of varying extent follows, provided freezing has not occurred. Excruciating pain may be felt if the skin temperature is lowered rapidly, but freezing of localized portions of the skin may be painless when the rate of change is slow.

Cold allergy is a term applied to the welts which may occur. Chilblains usually affect the fingers and toes and are manifested as reddened, warm, itching, swollen patches. Trench foot and immersion foot present essentially the same picture. Both result from exposure to cold and a lack of circulation. Wetness can add to the problem as water and wind soften the tissues and accelerate heat loss. The feet swell, discolor, and frequently blister. Secondary infection is common and gangrene may result.

Injuries from the cold may, to a large extent, be prevented by maintaining natural warmth through the use of proper footgear and adequate, dry clothing; by avoiding cramped positions and constricting clothing; and by active exercise of the hands, legs and feet.

Frostbite usually begins when the skin temperature falls within the range of -10˚ to -16˚C. Ice crystals form in the tissues and small blood vessels. Once started, freezing proceeds rapidly and may penetrate deeply. The rate of heat loss determines the rate of freezing, which is accelerated by wind, wetness, extreme cold, and poor blood circulation. Parts of the body most susceptible to freezing are those with surfaces large in relation to their volume, such as toes, fingers, ears, nose, chin and cheeks.

Navigational Information

International Maritime Satellite Organization

Around the world satellite communication systems have now become synonymous with reliable and quality transfer of information. The International Maritime Satellite Organization (INMARSAT) is an international consortium comprising over 75 partners who provide maritime safety management and maritime communications services.

The INMARSAT system consists of a number of satellites, which maintain geosynchronous orbits, and provides quality communications coverage between about 77˚N and about 77˚S, including locations with less than a 5˚ angle of elevation.

INMARSAT-A, the original system, provides telephone, telex, and fax services. However, this system is being replaced by INMARSAT-B, which, by the use of digital technology, is providing the services with improved quality and higher data transmission rates. INMARSAT-C provides a store and forward data messaging capability, but no voice communication.

Global Maritime Distress and Safety System (GMDSS)

The Global Maritime Distress and Safety System (GMDSS) provides a great advancement in safety over the previous usage of short range and high seas radio transmissions.

The GMDSS has been adopted by the International Convention for the Safety of Life at Sea (SOLAS) 1974. It applies to cargo vessels of 300 grt and over and all vessels carrying more than 12 passengers on international voyages. Unlike previous regulations, the GMDSS requires vessels to carry specified equipment according to the area in which they are operating. Such vessels navigating in polar regions must carry VHF, MF, and HF equipment and a satellite Emergency Position Indicating Radiobeacon (EPIRB).

Information on the GMDSS, provided by the U.S. Coast Guard Navigation Center, is accessible via the Internet, as follows:

U. S. Coast Guard Navigation Center

http://www.navcen.uscg.mil/marcomms/default.htm

Global Positioning System (GPS)

The NAVSTAR Global Positioning System (GPS) is a satellite-based system, operated by the U.S. Air Force, which provides very accurate positioning, time, and velocity information to multiple users. It is an all-weather system with world wide and continuous usage which will replace OMEGA and other such hyperbolic radio navigation systems. The space component of GPS consists of 24 satellites, of which a minimum of six are observable from any place on earth. GPS receivers convert data from the satellites to produce three-dimensional positions (latitude, longitude, and altitude). They compute information for fixes in terms of the World Geodetic System (1984) reference ellipsoid; hence, a datum shift correction may be required before a position can be plotted on a chart.

GPS provides two services for navigation positioning, but accuracy of a fix also depends upon the capability of user equipment.

Standard Positioning Service (SPS) is the standard level of positioning and timing accuracy. It is available without restrictions to any user on a continuous world-wide basis and provides horizontal accuracy to approximately 100m.

Precise Positioning Service (PPS) is limited to authorized users and provides horizontal accuracy to approximately 30m.

SafetyNET

NAVTEX is an international automated direct printing service for th promulagation of navigational and meteorological warnings and urgent information to ships. It is a component of the World Wide Navigational Warning Service (WWNWS) and is an essential element of GMDSS.

The SafetyNET broadcast system provides the same information as NAVTEX to vessels on the high seas beyond NAVTEX coverage (generally about 200 miles offshore) and is delivered by the INMARSAT-C system.

Note.—For further information concerning the International Maritime Satellite Organization (INMARSAT), the Global Maritime Distress and Safety System (GMDSS), the SafetyNET system, and the Global Positioning System (GPS), see Pub. No. 9, The American Practical Navigator (Bowditch); Pub. 117, Radio Navigational Aids; and Annual Notice to Mariners No. 1.

Optical Phenomena

Optical phenomena, whose frequency reaches a maximum in polar regions, range from electromagnetic displays to intricate geometrical patterns. The Aurora and Saint Elmo's Fire are electromagnetic displays. Halos, coronas, parhelia, sun pillars, and related effects are optical phenomena associated with the refraction and diffraction of light through suspended cloud particles; mirages, looming, and twilight phenomena such as the "green flash" are optical phenomena associated with the refraction of light through air of varying density. Occasionally sunlight is refracted simultaneously by cloud suspensions and by dense layers of air producing complex symmetric patterns of light around the sun. A mirage is caused by refraction of light rays in a layer of air having rapidly increasing or decreasing density near the surface. A marked decrease in the density of the air with increasing altitude is the cause of such phenomena known as looming, towering, and superior mirages. Looming occurs when objects appear to rise above their true elevation. Objects below the horizon may actually be brought into view. This apparent effect often leads to a serious underestimation of horizontal distances. Unimpressive landmarks, small icebergs and distant ships may acquire startling characteristics through apparent vertical stretching; this phenomenon is known as towering. A superior mirage is so named because of the appearance of an image above the actual object. Ships have been seen with inverted image above and an upright image floating above that. Apparent crowding of icebergs often results from the following affects of looming and superior mirages: flows lifted from below the horizon, reduced distances, skyward reflection of surface ice, and appearance of a mirage horizon on which the surface bergs are faintly duplicated.

Inferior mirages result from the upward bending of light rays in an unstable air mass. In the Arctic this phenomenon is observed locally whenever a superheated land mass or a wide expanse of open water is overrun by cold air, a condition that is most likely to occur in summer. Sinking below the horizon of relatively close objects may result in an overestimation of horizontal distances.

Occasionally a complicated vertical temperature distribution may transform hilly coastlines and small ice barriers into impressive walls of lofty pinnacles. This phenomenon is known as Fata Morgana.

On clear days, just as the upper rim of the sun disappears below the horizon, green light is sometimes refracted from the solar spectrum. This brief phenomenon is called the "green flash."

Floating ice crystals (cirriform clouds, light snow flakes, ice fog, or drifting snow) may cause the refraction of light into a variety of faintly colored arcs and halos. This phenomenon, which may be recognized from the fact that the red band is closest to the light source, includes halos, arcs that open toward or away from the sun, mock images, and various geometrical figures that may be located in various parts of the sky with reference to the sun.

Fogbows, resulting from refraction through suspended water particles, are seen in the region of the sky directly opposite from the sun, or the antisolar point. These bows, although occasionally brilliantly colored, are normally seen as broad white bands with faintly colored borders. Rainbows are also observed in the Arctic.

When atmospheric particles are about equal in size to the wavelength of light, diffraction is likely to occur. Diffractional phenomena frequently show properties analogous to those of refraction except for the reversal in the spectrum colors; violet now being closest to the source of light. Many of the optical phenomena witnessed in the Arctic arise through diffraction. The Brocken Bow, or Glory, appears on clouds or fog banks as a colored ring around the projected shadow of the observer's head. The solar and lunar coronas, which are observed only

through high clouds, resemble the halo except that they may assume increasingly larger diameters as the size of the particle decreases. When the light from the sun or the moon is diffracted by cirrus or cirrostratus, iridescence may sharply delineate the outline of clouds in brilliant green, blue, pink, orange, or purple. Polar observers may also witness the reversed colors of reflected iridescence near the antisolar point.

Reflection of sunlight takes place whenever the intervening particles are larger than the wavelength. Thus, sunlight that is reflected from ice crystals is transformed into sun pillars and parhelic circles. When both phenomena occur in combination they form the remarkable sun cross. Paricelenci circles are observed with moonlight.

Among the other reflection phenomena commonly observed in the Arctic are iceblink, landblink, and water sky. Iceblink and landblink are caused primarily by the yellowish white glare of highly reflective ice and snow fields on the underside of a stratus overcast. Water sky is a relatively dark reflection from open water. The sharp contrast in sky brightness, which may be seen from great distances, is often used to advantage in guiding polar ships toward otherwise invisible channels, hence, the name sky map. The bleak monotony of the Arctic regions is often dispelled by colorful sunrises and sunsets caused by multiple scattering of sunlight.

The Aurora Borealis (Northern Lights) and St. Elmo's Fire are two types of electrical phenomena frequently observed in this region. The zone of maximum auroral frequency extends along the periphery of a 20 to 25 degree circle whose center is at the magnetic pole. Consequently, the belt of maximum auroral activity is located approximately along a line connecting Severnaya Zemyla, Tromso, the S extremity of Greenland, northern Labrador, and Aklavik. Auroras are generally associated with moonless nights. An artificial maximum exists in winter because of the long hours of darkness. No conclusive evidence is available to show that a seasonal variation in the frequency of auroras exists. However, periods of intense sunspot activity are reflected in a maximum occurrence of this electrical phenomenon.

Generally auroras may be classified as having either a ray structure (rays, currents, draperies, corona) or a nebulous appearance (homogenous quiet arc, homogenous band, pulsating arcs, pulsating surfaces, diffuse luminous surfaces, and feeble glow). Flaming auroras, which fall in neither category, may be added to this list. Moreover, auroras may remain uniformly red, green, or purple, or assume a rapid succession of these colors. Brilliant shifting auroras are invariably accompanied by magnetic storms and electrical interference with communications.

St. Elmo's Fire is occasionally observed in this area, but because of its faintness it is most commonly observed during the night hours and when there are dark overcast days. These eerie flickers of bluish light are usually caused by the unusual electrification of the snow filled air which is most likely when the wind is strong. St. Elmo's Fire is restricted to the tips of such objects as ship masts, wind vanes, and airplane wings.

Abnormal Refraction

Abnormal refraction is not confined to particular geographical areas; however, meteorological conditions in the Arctic are such that this phenomenon may be expected more frequently. Arctic regions are most conducive to this condition due to the marked difference between sea and air temperatures, and as a result, there are frequent occurrences of extra long range visibility or some form of mirage when comparatively warm light winds pass over cold ice surfaces, or when cold winds blow over open water. This refraction is also caused when temperatures over open water are higher than those over an adjacent ice-covered coast.

Looming, which is the apparent rising of an object over the horizon, is one form of abnormal refraction. This occurs quite frequently at sea in high and middle latitudes and is manifest by the appearance of distant objects, which may actually be below the normal horizon at the moment of observation.

Looming can appear in two forms, one in which the observed object is apparently increased in height but not in size, or in which the object is increased in size and appears much nearer the observer.

The atmospheric condition responsible for looming is an abnormal decrease in the density of the air from the surface upward, with the resultant downward curvature of the light rays. As the density decreases with height, the more marked are the visual aberrations. When the rate of decrease in density is variable at low heights, the shape of the looming object becomes bulged and distorted. There may also be a thinning, flattening or pointing of the reflected image, in such a case a distant rounded peak may loom in its natural shape, appear with a distant flat summit, or with a distorted summit and appearing in closer proximity than its base. The appearance may also differ when viewed from the height of the masthead as opposed to the deck level.

Another form of abnormal refraction, known as superior mirage, is manifested by the apparent reflection from a mirror-like atmospheric condition where a pronounced inversion exists at a distance of several meters above the surface. An abnormal change in density results from this inversion producing very marked refraction. To the eye, it appears as an inverted image above the object and under certain conditions, a second image appears erect, close above the inverted image. In some instances the actual object may not be seen, but the inverted image or the erect image can only be seen.

The common factor with both looming and superior mirage is the condition of inversion of temperature where a warm layer of air is present over the sea at a suitable height. However, in the case of superior mirage, there is a more abrupt change from cooler to warmer air at certain heights.

Mirage effects near land appear from the ship as an unnatural image of the coastline, perhaps appearing singly, double or even triple. The mirage may also convey the impression that the coast is either more distant or closer than in actuality.

At sea, beyond range of land, ships and icebergs are the commonest forms of mirage. Ocean fog also contributes to mirage effects as the same factors such as temperature and humidity variations are present. Mirage is not visible in dense fog, but the erroneous reporting of fog itself may result from these suitable atmospheric conditions.

Routes

Recommended Routes

The Recommended Routes has within it routes to and from ports and junction points in the Arctic Ocean, and where applicable, navigational notes on a particular passage. For the

most part these routes are as direct as safe navigation permits; in some cases, divergences are made to avoid dangers to navigation or maximize/minimize the effects of a favorable/adverse current.

The arrival or departure positions are generally anchorages or pilot grounds.

Navigation in Waters Adjacent to Russia

The latest Russian charts and publications give only sufficient information for navigation to the ports open to international trade. NIMA Charts and Sailing Directions, as they are corrected and revised, will in general only give the information provided by Russia. Other navigational aids may exist and caution will be necessary to avoid the possibility of mistaken identification.

Atlantic to the Pacific (Northwest Passage)

Spans the North American Arctic from Davis Strait and Baffin Bay in the E to Bering Strait in the W, and has four potentially feasible routes. The E entrance or exit for all routes lies through Lancaster Sound (74˚15'N., 80˚00'W.); the W entrance or exit is in Amundsen Gulf (70˚45'N., 125˚00'W.).

In 1969, the first commercial ship, the S.S. Manhattan, a large tanker displacing nearly 150,000 tons and specially reinforced for this purpose, traversed the Northwest Passage via Lancaster Sound, Barrow Strait, Viscount Melville Sound, Prince of Wales Strait, and Amundsen Gulf. Throughout this voyage, a Canadian icebreaker was in constant attendance and on numerous occasions was forced to free this larger ship.

An attempt was made to penetrate the length of M'Clure Strait, but heavy ice beset the ship on several occasions, and this attempt had to be abandoned in favor of the route through Prince of Wales Strait.

Atlantic Routes to the Arctic Ocean

There are two practicable routes for surface vessels from the Atlantic Ocean between Canada and Greenland to the Arctic Ocean; both are restricted to icebreakers for short periods, normally in the latter part of August.

The first route lies through Nares Strait, which leads off the N end of Baffin Bay.

The second route runs through Jones Sound, which opens off the NW side of Baffin Bay, Norwegian Bay, Eureka Sound and Nansen Sound; the two latter sounds form the channel between Ellesmere Island and Axel Heiberg Island.

Inner Routes—West Coast of Greenland

Between Frederiksdal (60˚00'N., 44˚40'W.) and Kraulshavn (74˚07'N., 54˚04'W.) there are sheltered inner routes through the channels among the islands which fringe the W coast of Greenland. Local knowledge is required to use these routes which, in general, can be used by coastal vessels up to 40m in length and 3.5m draft. Some parts are navigable by larger vessels while, in other places, they are restricted to small craft only. Descriptions of those routes which have been surveyed are given in Pub. 181, Sailing Directions (Enroute) Greenland and Iceland.

Northern Sea Route

The Northern Sea Route passes out of the Barents Sea into the Kara Sea by way of one of the four following routes:

1. Through Proliv Yugorskiy Shar—this strait lies between Ostrov Vaygach (70˚N., 60˚E.) and the mainland.
2. Through Proliv Karskiye Vorota—this strait separates the N end of Ostrov Vaygach from Novaya Zemlya.
3. Through Proliv Matochskin Shar—this strait nearly divides Novaya Zemlya in half.
4. Around the N end of Novaya Zemlya.

This is a shipping lane that extends from Murmansk to the Bering Strait along the entire Arctic seaboard of Russia. This route is considered as also including extensions to Arkhangel'sk, in the White Sea (Beloye More), to various ports up the navigable rivers flowing into the Arctic Ocean, and to Vladivostok via the Bering Strait. The Northern Sea Route is normally available to shipping from mid-July to the end of October; the dates varying each year with the prevailing ice conditions. The total distance along the extended route is about 5,800 miles and the passage between Vladivostok, at the E end, and Arkhangel'sk and Murmansk, at the W end, usually takes about 6 weeks.

Since 1980, it was reported that the route was kept open by ice breakers for 100 to 120 days a year from late July to early November, the dates varying each year depending on ice conditions. The objective is to open the route for the whole year and this has been achieved to some extent at the W end. It is not expected that year-round navigation at the E end will be practicable before 1985. About 15 icebreakers were operating along the route in 1980, three of them nuclear powered, but of these, only five were at the E end.

Most vessels using the Northern Sea Route are ice-strengthened for navigation and are usually restricted to a maximum draft of 7.6m; this is because, apart from anchorage limitations, deeper draft vessels run the risk in unfavorable conditions of being forced into shallow water, grounding, and being crushed by the ice. Coal burning vessels of 1,500 to 2,500 tons are generally used locally along the route.

The Organization for the Administration of the Northern Sea Routes was established for the purposes of ensuring the safety of mariners and protecting from pollution the sea and the N coast of Russia.

In January, 1973 a convoy of vessels, escorted by ice breakers, arrived in Murmansk from the estuary of Reka Yenisey, after a voyage of 17 days.

In 1979 and 1980, the Russian icebreaker fleet kept navigation open all the year round in the western section between Murmansk (68˚59'N., 33˚04'W.) and Reka Yenisey (71˚24'N., 83˚01'N.).

In view of the low visibility frequently experienced, radiobeacons are, in general, the most valuable form of navigational aid along the northern sea route; however, insufficient reliable information has been received to enable such aids to be included in NIMA Charts and Publications. Up to date information should be obtainable from the icebreaker pilotage service. In 1979, it was reported that automatic lights and radio beacons were being installed on the N coast of Russia.

Icebreaker pilotage is available, on request, for the whole of the Northern Sea Route. For the W part of the route, from the W entrance to Kara sea to 125˚E, pilotage is provided from Gavan' Dikson (73˚30'N., 80˚31'E.). Gavan' Dickson is also the headquarters of Navigation Service West. For the eastern part, from 125˚E to the Bering Strait, it is provided from Pevek

(69˚45'N., 170˚20'E.), the headquarters of Navigation Service East.

Ice breaker pilotage is compulsory for all vessels using Proliv Borisa Vil'kitskogo or Proliv Shokal' Skogo, between approximately 98˚ and 108˚E, the precise limits depending on the prevailing ice conditions.

Icebreaker pilotage is also compulsory for vessels passing through Proliv Dmitriya Laptev (73˚00'N., 142˚00'E.) and Proliv Sannikova (74˚30'N., 140˚00'E.).

Icebreaker pilotage may be effected in one of the following ways:

1. A pilot embarked in each ship.
2. Ships, with or without pilots on board, being led by an icebreaker or ice strengthened vessel.
3. Guidance from a patrolling aircraft.
4. Instructions broadcast by radio.

The decision as to which method shall be employed on each section of the route will be taken by Navigation Service West, or East, or by the captain of the icebreaker. These authorities will also issue instructions as to where the icebreaker or the pilot are to be met, and the route to be followed by ships proceeding independently.

Track of the Northern Sea Route

Vessels heading E from Nordkapp, Murmansk, or the White Sea can pass either N or S of Ostrov Kolguyev. From Nordkapp or Murmansk the N route is shorter; from the White Sea the S route is less in distance, but passes close by the dangerous Koshki Ploskiye (Tonkiye Koshki), and also along the low Timanskiy Bereg, where foggy weather is common. Due to the ice accumulation E of Ostrov Kolguyev, vessels may be forced to take the S route along Timanskiy Bereg where there might be a relatively ice-free channel available.

The optimum route depends on the time of the year, ice and weather conditions, and experience of the master of the vessel. Some vessels which have found the channel E of Ostrov Kolguyev closed by ice have gone N, then approached Ostrov Matveyev (69˚28'N., 58˚30'E.) and Ostrov Dolgiy and made their way along the coast, where it is possible that there may also be a channel free from ice leading to Reka Pechora.

Vessels using Proliv Yugorskiy Shar are generally bound to the Kara Sea, which, due to ice is rarely navigable earlier than August. When there is generally no ice W of Proliv Yugorskiy Shar; such vessels take the N route past Ostrov Kolguyev.

Vessels bound for Reka Pechora, because of the brief period of navigation in Pechorskaya Guba, try to pass Ostrov Kolguyev between the middle of June and the middle of July, when the sea E of Ostrov Kolguyev is usually filled with ice; these vessels take the S route along Timanskiy Bereg.

Generally, when bound for Pechorskaya Guba or Proliv Yugorskiy Shar from either Nordkapp or the White Sea, the S route is recommended until August and the N route after August.

The waters and coasts E of Mys Kanin Nos have not been closely examined and all usual precautions should be taken.

From Nordkapp or the White Sea, vessels intending to pass S of Ostrov Kolguyev should make for Mys Kanin Nos in order to check position, but take care to keep in depths of more than 40m due to the strong and variable currents off the N coast of Poluostrov Kanin.

From a position 14 miles NNW of Mys Kanin Nos, steer 100˚ for position 68˚44'N, 45˚53'E, and then alter course to 103˚ to pass 12 miles S of Koshki Ploskiye. When 15 miles S of the light structure at the E end of Koshki Ploskiye, steer 060˚ until in position 69˚05'N, 52˚40'E, keeping more than 10 miles off Timanskiy Bereg. Then, if bound for Pechorskaya Guba, steer 090˚ for a position with Gulyayevskaya Koshka No. 3 Light (68˚54'N., 55˚32'E.) bearing 174˚, distance 10 miles. Vessels bound for Proliv Yugorskiy Shar head to pass 5 miles N of Ostrov Matveyev. When approaching Ostrov Matveyev, caution is necessary to avoid being set S into the passage between that island and Ostrov Dolgiy, or on to the latter island, and vessels should keep, if possible, in depths of not less than 27m. If uncertain of the position in thick weather, or at night in autumn, when in the vicinity of Ostrov Matveyev and when in a depth of 18m or less, vessels should anchor immediately.

From Nordkapp or the White Sea, vessels intending to pass N of Ostrov Kolguyev make for position 69˚59'N, 48˚12'E. If heading for Pechorskaya Guba, steer 120˚, which leads in depths of more than 40m off the NE coast of Ostrov Kolguyev to position 69˚05'N, 52˚40'E, given above, then continue as previously directed. If proceeding to Proliv Yugorskiy Shar, from the former position, steer to pass 5 miles N of Ostrov Matveyev. See Pub. 183, Sailing Directions (Enroute) North Coast of Russia for more information and directions.

Vessels bound for the Kara Sea

When approaching 32˚E, vessels bound for Kara Sea must apply for sailing directions by radio to the Chief of the Kara Sea Navigation Service, located on Ostrov Dikson (73˚30'N, 80˚20'E.). Instructions will then be given for the vessel to proceed either through the straits S of Novaya Zemlya or pass N of that island. In addition, information on ice conditions will be provided, and whether the assistance of an icebreaker will be required, together with the position of the icebreaker and the position of the pilot vessel if proceeding through Proliv Yugorskiy Shar, along with the call signs of such vessels. Vessels should then proceed as instructed, notifying the Kara Sea Navigation Service 24 hours before reaching either Proliv Yugorskiy Shar or the N point of Novaya Zemlya.

West Approach to the Kara Sea

Vessels approaching the Kara Sea from the W will have determined via radio from the Chief of the Kara Sea Navigation Service, situated on Ostrov Dikson, which of the four possible routes mentioned above is clear of ice. The vessel must give 24 hours notice of approach and must at the same time ask for further sailing instructions, and for recommendations regarding the possibility of navigating Kara Sea either alone, or with icebreaker assistance; the vessel will then be informed as to where to meet the pilot vessel or icebreaker and provided with the code numbers of such vessels.

Vessels navigating the Kara Sea and Reka Yenisey, must keep the authorities informed as to their positions through the nearest radio station, Amderma or Dikson; the position, weather, and sea conditions must be reported twice each day at 0300 and 1500 (Moscow time). In the event of ice being encountered, the vessel's position, and weather and sea condition, must be reported immediately; a vessel in need of icebreaker assistance must await instructions as to movements,

and requests for such assistance must be made through Dikson radio station.

The master of a vessel which requires icebreaker assistance should bear in mind that the icebreaker can arrive at the position of the vessel within 48 hours of the request to the Chief of the Kara Sea Navigation Service, but if in the opinion of the Service the ice situation is not of emergency, a plane will be sent to investigate the ice zone; the Service will then advise the vessel as to how to proceed, without aid, to open water, or to move to another area more favorable from the point of view of ice conditions.

The above regulations also apply to vessels proposing to proceed W from Kara sea. Of the four above routes, the shortest passage from Nordkapp (North Cape) to Ostrov Belyy is through Proliv Matochkin Shar, the next shortest through Proliv Karskiye Vorota, and the next through Proliv Yugorskiy Shar. If proceeding to Obskaya Guba, the route N of Novaya Zemlya is shorter than by Proliv Yugorskiy Shar, and if proceeding to the mouth of Reka Yenisey it is even shorter than that by Proliv Karskiye Vorota.

Subject to the above general regulations, when approaching Kara sea, the vessel should determine which of the straits is clear of ice and steer for it. The Arkhangel'sk and Proliv Matochkin Shar radio stations transmit data of the ice observations of the Kara Hydrometeorological Stations daily, to which will be added, during the navigational season, particulars of the ice, which will be communicated to vessels in Kara sea at the same.

Due to the limited range of visibility, the observations of the Kara stations only give the ice conditions in their vicinity. If, for example, Yugorskiy Shar and Vaygach report the absence of ice in the straits and at sea on the horizon, this does not always signify that there is no ice at all near the straits; for the edge of the ice may be from 15 to 20 miles from the entrance to them, having been borne away by the tidal currents and the wind. Therefore, before finally selecting the route for passing into Kara sea, the observations of the stations for several days previously should be studied. A sharp drop in the temperature of the surface water at the stations with the wind blowing from the sea; fog remaining on the horizon at sea; the prevalence of winds from the direction in which the ice may be moving; all this taken together may help to give a good idea of the ice conditions.

Should a vessel have no information concerning the ice except that sent by the radio stations, it should proceed to Proliv Yugorskiy Shar or Proliv Karskiye Vorota, preferably the former; if these straits are closed by ice or the ice is concentrated immediately E of them, it should proceed to Proliv Matochkin Shar, provided the latter is not ice bound or the observatory cannot see any ice at sea.

If all the straits are clear of ice, but the state of the ice beyond is unknown, at the beginning of navigation it is best for the vessel to make for the S straits, since the ice E of them is usually weaker in structure and more passable than on the parallel of Proliv Matochkin Shar. The route through Proliv Karskiye Vorota should only be selected in preference to that through Proliv Yugorskiy Shar when it is quite certain that there is no ice farther E or that it is open and easy to pass through; usually, if the ice remains NE of Proliv Yugorskiy Shar, it is also E of Proliv Karskiye Vorota.

If the ice conditions in the SW part of the Kara Sea and E of Proliv Matochkin Shar are unfavorable, it is sometimes possible and even easier to proceed round the N end of Novaya Zemlya. There have been years when the routes through all the straits or E of them, as well as round the N end of Novaya Zemlya, have been closed by ice.

Should ice conditions in the SE part of the Barents Sea hinder a vessel bound into Kara Sea and force her to await better conditions, there is no available anchorage affording shelter from all winds. In such conditions, a vessel should either take shelter under the lee side of Ostrov Kolguyev or run for temporary shelter in Guba Belyush'ya or Guba Chernaya, should these not be closed by ice. It should be kept in mind that should there be considerable quantities of ice in the E part of Pechorskaya Guba, though the entrance to Guba Chernaya may be clear of ice, a shift of wind S will send the ice into the entrance and may temporarily obstruct it. Shelter from easterly winds can also be obtained in Bukhta Indiga.

Proliv Yugorskiy Shar is marked by ranges and beacons and navigation through it presents no great difficulty, but, for all that, it requires great care. The channel is also buoyed, but the buoys cannot be relied on. Due to the ice they may not be in position or they may be carried away by it. Vessels are strongly advised not to attempt the passage of the strait in fog, because of the strong tidal currents.

Vessels proceeding to Proliv Yugorskiy Shar from the W are usually subject to a N drift, and often in thick weather find themselves N of the entrance to the strait, possibly off Lyamchina Guba; sometimes also between Ostrov Matveyev and Proliv Yugorskiy Shar a vessel may be subject to the effect of strong irregular currents setting N and NNW at a rate of 4 knots. In this case the vessel may find herself off Ostrova Karpova, near one of which there is an outlying rock which from a distance resembles a beacon. Occasionally, although such cases must be considered as exceptional, vessels during the 90 mile passage from Poluostrov Russkiy Zavorot to Ostrov Matveyev have been carried 6 miles S.

Proliv Karskiye Vorota, being much wider and deeper than Proliv Yugorskiy Shar, is not well marked; its shores are rugged and have numerous dangers extending off them, mainly from the SE coast of Novaya Zemlya. Though many vessels have passed safely through Proliv Karskiye Vorota, which tends to show that there are no sunken dangers in the middle part of it, this cannot be confirmed until it has been properly examined. In case of fog, a fairly frequent occurrence, it is very difficult to anchor in the strait because of the depth. Navigation through Proliv Matochkin Shar presents no difficulties. In thick weather both entrances are difficult to identify, and it is better not to enter it in fog.

Although there is a greater probability of encountering heavy and difficult ice in the passage N of Novaya Zemlya, and although it is only infrequently navigated by cargo vessels, there are numerous cases of special vessels having used this route and in some years they have not met with any ice; this proves that the route presents no special difficulties to vessels built for navigating in the ice.

A vessel using this route should make her landfall off the prominent Poluostrov Admiralteystva, and then range the NW coast of Novaya Zemlya, bearing in mind that icebergs from the various glaciers on this coast may be encountered, especially N of Mys Nassau.

The course from Proliv Karskiye Vorota or Proliv Yugorskiy Shar to NW of Ostrov Belyy depends upon the position of the ice in the Kara Sea. If the sea is clear of ice, a course may be steered from Proliv Karskiye Vorota direct to a position about 25 miles NW of **Mys Ragozina** (73˚23'N., 70˚00'E.), the NW end of Ostrov Belyy, or from Proliv Yugorskiy Shar to about 55 miles W of Mys Skuratova, and then to about 25 miles NW of Mys Ragozina. It is also recommended to steer from Proliv Yugorskiy Shar direct towards Mys Kharasovoy, and identify the light beacon there, and then to proceed N, keeping from 10 to 20 miles off the western coasts of Poluostrov Yamal and Ostrov Belyy, avoiding the banks. If there is much ice in the Kara Sea, it may be necessary to steer SE along the coast, keeping S of the ice, and gradually turn N along the W coasts of Poluostrov Yamal and Ostrov Belyy.

Ostrov Belyy to Proliv Borisa Vil'Kitskogo or Proliv Shokal'skogo

For a vessel proceeding from the vicinity of Ostrov Belyy to the Laptev Sea by way of one of these straits, there is a choice of two routes depending upon ice conditions. The first, or inshore route, is that ranging the mainland shore. The second, or offshore route, passes W of Ostrov Sverdrup, then N in order to make Ostrov Uedineniya, then E so as to pass between Ostrov Kirova and Ostrov Voronina, and into either of the straits.

During N or W winds, the inshore route becomes hindered by great concentrations of ice being pressed towards the coast and the various islands near it. Under such conditions a vessel may sometimes be able to proceed by taking advantage of the loosened ice under the lee of islands, shoals or grounded ice. This route requires great caution, due to the incomplete nature of the surveys and to the possibility of the existence of uncharted dangers. For this reason a vessel should only proceed among the various islands lying close off the mainland in case of absolute necessity and when ice conditions are easier among them than farther offshore. In some years the fast ice remains during the early part of the navigation season along the coast, and even as late as the middle of the season in the various inlets. The seaward limit of the fast ice may generally lie about the 18m contour.

During prolonged N winds it frequently happens that the pressure of ice towards the coast is so heavy as to render passage near the coast very difficult or impossible until the wind shifts S. In such cases a route farther offshore may be practicable, since there may be more open conditions under the lee of the banks N of the 79˚N.

From the Kara Sea to Laptev Sea

There are three possible routes from Kara Sea to Laptev Sea: through Proliv Borisa Vil'kitskogo, through Proliv Shokal'skogo, and N of Severnaya Zemlya. Of these three routes the shortest, best marked, and best known is Proliv Borisa Vil'kitskogo (78˚00'N., 104˚00'E.). Icebreaker assistance is usually required during the early part of the navigation season. The choice between Proliv Borisa Vil'kitskogo and Proliv Shokal'skogo will depend mainly on the ice conditions in them and in the Laptev Sea. An icebreaker has passed from the Kara Sea N of Severnaya Zemlya and proceeded to the SW part of the Laptev Sea. This route has not been in use by shipping.

Proliv Shokal'skogo can be navigated by vessels of virtually any draft dependent only upon ice conditions in it and in the Laptev Sea. In the early part of the navigation season, up to the beginning, and sometimes even until the middle of September, the ice is usually fairly dense along the E shores of Severnaya Zemlya and Poluostrov Taymyrskiy; in some seasons this ice is a serious obstacle to navigation.

In years when there are large amounts of ice its S boundary may reach almost as far S as the coast in the vicinity of Khatangskiy Zaliv and Anabarskiy Zaliv. As this ice melts and breaks up its S edge retreats N, sometimes fairly rapidly, and considerable areas, in which the flows are sparse or which may be completely clear of ice, may appear. In view of the fact that the clearing of the ice in the N part of the Laptev Sea is produced by the effect of the warm outflow from the various rivers and takes place from S to N, it may be assumed that the ice will be least dense E of Proliv Borisa Vil'kitskogo than E of Proliv Shokal'skogo. It should also be kept in mind that icebergs abound in Proliv Shokal'skogo and constitute a serious danger in thick weather. In spite of these remarks, ice conditions may prove to be easier in Proliv Shokal'skogo than in Proliv Borisa Vil'kitskogo.

The possibility of using the route N of Severnaya Zemlya has been demonstrated by the icebreaker Sibiryakov, which rounded Mys Molotova on August 15th, 1932, and proceeded S to the NE coast of Poluostrov Taymyrskiy. The icebreaker Sadko, when N of Mys Molotova in 1935, reported that there was a clear passage into Laptev sea, though ice could be seen on the E horizon.

Proliv Borisa Vil'kitskogo to Khatangskiy Zaliv

Should there be no ice in the Laptev Sea, a vessel proceeding to Khatangskiy Zaliv and having passed through Proliv Borisa Vil'kitskogo should steer to pass about 6 miles N of Ostrova Komsomol'skoy Pravdy; it should then steer about 118˚ to pass about 18 miles off the extremity of Poluostrov (Taymyr) Povorotnyy. When approaching Ostrov Andreya in thick weather, soundings will afford some indication of the vessel's distance offshore. The vessel should continue on course 118˚ until on the meridian of the E extremity of the northernmost of Ostrova Petra (Pyotr Islands), when it should steer 142˚ for about 43 miles, and when on the parallel of the S extremity of the S of Ostrova Petra, Ostrov Yuzhnyy, it should alter course to 180˚ and proceed until it has passed the 4.6m patch reported to lie about 13 miles ESE of Mys Vos'mogo Marta, when it may haul W so as to identify Marii Pronchishcheva beacon. Then it should steer to pass about 6 miles E of Ostrov Preobrazheniya, which is an excellent landmark.

When pack ice is present in the Laptev Sea, vessels are usually assisted by an ice breaker; should it be possible for them to proceed unescorted; directions as to choice of route will be given by the ice breaker.

Proliv Borisa Vil'kitskogo to Bukhta Tiksi

A vessel proceeding to Bukhta Tiksi, having passed about 6 miles NE of the NE end of Poluostrov (Taymyr) Povorotnyy, should steer for position 76˚51'N, 112˚45'E, and then steer ESE to a position 25 miles NE of Ostrov Sagyllakh Ary (Khayyalakh), which has a radio beacon on it, thus passing between the coastal shoals off the NE side of the Lena Delta and the

outlying dangers. A wreck, whose position is approximate, has been charted in this vicinity.

Because of the low-lying land and fringing shoals of the delta of Reka Lena, it is impossible to fix a vessel's position by landmarks. Soundings are of little assistance, and celestial observations may be impossible or inaccurate because of weather conditions. Careful attention to dead reckoning and frequent current observations is necessary.

Non-tidal variations in sea level of about 3m, or in some cases as much as 5m, may occur in parts of the Laptev Sea and the East Siberian Sea, including Proliv Dmitriya Lapteva and Proliv Sannikova; warnings of the onset of these variations are given in local forecasts.

Proliv Borisa Vil'Kitskogo to Proliv Dmitriya Lapteva

Vessels bound E via Proliv Dmitriya Lapteva should continue on the above ESE course up to 130˚50'E, then change course for the W entrance of the Strait. Several shoals have been reported near this track and little is known of the depths; precautions are advised.

Proliv Borisa Vil'Kitskogo to Proliv Sannikova

Vessels bound E via Proliv Sannikova should pass N of **Ostrov Semonovskiy** (74˚14'N., 133˚12'E.). Caution is necessary as the island has disappeared; Banka Semenovskaya, a shoal with a depth of 1.8m, now exists in its place.

When at about 130˚E, the depths will decrease rapidly from about 29.3 to 40.2m, to about 11.9 to 20.1m. This decrease in depths is more sharply defined N of 75˚N than S of that parallel. The high coast of Ostrov Stolbovoy and the cliffs near the S end of Ostrov Kotel'nyy are all good landmarks.

Having reached the meridian of Ostrov Stolbovoy, the depths will increase to about 18.3 to 21.9m. Vessels have experienced a northerly set of 40 miles on passage from Proliv Borisa Vil'kitskogo to Proliv Sannikova, and have found themselves near Ostrov Bel'kovskiy; this island is steep-to and soundings give no warning of a vessel's approach to it. Should a vessel, having passed over the comparatively shallow depths N of Ostrov Semonovskiy, find that the depths increase to about 40.2m, this will probably be an indication that she is N of the track. It should be kept in mind that isolated depths of 40.2 to 43.9m exist off the N end of Ostrov Stolbovoy, which is steep to, so that extreme caution is necessary in thick or foggy weather.

East Siberian Sea and Western Approaches

There are three possible routes from the Laptev Sea to the East Siberian Sea; through Proliv Dmitriya Lapteva, through Proliv Sannikova, or N of Novo Sibirskiye Otrova. Proliv Dmitriya Lapteva is available only for vessels drawing not more than 6.7m.

Proliv Sannikova (74˚30'N., 140˚E.) can be used by vessels of virtually any draft, but though its navigation from W to E is comparatively easy, passage in the opposite direction is rendered difficult for vessels drawing more than 7.9m by the shallow nature of the W part of the East Siberian Sea, the depths and currents in which are little known.

Vessels passing through Proliv Sannikova from E to W should steer for position 73˚40'N, 150˚00'E. Then they should steer to make good a WNW course until 142˚E, when they should steer to make good a W course and pass through the strait along 74˚30'N. It should be kept in mind that the strait and its E approaches have not been closely examined, and isolated shoals or patches may exist. Should it not be possible to determine the direction and rate of the current from astronomical observations, the vessel should anchor from time to time and take observations of the current before proceeding further.

East Siberian Sea and Eastern Approaches

During the navigation season, the shipping route from Proliv Longa (70˚00"N., 180˚00'.) W as far as Reka Kolyma (69˚30'N., 161˚00'E.) is restricted by ice conditions to a shore lead which is usually opened by offshore winds and narrowed by onshore winds. Only temporary passages are formed along the section of coast between Mys Billingsa and Mys Shmidta, where ice conditions are most uncertain and the lead may be closed completely. Vessels up to 1,500 dwt with a draft of not over 4.5m, are reported to be the most suitable unstrengthened types for this passage. Deeper draft vessels must be strengthened and may require icebreaker assistance for the most efficient passage. The W part of the East Siberian Sea, as far E as the Reka Kolyma, is usually clear during the navigation season S of a line from Ostrova Lyakhovskiye to Ostrova Medvezh'i.

Westbound vessels having arrived at a position about 30 mile N of Mys Shelagskiy proceed to position 70˚23'N, 169˚04'E; then the route recommended by the Russian Sailing Directions is to head WSW to a position about 5 miles N of Mys Bol'shoy Baranov which is a good mark on this section of coast. Then vessels bound for the straits of Novosibirskiye Ostrova set a course to pass NE of Ostrova Medvezh'i, keeping about 10 miles off the group. Vessels bound for Ostrov Chetyrekh-stolbovoy NNW from a position 5 miles N of Mys Bol'shov Baranov.

Passage—The Chukchi Sea

Vessels passing through the E section of the Chukchi Sea from the Bering Strait to the Beaufort Sea are recommended to use the following directions:

From the Bering Strait, E of Fairway Rock, in position 65˚38'N, 168˚31'W, proceed to position 68˚21'N, 167˚18'W, W of Point Hope. From W of Point Hope proceed to position 68˚58'N, 166˚40'W, NW of Cape Lisburne. From NW of Cape Lisburne proceed to position 70˚34'N, 162˚25'W, NW of Icy Cape. From NW of Icy Cape proceed to position 71˚20'N, 156˚55'W, W of Point Barrow.

Ice conditions may affect navigation N of Point Hope.

Bering Sea Coast Routes

This route is part of the Northwest Passage, which connects the Pacific Ocean with the Atlantic Ocean N of the American Continent. A through passage is rarely attempted by any one vessel in a single season because of the shortness of the season and unpredictability of ice conditions.

Southeast Coast of Siberia—Coastal Routes

Because of exceptionally unfavorable weather conditions, caused by ice and long periods of fog, the Russian authorities have instituted recommended one-way tracks, separated by as much as 20 miles in places, for the use of shipping off the SE coast of Siberia. Ships should follow the recommended tracks,

but if forced to deviate from them, should do so to starboard if possible.

The tracks run through an extensive Russian exercise area off the SE coast of Poluostrov Kamchatskiy and through a mined area off Mys Shipunskiy.

Vessels bound N to Provideniya (64˚20'N., 173˚25'W.) should use the following track:

50˚45.0'N, 157˚36.0'E.
51˚41.0'N, 158˚51.0'E.
53˚00.0'N, 160˚39.0'E.
54˚31.6'N, 162˚49.0'E.
59˚45.0'N, 170˚01.8'E.
59˚45.0'N, 171˚04.5'E.
61˚52.5'N, 176˚57.6'E.
61˚59.0'N, 179˚24.0'E.
64˚05.0'N, 173˚57.0'W.
and then continue into harbor as recommended.

Vessels bound S from Provideniya should use the following track:

64˚09.0'N, 174˚03.5'W.
62˚08.0'N, 179˚18.0'E.
62˚00.0'N, 176˚36.6'E.
59˚50.0'N, 170˚40.6'E.
59˚50.0'N, 169˚31.0'E.
58˚52.0'N, 168˚00.0'E.
55˚59.0'N, 163˚50.0'E.
54˚34.0'N, 162˚25.0'E.
53˚00.0'N, 160˚25.0'E.
51˚47.0'N, 158˚37.5'E.
50˚50.0'N, 157˚20.0'E.

Northern Sea Route

To cover the recommended tracks of the S extension of the Northern Sea Route along this coast, on the W side of the Bering Sea, there are marine radiobeacons with ranges exceeding 75 miles on all the salient points of the E coast of Poluostrov Kamchatskiy. These beacons are grouped together with a beacon on **Mys Mayachnyy** (52˚53'N., 158˚42'E.), in the approach to Petropavlovsk. In addition, there is a radiobeacon close E of **Ust-Kamchatsk** (56˚13'N., 162˚26'E.) and two radiobeacons on the W side of Zaliv Olyutorskiy, near **Bukhta Lavrova** (60˚20'N., 167˚06'E.).

In the approach to **Anadyr** (64˚44'N., 177˚32'E.), there are radiobeacons on **Mys Barykova** (63˚03'N., 179˚28'E.) and on **Kosa Russkaya Koshka** (64˚34'N., 178˚33'E.).

Caution.—Caution is necessary as the radiobeacons and other radio aids to navigation along the Arctic coast of Russia between the Bering Strait and 90˚E are reported unreliable.

Seas

The North Polar Sea

The North Polar Sea is partly covered with sea ice at all times, the extent sea ice coverage range from about 10 to 90 per cent or 100 per cent depending on season and locality. One year old ice is seldom more than 2.5m thick but rafted ice can extend down to 12m or even more. After one winter sea ice has lost its salt by a leaching process, and therefore when it melts it dilutes the surface layer. The East Greenland and Canadian current carry both sea ice and icebergs, the latter from the Greenland ice cap, S to various latitudes but normally not farther than Newfoundland.

Although the Arctic is commonly thought to be largely ice covered, less than two fifths of its land surface apparently supports permanent ice. The remainder is ice free either because of relatively warm temperatures or scant snowfall. Glaciers are formed when the annual accumulation of snow, rime, and other forms of solid precipitation exceeds that of summer melting. The excess snow is converted slowly into glacier ice, the rate depending on the temperature and annual accumulation. In the Arctic, where most glaciers have temperatures far below freezing point, the snow changes into ice slowly. In NW Greenland, a hole 426m deep was made into the ice sheet without reaching glacier ice. The hole showed over 800 annual snow layers, from which it was possible to determine precipitation change for the last eight centuries.

Offshore in the Arctic Ocean N of Alaska the movement of ice indicates there is a large clockwise circulation of current.

The Barents Sea

The Barents Sea is bordered on the S by the coasts of N Norway and Russia, on the W and N by the archipelagos of Svalbard and Zemlya Frantsa Iosifa, respectively, and on the E by Novaya Zemlya and Ostrov Vaygach. It adjoins the Norwegian Sea between Norway and Svalbard, and the Kara Sea between Zemlya Frantsa Iosifa and Novaya Zemlya.

The SW part of the Barents Sea is kept from freezing by the comparatively warm water of the North Cape Current, thus permitting year round navigation. The remainder of the sea is encumbered with ice during part or all of the year.

The mainland coast of the Barents Sea is rocky and indented by numerous fjords in the W, and is low in the E. The S part of the Barents Sea cuts deeply inland to form a large body of water known as Beloye More (White Sea).

Barents Sea covers an area of 1,424,000 km^2 with a volume of 316,000 km^3. The greatest depths are in the W part of the sea. At this location a trough with the greatest depth of 600m (within the Barents Sea) enters the Norwegian Sea. The Barent Sea is characterized by extensive shallow areas where banks are crossed by gutters. The rugged bottom relief of the Barents Sea has a significant effect on its hydrology.

The position of the Barents Sea in the high latitudes goes beyond the Polar circle, and its connection with the Atlantic Ocean and Central Arctic Basin dictate the main climatic feature. The water circulation in the Barents Sea is generally counterclockwise. Yet, inflows from the neighboring basins and the rugged bottom relief cause a complicated system of currents to be formed. The E part of Barents Sea is entirely on the continental shelf. Depths vary from 100 to 350m with complicated bottom topography resulting from glacial action, producing many gentle rises and depressions. Bottom deposits at depths less than 100m consist mainly of sand with some boulders, gravel and shell. As depths increase, mud begins to mix with sand until, at maximum depth, mud predominates. In some shallow flat areas mud may replace the sand.

In the W, the sea is entered by the warm North Cape Current and it divides into the N and coastal current. The N periphery of the gyres is cold current. On merging, the cold current forms the Medvezhinskoye Current which is directed E to W. Further to the E, the North Cape Current falls into several legs.

The vertical structure of the Barents Sea waters is governed by several factors; a well-developed autumn-winter convection, inflow of Atlantic waters, wind mixing and summer warm-up. The Atlantic waters have an effect on the SW part of the sea. The temperature and salinity tend to change insignificantly with depth in this part. The horizontal distribution of the surface water temperature is characterized by a decrease from SW to NE. The highest salinity of 35‰ also occurs in the SW part of the sea receiving the Atlantic waters where the seasonal variations in salinity are clearly pronounced. In winter, the salinity across the sea rises to 35‰ except for the SE part in which it remains at 32.5-33‰. In summer, the river water goes far into the open sea and ice-melting makes surface water desalted even in the central and W parts.

The distribution of salinity with depths, as that of temperature, is not uniform across the sea. In summer, the desalted layer is 20 to 30m deep. At the lower boundary of the layer, a salinity discontinuity is formed which disappears in winter.

In winter, about 75 per cent of the Barents Sea is usually covered with ice. The warm North Cape Current maintains a temperature above 0˚C throughout the year in the SW part of the sea.

The entire S shore of the Barents Sea is bordered by a belt of barren country known as the tundra, the chief characteristic of which is the absence of forest vegetation. The greater part of the tundra is a gently undulating plain containing numerous lakes, rivers, swamps, and bogs.

The Barents Sea is navigable up to 75˚N and as far E as 50˚E by the middle of June. Towards the end of June the W coast of Novaya Zemlya, between Gusinaya Zemlya (71˚30'N., 51˚40'E.) and Poluostrov Admiralteystva (220 miles NNE), begins to clear of ice. The entire W coast of Novaya Zemlya is ice-free in early July, when the whole Barents Sea S of 77˚N is navigable.

In some years, the ice is so open that vessels may reach Zemlya Frantsa Iosifa, where the sea may be quite free of ice in August, while in other years the islands are quite inaccessible on account of ice. Zemlya Frantsa Iosifa was once reached in June, July, and August usually are most convenient for navigation, but navigation is not possible every year. On average, 50 per cent of the time a vessel has gotten through or the vessel has been free of ice right up to the island. Southward of Zemlya Frantsa Iosifa, much heavy pack ice surrounds it and young ice rapidly form in calm weather. Many of the narrower channels and fjords amongst the islands are perpetually ice-bound, but the larger ones are generally free, at some period, every season.

The Beaufort Sea

The Beaufort Sea forms a part of the Arctic Ocean and is a wedge shaped area bounded, on the S, by the N coasts of Alaska and Canada and, on the E, by the most westerly of the islands of the Canadian Arctic Archipelago.

The N limit of the Beaufort Sea is a line extended from Point Barrow, the N point of Alaska, then leading to Lands End (76˚22'N., 122˚36'W.) on Prince Patrick Island.

The E limit is formed by the coast of Prince Patrick Island from Lands End to Griffiths Point, then by a line leading to Cape Prince Alfred, the NW extremity of Banks Island, continuing by the W coast of Banks Island to Cape Kellett. Again, a line leading from Cape Kellett to Cape Bathurst (70˚35'N., 128˚01'W.) and continuing on to the mainland coast.

Amundsen Gulf extends E from the SE side of the Beaufort Sea. The deepest soundings obtained in the Beaufort Sea are in its W part, where depths over 3,658m have been measured about 130 miles N of the Alaskan coast. Further E the depths decrease and reach to the maximum at the SE end of the Beaufort Sea. Along half way between Banks Island and the mainland coast, the depth is about 457m. Off the Alaskan coast the continental shelf has an average width of about 30 miles and shoal water, with depths of less than 11m, extends from 5 to 10 miles offshore. Further E along the Canadian coast, between Herschel Island (69˚35'N., 139˚05'W.) and Cape Bathurst, a relatively shallow coastal shelf, with depths of under 54m, extends from 50 to 70 miles offshore and most of this coast is fringed with an extensive area of shoal water. To the W of Banks Island, it was found that the continental shelf was about 100 miles in width.

In the Beaufort Sea, the bottom sediments are generally poorly-sorted muds or sandy muds. On the continental shelf, gravels are frequently found, but only sporadically on the upper continental slope and never on the lower slope or abyssal plain. Towards the E, the sediments become relatively more fine-grained and better-sorted, being affected by the delta activity of the Mackenzie River.

The earth’s magnetic field is disturbed by local anomalies at many places on the SE side of the Alaska Peninsula and in the off-lying islands; in the Aleutian Islands; and on the E side of Poluostrov Kamchatskiy, all of which are areas of volcanic activity.

Local magnetic anomalies also exist in the vicinity of St. George Island (56˚36'N., 169˚30'W.) and Bukhta Provideniya (64˚20'N., 173˚30'W.).

Large anomalies occur more frequently in shallow water near land and, in general, the effect diminishes rapidly with distance. In some localities an anomaly has multiple sources and the effect may be felt for many miles.

Details of the anomalies mentioned above are given later in the text.

The Beaufort Sea is covered with vast expanses of first year and multi year ice, 300 cm thick during most of the growth cycle. The first year ice is generally confined to an area within 100 miles of the N Alaskan coast. Some years it may extend more than 200 miles from the coast.

Activities related to the oil exploration and exploitation industry may be encountered in the coastal waters of the Beaufort Sea. Due to the continuing nature of the industry, mariners are advised to obtain the latest information regarding the disposition of drilling ships and rigs and the location of artificial islands, whether under construction, completed or dissipating after abandonment, before proceeding through this area. (See appropriate appendix applicable to the country in the text.)

Beloye More (White Sea)

The shores of the White Sea are usually covered with snow from November to May, inclusive, and the precipitous cliffs, which are scarcely noticeable in summer, stand out boldly from the white background; from June to October the shores appear brown, and the outlines of objects are concealed in the general dark mass, but the upper edge of the coast shows sharply. The

appearance of the shores also changes with the height of the tide where the rise is considerable.

Timanskiy Bereg and the coast farther E, composed of sand or sandy clay, are only slightly above sea level, and the land has the character of a barren tundra, but at some distance inland there are high, flat topped hills.

Ostrov Kolguyev, lying off Timanskiy Bereg, is moderately high in its N part; it is either covered with peat or consists of bare sand ridges, intersected by gullies and enclosing small lakes or swamps. The S part of the island is low, flat, and composed of grass, bog, and peat.

The principal rivers are the Reka Onega, the Reka Severnaya Dvina, and the Reka Mezen, which flow into the White Sea, and the Reka Pechora, which into the Barents Sea.

The rivers flowing into the W side of the White Sea are generally mountain torrents and are not navigable, but those flowing into the E side are more or less navigable, and are of great industrial importance to Arkhangel'skaya Oblast.

The Bering Sea

The Bering Sea, a part of the Pacific Ocean, lies between the coasts of Alaska, Siberia, and N of the Aleutian Islands which extend about 900 miles WSW from the SW extremity of the Alaska Peninsula (54˚50'N., 163˚20'W.). The N limit of the sea is recognized by a line drawn to join Cape York (65˚24'N., 167˚30'W.) and Mys Kriguygun (Mys Krigugon), about 90 miles W. It is named after Captain Vitus Bering, having previously been called the Bobr Sea, the Kamchatka Sea, the Aluska Sea, and the Aleut Sea. The Bering Strait leads from the N end of the Bering Sea into the Chukchi Sea.

There are few off-lying below-water dangers in the Bering Sea and along most of the W shore. There is also deep water close in where the sandy shoals and spits extend; these places are almost all steep-to. The tidal currents are mostly weak and, in general, passage can safely be made along the W side by following the coast at distances at which the navigational marks can be seen. On the E side there are extensive areas of shallow water and conditions for navigation of Bering Sea as a whole are often difficult because of the prevailing fog during the short summer season, and strong winds which influence the currents so that they are difficult to predict. In addition, as mentioned at the relevant places in the text, parts of the sea are not adequately surveyed and in some places the charts are inaccurate. Taken together all these factors, navigation in the region demands particular care.

The S portion of the ice covered area of the Bering Sea contains thin first year ice 30 to 71cm thick near the end of the growth cycle. The N portion and immediate coastal areas N of 62˚N attain medium first year growth 71 to 122cm.

In winter, much of the N part of Bering Sea is frozen over. In spring the ice breaks up and its movements are then dictated by the currents and winds. As the prevailing winds greatly affect the currents, mariners wishing to push N early in the season should be influenced by favorable movements.

Spring is generally considered the best season for navigation, although only slightly better than summer; in spring, winds have decreased from their winter maxima, the incidence of fog has not reached its peak, ice is beginning to thaw and sea conditions are as good as in any other season.

On the W side of the Bering Sea there are marine radiobeacons with ranges of 75 miles or more on all the salient points of the E coast of Poluostrov Kamchatskiy. These are grouped and together with a beacon on Mys Mayachnyy (52˚53'N., 158˚42'E.), in the approach to Petropavlovsk, they cover the recommended tracks of the S extension of the Northern Sea Route along this coast.

In addition, there is a radiobeacon situated close E of Ust-Kamchatsk (56˚13'N., 162˚26'E.) and two radiobeacons on the W side of Zaliv Olyutorskiy, near Bukhta Lavrova (60˚20'N., 167˚06'E.).

In the approach to Anadyr' (64˚44'N., 177˚32'E.) there are radiobeacons on Mys Barykova (63˚03'N., 179˚28'E.) and on Kosa Russkaya Koshka (64˚34'N., 178˚33'E.).

On Mys Lesovskogo, in the entrance to Bukhta Provideniya, an important stopping place for ships using the Northern Sea Route, there is a radiobeacon with a range of 200 miles. This beacon is grouped with another on Mys Chaplina (64˚24'N., 172˚13'W.), which is the S of a number of radiobeacons situated on the salient points of the coast on the W side of the approach to, and in Bering Strait. There is also a radiobeacon on the N end of Ostrov Ratmanova (65˚50'N., 169˚02'W.).

A number of radiobeacons are reported to transmit from positions on the NE coast of Siberia between the Bering Strait and 178˚E. Due to the prevailing low visibility they are considered to be important aids for vessels navigating the Northern Sea Route. However, due to lack of reliable information, no details of those situated W of 170˚W are given.

Caution.—The radiobeacons on the W side of the Bering Sea cannot be relied upon due to the possibility of changes being made without warning by the Russian authorities.

The W side of the Bering Sea is likely to be clear of ice a little earlier than the E side, and a vessel following the edge of the pack ice can reach Mys Navarin (62˚15'N., 179˚07'E.) about the middle of May. Heavy ice formed in Anadyrskiy Zaliv is met coming out of the gulf. The ice sets NE into the channel between Mys Chaplina (64˚24'N., 172˚15'W.) and St. Lawrence Island and then E onto the N side of the island.

In exceptionally good seasons, there may be a clear lead from Mys Navarin to Mys Chaplina or St. Lawrence Island as early as the 15th May; but after E winds flow, the ice may be found heavily packed in this vicinity. In this event it is advisable to follow the line of the pack ice E and try the E side of the sea. By so doing the ice edge will probably be found from 20 to 80 miles S of St. Matthew Island (60˚20'N., 172˚30'W.) and leading E close to the W coast of Nunivak Island. From there it should be possible to head N to St. Lawrence Island and along the S side of it to find clear water in the channel. The intent should be to get to the W of the island before the ice opens from Mys Navarin to Mys Beringa (65˚00'N., 175˚55'W.). It is useless to try to pass N of St. Lawrence Island, as the heavy ice from Anadyrskiy Zaliv remains there much later than the ice on the S side.

Along the N of St. Lawrence Island, ice clears much earlier than on the W side of thr Bering Sea, and vessels reaching Mys Chaplina find the ice broken into large flows around which they can work outside the fast ice as far as Mys Dezhneva (66˚05'N., 169˚38'W.).

After the Bering Sea has cleared of ice, it is recommended that vessels bound through Unimak Pass, the first ship channel W of Alaska Peninsula, for ports in the NE part of the sea, proceed, as follows:

1. **Unimak Pass to Norton Sound.—**Proceed through the following positions:
   a. 54˚36'N, 165˚04'W (off Cape Sarichef).
   b. 60˚14'N, 168˚04'W (W of Nunivak Island0>
   c. 63˚00'N, 167˚40'W (E of St. Lawrence Island).
   d. 63˚41'N, 165˚18'W (entrance to Norton Sound).

Then, if bound for St. Michael on the S side of Norton Sound, proceed through position 63˚41'N, 162˚21'W, N of Stuart Island.

Vessels bound for Golovnin Bay and Nome, on the N side of the sound, can proceed direct from the E of St. Lawrence Island.

Small vessels for which Isanotski Strait (64˚50'N., 163˚23'W), the first passage W of the Alaska Peninsula, is suitable, can use a route farther E.

2. **Unimak Pass to Port Clarence.—**From E of St. Lawrence Island proceed through the following positions:
   a. 64˚58'N, 167˚40'W (E of King Island).
   b. 65˚19'N, 167˚40'W (SW of Cape York).
   c. 65˚19'N, 166˚51'W (off Point Spencer).
   d. 65˚17'N, 166˚25'W (Port Clarence).

3. **Unimak Pass to Bering Strait.—**Proceed as above as far as King Island. Then pass through position 64˚58'N, 167˚40'W, E of Fairway Rock, into the strait.

The Chukchi Sea

The Chukchi Sea, formerly called the Chukotskoe Sea, is a part of the Arctic Ocean extending N from the Bering Sea between the coasts of Alaska and Siberia as far as a line joining Point Barrow (71˚22'N., 156˚23'W.) and the N side of Ostrov Vrangelya, about 445 miles W.

There is a counter-clockwise circulation of current in the Chukchi Sea. In the Chukchi Sea the tidal currents are little known, but they are considerable in some parts of it. During the navigation season, streams of a semdiurnal character are strongest in the vicinity of Ostrov Vrangelya (71˚10'N., 179˚00'W.). As the ice field develops across the sea, the tidal currents decrease in strength.

Vessels making a passage through the E part of Chukchi Sea to Beaufort Sea are recommended to proceed, as follows:
   a. 65˚38'N, 168˚31'W (E of Fairway Rock).
   b. 68˚21'N, 167˚18'W (W of Point Hope).
   c. 68˚58'N, 166˚40'W (NW of Cape Lisburne).
   d. 70˚34'N, 162˚25'W (NW of Icy Cape).
   e. 71˚20'N, 156˚55'W (W of Point Barrow).

Ice conditions may hamper navigation N of Point Hope. Passage through the W part of the Chukchi Sea is normally made by the Northern Sea Route.

This route is part of the Northwest Passage, which connects the Pacific Ocean with the Atlantic Ocean N of the American Continent. A through passage is rarely attempted by any one vessel in a single season because of the shortness of the season and unpredictability of ice conditions.

North of the Bering Strait, in the Chukchi Sea, the ice cover is medium and thick first-year growth (greater than 122cm) during most of the growth cycle.

East Siberian Sea

The East Siberian Sea, lying between Ostrov Vrangelya (72˚N., 180˚E.) and Novosibirskiye Ostrova, about 100 miles NE, is a shallow basin that deepens gradually NE from gently sloping shores. The depths along the shore and within the East Siberian Sea vary considerably.

The W part of the sea, S of Novosibirskiye Ostrova, and the waters along its S shore as far E as the approaches of the Reka Kolyma are shallow with numerous shoals.

The central and E parts of the the East Siberian Sea and the waters adjacent to the coast are deeper and clear of known dangers. Except for Ostrova Medvezh'i, which lie N of the mouth of the Reka Kolyma between about 19 miles NE and 58 miles E of Mys Krestovyy, the islands off the coast are few and close to shore.

To the E of Novo Sibirskiye Ostrova, the shelf remains wide, but the continental slope becomes less steep than that bordering the Laptevykh Sea. The East Siberian Sea is very shallow, with depths of 10 to 20m in the W and 30 to 40m in the E.

In shallow water, the seabed consists mainly of sandy silt with pebbles and broken boulders. In deeper water, nearer the shelf edge, mud predominates.

In the W area of the East Siberian Sea, W of the Reka Kolyma (161˚E.), ice conditions are practically always favorable during the navigational period, unless a spell of onshore winds drives the ice back towards the coast. The E area of the East Siberian Sea, E of the Reka Kolyma, is the most difficult part of the Northern Sea Route, with the exception of the region of Proliv Borisa Vil'kitskogo.

The vegetation along the shores of the East Siberian Sea is uniform but poor. Except where there are rocky outcrops, there is the usual Arctic covering of tundra. The tundra is hummocky and in places patchy; in most places it is marshy and is covered, sometimes fairly dense with grass. Creeping willows and dwarf birches are found in a few places, and in the more elevated and drier parts there is reindeer moss. A variety of flowering plants bloom during the short Arctic summer in places sheltered from the wind.

The Kara Sea

The Kara Sea is located on the E of the Novaya Zemlya, N of the Polar circle. It is bounded on the S by the N coast of Siberia; on the W by Ostrov Vaygach, Novaya Zemlya, and a line drawn from the NE extremity of Novaya Zemlya to the E extremity of Zemlya Frantsa Iosifa; on the E by a line drawn from the E extremity of Zemlya Frantsa Iosifa to the N extremity of Severnaya Zemlya; and on the E by the W coasts of Severnaya Zemlya.

In addition to adjoining the Barents Sea between Novaya Zemlya and Zemlya Frantsa Iosifa, the Kara Sea is connected with it by Proliv Yugorskiy Shar, between the mainland and Ostrov Vaygach; by Proliv Karskiye Vorota, between Ostrov Vaygach and Novaya Zemlya; and by Proliv Matochkin Shar, which divides Novaya Zemlya into two islands.

The E part of the Kara Sea is connected with the Laptev Sea by Proliv Borisa Vil'kitskogo, Proliv Shokal'skogo, and Proliv Krasnoy Armii. The greater part of the Kara Sea is covered with ice throughout the year. The most favorable ice conditions during the navigation season are found in the region where the large Siberian rivers, bringing comparatively warm water, flow into the sea. Detailed exploration in the eastern part of the Kara Sea, formerly rendered impracticable by the constant ice, has in recent years been facilitated by the use of icebreakers and

aircraft. A number of islands front the S shore of the Kara Sea, and several outlying islands are in the N and NE parts of the sea.

The sea covers an area of 993,000 km^2, having a volume of 101,000 km^3.

The Kara Sea has a diversified bottom relief; the average depth is 113m with the greatest depth being 620m. Its S and E parts are shallow, as 40 per cent of the area is less than 50m deep. Only 2 per cent of the sea area is deeper than 500m. The Kara shelf is divided N to S by two troughs, the St. Ann trough and Voronin. Along the E coast there are the Novaya Zemlya and Eastern-Novozemelal'sky troughs, with depths of 200 to 400m. The Kara Sea and the Barents Seas are connected by Yugorsky Shar, Kara Gate, and the Matochkin Shar. In the N part, the seas are connected by a broad passage between the Npoint of Novaya Zemlya and Franz Josef Land.

The Kara Sea is mostly shallow to medium depth and entirely on the continental shelf; in it are two areas of deeper water: A deep (600m) N to S rift which starts at the N end of Novaya Zemlya and runs N to the E of Zemlya Frantsa Iosifa; and the Novaya Zemlya Trough (300 to 400m), which lies close E of Novaya Zemlya.

Elsewhere, the Kara Sea is occupied by a series of platforms or broad terraces stepping down from the SE to N and W, where the continental slope edge lies at about 200m.

The seabed consists mainly of clay and mud in the shallower areas, with mud predominating in the deeper waters. The counter-clockwise current eddy favors the accumulation of mud at shallow depth in the SW part of the sea. Shallow deposits near river mouths are made up of sands and silty sands.

Although the proximity of the Atlantic Ocean makes the climatic conditions milder, the climate remains Arctic. The Atlantic effect, warm water develop air masses encountering the high mountains of Novaya Zemya, as a result making the Kara Sea climate more severe than that of the Barents Sea. The climatic features of the Kara Sea (monsoon, winter cooling and summer warm-up) also influence the formation of hydrological conditions of the sea.

Run-off from the Ob and Yenisey rivers influences the Kara Sea hydrology. The Kara Sea receives 1,290 km^3 of river waters annually. The Ob river discharges 450 km^3 and the Yenisey about 600 km^3. The Ob-Yenisey run-off causes a significant circulation in the Kara Sea.

On all the shores of the Kara Sea, the vegetation is poor and of a characteristic Arctic nature. In most places there is a covering of tundra, but in parts of Novaya Zemlya there are outcrops of sedimentary slate; in the W part of Poluostrov Taymyrskiy there are outcrops of gneisso-granite, and parts of N Novaya Zemlya and of Severnaya Zemlya are covered by glaciers. The tundra is lumpy and is covered with grass, which is sometimes thick as, for instance, in Poluostrov Yamal. In most places the tundra is marshy and in some places it is patchy. Here and there the ground is covered with creeping willow or dwarf birches. Iceland moss is sometimes seen in the higher, drier and sandy places. Many species of wild flowers grow in places sheltered from the wind and bloom in masses during the short Arctic summer.

Huge flocks of geese migrate to breed during the summer in the Kara Sea region. During the moulting season, which occurs about the end of July or beginning of August, these birds are unable to fly and are killed in large numbers. Besides geese there are ducks (including the eider duck in Novaya Zemlya), loons and several species of snipe and gulls. The arctic owl is a resident. Eagles, gerfalcons and hawks are found on the mainland coast and on Ostrov Vaygach. Bird rookeries, some of great extent, are found in many places along the W coasts of Novaya Zemlya.

The Laptev Sea

The Laptev Sea lies between Severnaya Zemlya and Novosibirskiye Ostrova and the continental coast continued S. It consists of a shallow basin, with shifting off lying shoals and banks in the S part. The depths gradually increase to the N limit, which is the edge of the continental shelf extending SE from the N end of Severnaya Zemlya.

The meridian of 139°E has been designated by the government of Russia as an arbitrary boundary separating the NE part of the Laptev Sea from the adjacent East Siberian Sea.

The SE part of the Laptev Sea is connected with the East Siberian Sea by Proliv Dmitriya Lapteva, Proliv Sannikova, and Proliv Eterikan, which are the straits of Novosibirskiye Ostrova. The S continental shores of the Laptev Sea are mostly low, barren, tundra indented by several large gulfs and bays into which the principal rivers flow.

The character of the continental shelf in the Laptev Sea differs markedly from that of the Kara Sea. Apart from some deep troughs around Severnaya Zemlya, the shelf is very flat and, on average, less than 75m in depth. Very shallow zones extend beyond the mouths of the large rivers. The shelf is narrow, seaward of Severnaya Zemlya, but widens to nearly 300m off the NE coast of Siberia. The continental slope begins at 200m and falls steeply to 1,000m. Bottom deposits in the shallower areas are mainly sand and mud, but some pebbles and broken boulders can also be found. In deeper water the seabed consists entirely of mud.

The low S shores of the sea are mostly composed of sand and clay with layers of buried ice, and are subject to constant erosion. Hills and some rock occur along the N coast of Poluostrov Taymyr. Farther N, Severnaya Zemlya, the archipelago comprising the NW boundary of the Laptev Sea, attains elevations of about 701m. The four main islands are ice capped and mostly steep-to.

Only the W islands of the archipelago of Novosibirskiye Ostrova lie entirely within the limits of the Laptev Sea. These are Ostrov Bel'kovskiy, Ostrov Stolbovoy, and Ostrov Semenovskiy. The latter, consisting of sand, clay, and imbedded ice, is rapidly eroding and may have disappeared entirely.

Navigation in the middle of the Laptev Sea is especially hazardous even when clear of ice because of the absence of seamarks, unknown permanent currents, irregular wind currents, and shifting shoals and banks. Poor visibility, overcast sky, abnormal refraction, and mirage are prevalent during the navigation season.

At the beginning of the navigational season, ice conditions are more favorable in the E part of the sea and less favorable in the W. The best conditions are found in the vicinity of the large rivers. The worst conditions are found in the E approaches to Proliv Borisa Vil'kitskogo and around Novo Sibirskiye Ostrova.

Along the shores of Laptev Sea the vegetation is fairly uniform and, except where there are rocky outcrops, there is a continuous but fairly narrow coastal belt of tundra. This tundra

is mostly covered with dense layer of moss or lichen and is often swampy; in places where it is sheltered from the wind it is covered with grass, which is sometimes fairly thick, as, for instance, near the mouth of Reka Olenek. In some places there are creeping willows and dwarf birches, and on the most sheltered slopes of the hills there are considerable areas covered with several species of flowering plants. In Novo Sibirskiye Ostrova the tundra is almost barren, but there are isolated patches of several species of flowering plants.

The Lincoln Sea

The Lincoln Sea is the name applied to that part of the Arctic Ocean which lies off the NE end of Ellesmere Island and the NW end of Greenland; it extends from Cape Columbia, the N extremity of Ellesmere Island, on the W, to Kap Morris Jesup, the N extremity of Greenland, on the E; on the S, it is bounded by the coasts of Ellesmere Island and Greenland and by the N entrance of Robeson Channel.

The Norwegian Sea

The Norwegian Sea flows over the continental shelf off the Norwegian coast and has been eroded by the Norskerenna (Norwegian Trench). A glacial trough which follows the S and W coasts of Norway and terminates at the shelf edge in about 62˚N. Norskerenna is between 25 and 50 miles wide and has a maximum depth of 433m. The coast is indented with fjords, which often extend many miles inland and attain depths far exceeding those of the adjacent sea.

The S boundary of the Norwegian Sea is the Wyville Thompson Ridge, extending from Scotland to Iceland and with an extension between Iceland and east Greenland. In the deep waters of Norske Havet or Norwegian Sea, the main bottom constituent consists of ooze, clay, very fine sand, or a mixture of these materials.

On the continental shelf, which is narrow and deeply indented, rock predominates, overlaid with patches of sand and gravel. East of 25˚E, mud is also present. Off the continental shelf, the rock loses its dominance. In the west there is a narrow band of sand and gravel, and sand, mud and gravel merging at about 500 to 1,000m into an area of fine muds and oozes which occupy the deeper waters of the Norwegian Sea.

Along the parallel 72˚N, where the slope is less steep, areas of sand and mud predominate, gradually giving way to mud at about 350m.

Off the Norwegian coast, the continental shelf is of varying width, from 100 miles in 65˚N to 15 miles off Vesteralen, with extensive areas more than 200m in depth. The shelf is characterized by a series of straths, outer banks, and islands. The straths are broad, elongated depressions of glacial origin which generally form a pattern parallel and perpendicular to the coast. They cut deeply into the coast, are often deepest at their landward end, where they usually terminate in a sharp escarpment, and are not evident in the slope region. The largest bank in the area is **Sklinnabanken** (65˚20'N., 10˚15'E.), with a least depth of 120m.

On either side of the trough and within the trough itself are several banks, of which the more important are:

Little Fisher Bank	56˚55'N, 6˚20'E.
Great Fisher Bank	56˚45'N, 4˚10'E.
Eigersundbank	57˚45'N, 5˚25'E.
Revet	58˚05'N, 4˚35'E.
Ling Bank	58˚10'N, 2˚30'E.
Coral Bank	58˚30'N, 2˚55'E.
Klondyke Bank	58˚45'N, 3˚10'E.
Kalsmedgrunnen	58˚50'N, 5˚20'E.
Bergen Bank	60˚05'N, 2˚00'E.
Viking Bank	60˚35'N, 2˚30'E.

There is a marked variation in the character and distribution of the bottom sediments, which is related to the diverse sources of supply, conditions of deposition and bottom configuration. Fine sand and mud are the basic constituents of the shelf sediments, with gravel and rock freely dispersed among them. The coastal complex, which extends to the 100m depth contour, is extremely rocky with sand, stone and shingle edging the rocky patches. In the deep incursions through the shelf and in the deep waters of the fjords, the bottom is mainly one of mud overlying either glacial sediments or the rock floor.

Surface Temperatures

Surface temperatures in the Arctic Ocean system are always low, seldom rising above 4˚C or 5˚C even at the height of summer. Wherever there is ice the temperatures are close to 0˚C or lower (seawater of salinity 34 parts per thousand freezes at about -1.8˚C). There is an area known as the “north water,” in northern Baffin Bay or southern Smith Sound, which remains unfrozen all winter, and in this region the summer temperatures are often above 5˚C. Hudson Bay, which in summer is subject to considerable surface dilution from land drainage, can be as warm as 10˚C in its S part for a brief period.

CANADA



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General

The Dominion of Canada, the largest self-governing country in the Commonwealth of Nations is a federal state, established in 1867 by the British North America Act. Discovered by Cabot in 1497, it was formed from the colonies originally settled by the French and British in the 17th century together with lands owned by the Hudson's Bay Company. The Dominion was finally completed by the inclusion of Newfoundland in 1949.

The country now contains the whole of the North American continent N of the border of the United States of America, excluding Alaska which is one of the United States of America but including all of the islands, known as the Canadian Arctic Archipelago, which lie between the Arctic Ocean, on the W, and the median line with Greenland, on the E.

Within the Dominion, there are ten self-governing provinces and three territories administered by the Federal Government, which have a total area of about 3,852,000 square miles. The following describes the Arctic Circle and conditions prevail over Arctic Canada is very sparsely populated.

Of these, three quarters are Inuit (Eskimos) and a very small number are North American Indians, the other native who are found only around the S part of Hudson Bay; most live in small settlements.

The islands of the Canadian Arctic Archipelago, some of which are very large can be divided into three groups, as follows:

1. The Queen Elizabeth Islands, the N group, are separated from the other two groups by Parry Channel and from Greenland by Nares Strait, down the middle of which runs the boundary between Canada and Greenland.
2. The SE group comprises Baffin Island, Bylot Island, and a number of smaller islands.
3. The SW group consists principally of Somerset Island and Prince of Wales Island, situated N of the Boothia Peninsula; and, stretching away in a WNW direction from Boothia Isthmus, King William Island, Victoria Island, and Banks Island.

The Northwest Territories evolved from "Rupert's Land and the Northwest Territory" where the Hudson's Bay Company had established trading posts which were acquired by Canada in 1869. Subsequently, all of the extensive lands between Manitoba and British Columbia were added and the Northwest Territories formally organized on the mainland in 1874.

The territories were completed with the transfer to Canada by Great Britain of her sovereignty rights in the Canadian Arctic, although it was not until 1931 that Norway recognized

Canada's title to the Sverdrup Islands. The history of the archipelago is largely the history of the search for a Northwest Passage.

The Canadian Arctic regions include all the islands N of the mainland generally referred to as the Canadian Arctic Archipelago and the mainland coast from Point Barrow, Alaska, E to Melville Peninsula and the NW shores of Hudson Bay. The region is roughly triangular in shape, covering approximately 33 per cent of Canada, and the land masses within this vast territory can be divided into three main groups, as follows:

1. **Eastern Block.—**An area covering sea approaches generally made through Davis Strait or Hudson Strait, and along the NW shores of Hudson Bay, the Melville Peninsula, the Boothia Peninsula, Baffin Island, Bylot Island, Southampton Island, and Somerset Island.
2. **Western Block.—**An area covering sea approaches generally made through the Bering Strait and the Beaufort Sea, or from the Mackenzie River; that includes the mainland coast from the vicinity of Point Barrow, Alaska to the E shores of Peel Sound, Franklin Strait, James Ross Strait, and Rae Strait; and also along the shores of Banks Island, Victoria Island, Prince of Wale Island, and King William Island.
3. **Northern Block.—**Sea route to this area is possible only in the E and S through Smith Sound, Jones Sound, or Lancaster Sound and some of their tributary channels. The passage also consists through the triangle groups N of Parry Channel, collectively known as the Queen Elizabeth Islands.

Buoyage System

he IALA Buoyage System (Region B) is in effect. See Chart No. 1 for further IALA Buoyage System information.

Mariners are reminded that buoys in the arctic region are liable to disengage from their charted position by ice or inclement weather.

Adjacent to Canadian waters, the West Greenland Buoyage System conforms to Region A of the IALA Buoyage System. All newly-erected and restored beacons that require to be held to port, with an ingoing direction, will be fitted with topmarks in accordance with IALA rules. Hence, port beacons with red can topmarks and beacons with a triangle point down can be expected to be found.

For complete details, consult *The Canadian Aids to Navigation System*, published by the Canadian Coast Guard and available from Canada Communication Group Publishing, Supply and Services Canada, Ottawa, Ontario KIA 0S9.

Cautions

Navigation Lights

Mariners are cautioned that colored lights and lights on buoys in this region may be seen as white because of over icing, snow, or hoar frost, and that the visible range of lights can be greatly reduced or disappear for the same reason.

Special Purpose Buoys

Special purpose buoys, used in Canadian waters, do not have lateral or cardinal significance. They may be a variety of shapes of lighted and unlighted buoys. They may display yellow reflecting material. Except for the scientific (data collecting) buoy, all special purpose buoys may display a yellow flashing light.

A hazard buoy marks an area of random hazards such as shoals and rocks. It is white with an orange diamond on opposite sides and with an orange horizontal band above and below the diamond; there is lettering or the hazard symbol inside the diamond. If lighted, the light is flashing yellow, and may display yellow reflecting material.

Currency

The official unit of currency is the Canadian dollar, consisting of 100 cents.

Currents

The Arctic Ocean

The flow of water off North Greenland and the NW side of the Canadian Arctic Archipelago is determined by a large clockwise circulation centered in the Beaufort Sea. In the N of this area the currents usually set S; elsewhere they set SW. Their mean rate is said to be less than a knot.

Due to the severity of the climate in the Arctic, the tidal and offshore current observations are confined to the short summer season when the greater part becomes ice-free. These observations are just sufficient to indicate that the currents form a pattern, at least in summer. The drift of pack ice and icebergs suggests that the same general pattern may also prevail during the winter.

Water from the Arctic Ocean enters the region through the various channels within and around the Canadian Arctic Archipelago, when it finally emerges into Baffin Bay or Davis Strait. Another main source of water is a relatively warm N current off the W coast of Greenland (West Greenland Current) that eventually rounds the head of Baffin Bay and sets S to SE off the E coast of Baffin Island. As it does so, it is joined by the water emerging from the archipelago. This S to SE current is known as the Canadian Current. To the S of about 61˚N it is joined by an outflow from Hudson Strait, the combined flow setting SE off the coast of Labrador where it is known as the Labrador Current.

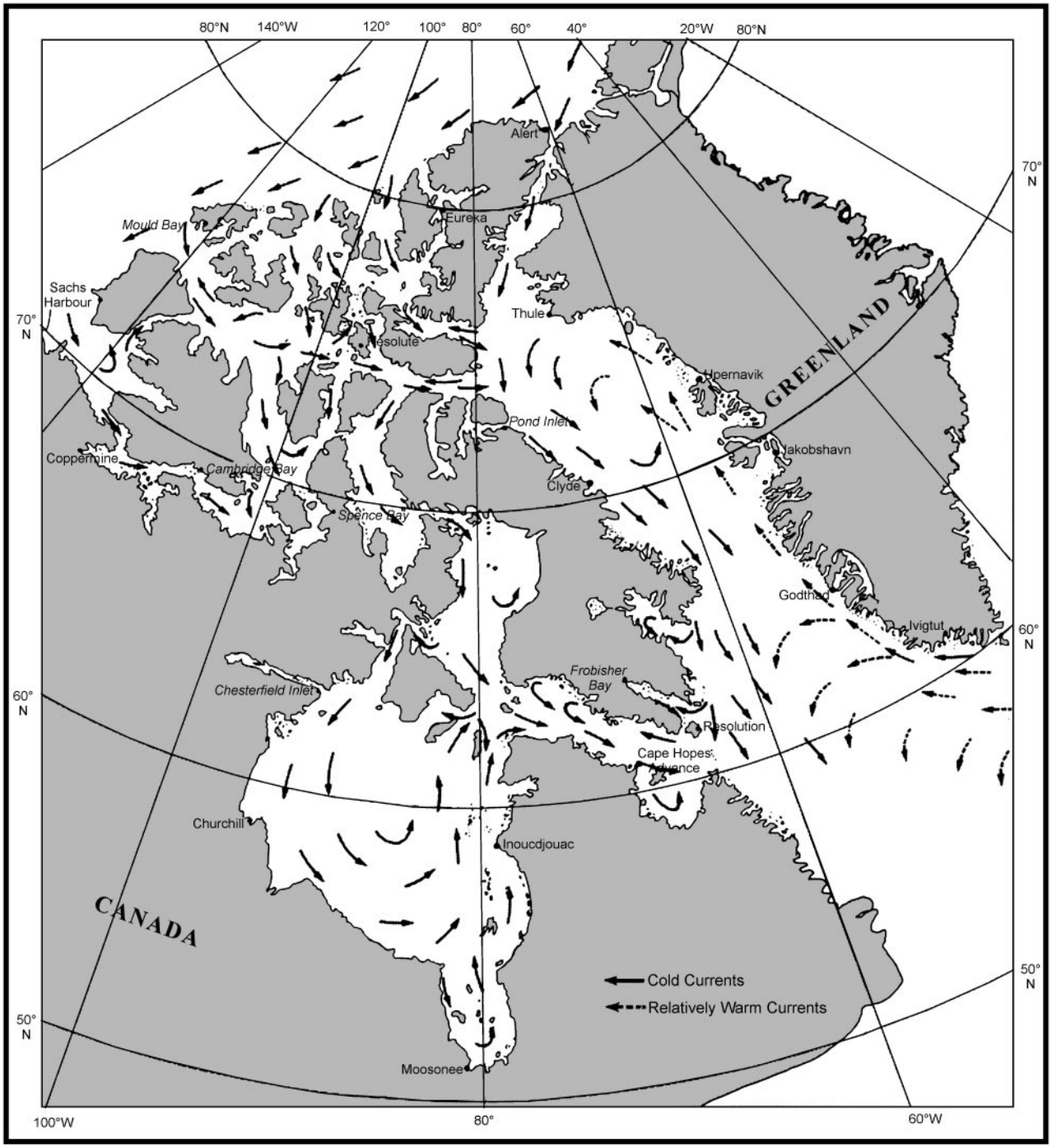
Since the flow of water is controlled by varying oceanographic and meteorological conditions both within and outside the region, the currents may be expected to show a high degree of variability both in direction and rate. This is particularly so in the channels within the archipelago where they are greatly influenced by the recently prevailing winds. Moreover, the run-off of fresh water from the land in spring and summer greatly affects the currents within and near fiords and in the vicinity of river mouths.

The offshore currents are sometimes influenced by tidal currents to attain considerable rates in some parts of the region.

Canadian Arctic Archipelago

In general, the flow of water through the archipelago is from the Arctic Ocean towards Baffin Bay. Where the channels are aligned N to S the currents set S, and where they are orientated W to E the currents set E; there are some exceptions to this general rule.

In Amundsen Gulf, there is a counterclockwise circulation, with water entering the gulf from the Beaufort Sea and leaving



Generalized Sea Surface Currents

by means of a NE current in Prince of Wales Strait and an E set into Dolphin and Union Strait.

A counterclockwise pattern is also said to prevail in Viscount Melville Sound; a branch from this circulation sets N into McDougall Sound.

A SE set into M'Clintock Channel sends a recurved branch N into Franklin Strait and Peel Sound. Although the flow is generally E in Lancaster Sound and Jones Sound, a W current, derived from the Canadian Current, runs along the N side of each sound.

The mean rates of these currents are probably less than a knot except in parts of Nares Strait, where they may sometimes run at 1 knot to 2 knots. The currents in the channels within the archipelago are greatly influenced by the winds; the rate of the current may be temporarily increased or its direction may even be reversed by recently prevailing strong winds.

Geophysical Features

The overall physical features and their pattern of land forms across the vast extent of N Canada and the Arctic Archipelago is defined by tundra and polar deserts.

The entire N coast of the mainland. except at the extreme E end, is backed by an immense terrain with a low surface. The greater part of which is composed of the Canadian Shield. The shield dips towards the N and W, entirely surrounds and underlies a great depression forming Hudson Bay. It then extends N into the archipelago, across most of Baffin Island, terminating in the SE parts of Devon Island and Ellesmere Island.

On the mainland, except around the S part of Hudson Bay which is very low-lying, most of the shield has general elevations of about 450m, but the country is rugged with numerous hills and rocky exposures rising about 30 to 60m above the general level. At the extreme E end of the mainland coast, in N Labrador, the NE rim of the shield has been tilted up to form snow and ice-covered mountains which stretch N, increasing in elevation to over 1,500m along almost the whole of the W shore of Davis Strait and Baffin Bay. Two great waterways break through this mountainous rim to form Hudson Strait, leading to Hudson Bay and Parry Channel, leading to the Arctic Ocean.

The lower W side of the shield, in the vicinity of Amundsen Gulf, and the NW side, where its irregular boundary crosses the S islands of the archipelago, are both gently overlapped by sedimentary rocks, parts of which rise to local hills and plateaux. Farther W, these merge into the Arctic Coastal Plain which borders the shores of the Arctic Ocean as far as the Canada/Alaska boundary, on the mainland, and **Meighen Island** (80˚00'N., 100˚00'W.), on the NW side of the Arctic Archipelago.

The islands of the archipelago, from N of Parry Channel to the N end of Ellesmere Island, are also composed of sedimentary rocks but are of a different nature; they are distinguished by rolling terrain and plateaux along the N side of Parry Channel, giving way to folded plains with piercement domes in the Sverdrup Basin, which occupies the central part, terminating in snow and ice-covered mountains on Axel Heiberg Island and Ellesmere Island in the far N.

The lowlands of the region are dominated by glacial deposits left over from the Ice Age, although, in places, such deposits are totally absent; this is particularly the case on the N islands of the archipelago and around the Mackenzie River where they are replaced by extensive outwash deposits. Many areas are poorly drained, covered with lakes, pools and marshy ground; the latter is found especially around the S part of Hudson Bay. On the E and W sides of the bay, and the E side of Victoria Island in the S part of the archipelago, the glacial drift has been patterned into ridges.

Except around the S part of Hudson Bay and on the S side of the entrance to Hudson Strait in the vicinity of Ungava Bay, the entire region just described is subject to continuous permafrost where the ground is frozen up to 500m below the surface and only thaws in summer to a depth of not more than 1m. Under these conditions, even in places where the soil has not been removed by glaciation, agriculture is impossible and trees seldom grow; however, around the S parts of Hudson Bay and Ungava Bay, particularly at the mouths of rivers, there is a belt of inferior coniferous forest, giving way to smaller, stunted growths. To the N of the tree line, on the mainland, the permafrost plains, called the “Barren Grounds” W of Hudson Bay, are covered with tundra. In the archipelago, most of the islands are bare, the ground locked in by ice for most of the year.

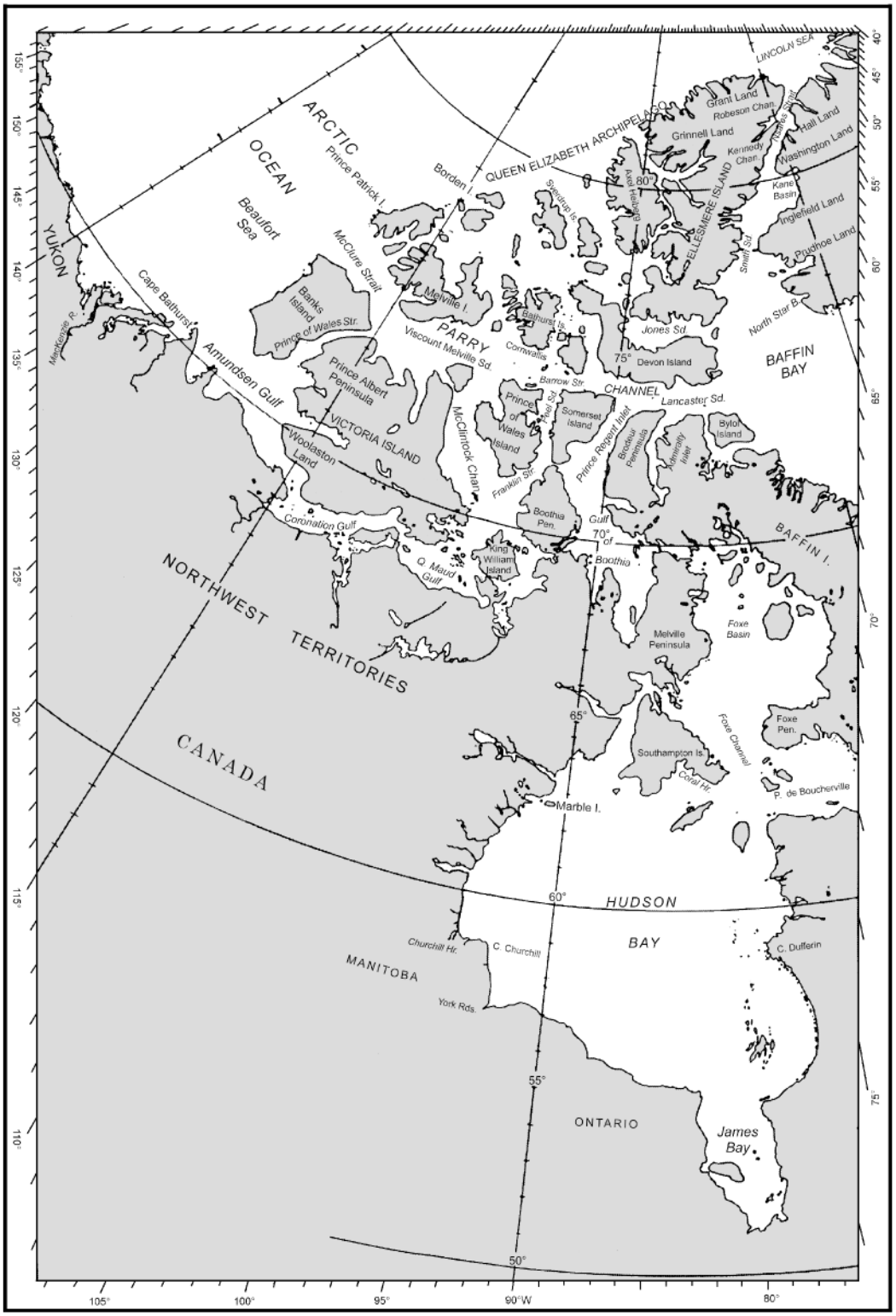
Glaciation is a feature of some coastal areas but, on the mainland, is confined to a small mountainous area at the N end of the Labrador Peninsula. It is also of strikingly small extent in the archipelago where precipitation is too slight to cause a permanent ice-covering of low ground. Glacier ice is significant on Baffin Island, N of Cumberland Sound, as a coastal belt about 60 miles wide, dissected by numerous fiords. It increases N of Parry Channel where a dozen ice caps cover the E part of Devon Island and about 33 per cent of Ellesmere Island and Axel Heiberg Island. Some of these are situated on plateau, while others are highland ice which almost bury underlying mountains. To the W and SW of this main zone of glacier ice there are small ice caps on Meighen Island and Melville Island. Relatively few glaciers reach the sea.

Ice in the ground has produced some unique coastal features. Towards the W end of the N coast of the mainland, in the vicinity of the otherwise low-lying and flat Mackenzie River delta, irregular accumulations have resulted in the formation of large numbers of “ice blisters” with pingos, which are conical or rounded mud hillocks, on them; these are repeated offshore as shoals. In other places, where the ice thaws and produces an uneven settlement of the ground after drainage, lake basins have formed with a characteristic shape depending on the dominant wind direction; examples of these are the countless elongated lakes which back the coasts of the Tuktoyaktuk Peninsula, E of the Mackenzie River delta, and the circular lakes of the Great Plain of the Koukdjuak which bounds the E side of Foxe Basin. Along all of the coasts of the region, extensive glaciation during the Ice Age has produced numerous elevated marine features, principally raised beaches, formed by the rebound of the earth’s crust after removal of the weight of ice upon it and flooding by the sea. This process is still perceptible around Hudson Bay, on the E side of which the highest of these features are to be found.

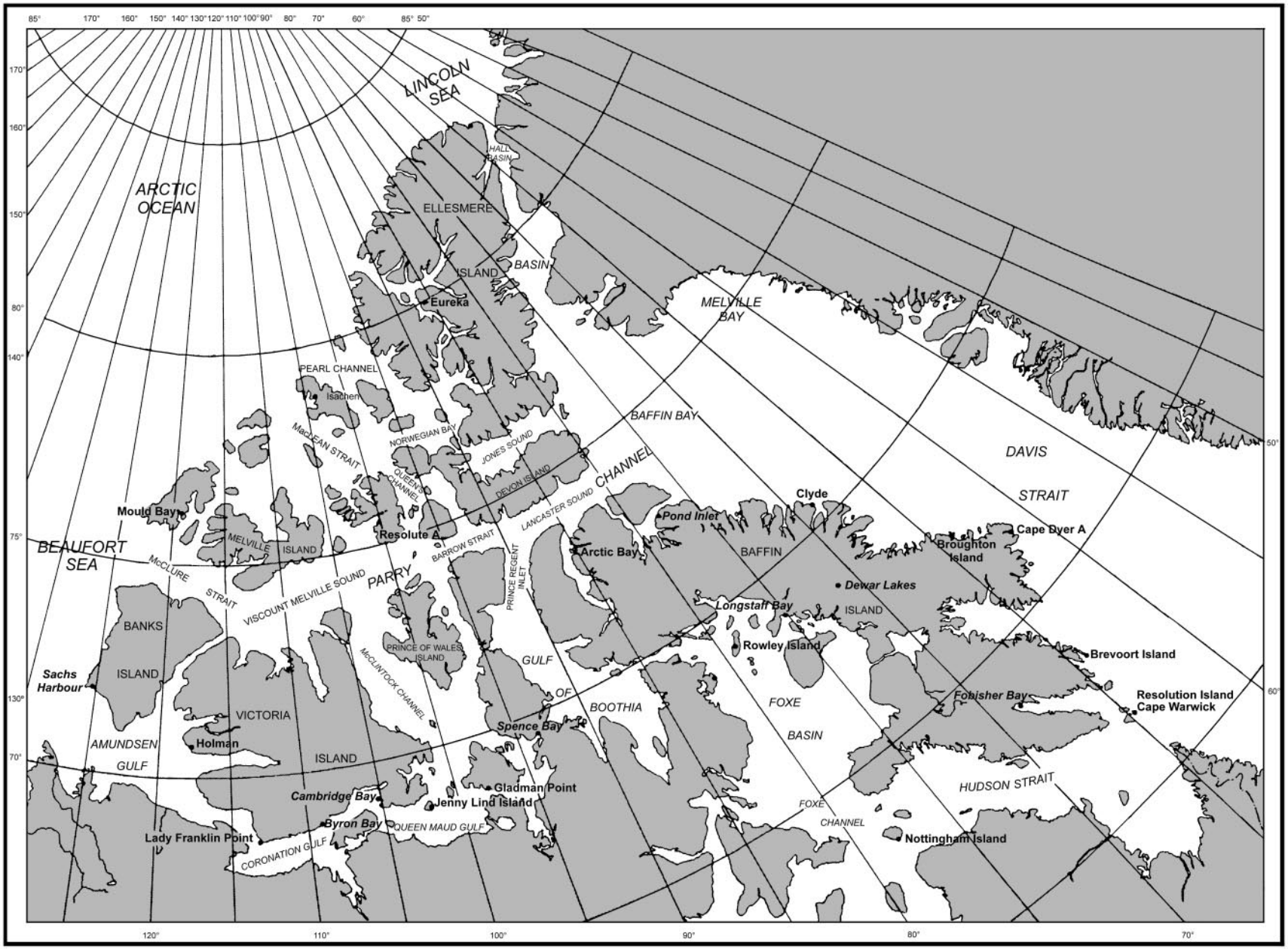
The drainage of that part of the great plateau E of Hudson Bay is divided, the rivers flowing on the one hand to Hudson Bay and Hudson Strait, and on the other to the Atlantic Ocean and Saint Lawrence waterway.

Similarly, the drainage of the “Barren Grounds” is divided between Hudson Bay and the Arctic Ocean. The headwaters of some of these rivers lie in U.S. territory; of these, the largest is Nelson River which is 1,600 miles long from its farthest source in the Rocky Mountains. Along the course of the river there are some important electrical power generating stations and water is also drawn from it for irrigation. Hydro-electric power is also generated on the Churchill River.

The largest and longest of all the rivers is the Mackenzie River, which flows into the Arctic Ocean about 110 miles E of the Canada/Alaska boundary; it is navigable by shallow-draft vessels for long distances. Generally, the rivers of the region and most of the streams start to flow after the winter freeze in late May or in June; the flow then increases rapidly to a peak within 1or 2 weeks, decreasing almost as quickly to a low stage for the remainder of the summer. On the mainland, the annual runoff is about half the average of that for the whole country and, in the Arctic Archipelago, about one third of the average.



The Canadian Arctic—Chartlet No. 1



The Canadian Arctic—Chartlet No. 2



The Canadian Arctic—Chartlet No. 3

Eastern Block

The mainland section of the eastern block extends from the vicinity of Chesterfield Inlet north to Bellot Strait and NE to Fury and Hecla Strait. It is mostly an area of rugged Precarnbrian rocks, vast stretches of which are heavily glaciated. Along the low shores of Roes Welcome Sound, between Cape Fullerton and Repulse Bay, this heavy cover of glacial drift has resulted in a smooth and regular coast and has impounded the drainage into a waterlogged pattern of shallow lakes and meandering rivers. Muddy underwater flats extend a considerable distance offshore.

Baffin Island, the largest island in the Canadian Arctic Archipelago, ranks as the second largest island in the northern hemisphere. Its area is 507,451 km^2. Bylot Island, 11,067 km^2 in area, lies within the large bay at Baffin Island's NE corner.

The highland zone along the east coast of Baffin Island extends inland only to about the heads of the major fiords, and south of Cumberland Sound the terrain is upland in character rather than truly mountainous. In Hall and Meta Incognita Peninsulas the land rises toward the east and NE but the greatest elevations seldom exceed 900m. The rugged south and SW coasts of both peninsulas are generally below 300m in height, and are fringed by a maze of reefs, rocks, and islands. The north and NE coasts are, by contrast, bold and precipitous, forming the impressive SW shore of Frobisher Bay and the Davis Strait shore of Hall Peninsula.

The mountainous zone extends NW from Cumberland Sound, with the exception of Barnes Ice Cap, and contains all the major ice fields and glaciers on Baffin Island and Bylot Island. The largest and highest of these fields is Penny Ice Cap on Cumberland Peninsula, rising to elevations of about 2,000m in the central area and with heights estimated at just over 2,100m in its SE section.

Between these ice fields, the entire east coast is distinguished by precipitous peaks from 900 to 1,500m high. Some of these rise almost sheer from the sea, and are surrounded by ice fields and glaciers which, although less extensive than those of Bylot Island and Cumberland Peninsula, are nonetheless considerable and impressive. There are also small ice fields in the NE parts of Hall and Meta Incognita Peninsulas.

The area contains two outstanding major features. One is the Barnes Ice Cap, located W of the mountain zone, with streams draining east to the fiords between Clyde and Scott Inlets and W to Foxe Basin N and S of Eqe Bay. The cap rises to about 1,100m and is a relic of the vast ice sheet which formerly covered the entire area. For miles around it is encircled by high moraines and fields of glacial outwash.

The gentle gradient continues offshore for considerable distances giving shallow coastal waters and low featureless coasts. For 10 to 30 miles inland these coasts are bordered by a distinctive belt of waterlogged, marshy country, dotted with numberless shallow circular lakes and drained by a striking pattern of straight parallel currents flowing at right-angles to the coast.

Government

Canada is a confederation with a parliamentary democracy. The country is divided into ten provinces and three territories.

Elizabeth II, recognized as the Chief of State, appoints a Governor-General. The Governor-General appoints a Prime Minister after Parliamentary elections are held. The bicameral



Flag of Canada

Parliament consists of a 105-member Senate, appointed by Governor-General for 5-year terms, and a directly-elected 301-member House of Commons, serving 5-year terms.

The legal system is based on English common law, except in the province of Quebec, where the legal system is based on French civil law.

The capital is Ottawa.

Holidays

The following holidays are observed:

January 1	New Year's Day
Good Friday	Variable
Easter Monday	Variable
First Monday preceding May 25	Victoria Day and Queen Elizabeth II Day
July 1	Canada Day
First Monday in September	Labor Day
Second Monday in October	Thanksgiving Day
November 11	Remembrance Day
December 25	Christmas Day
December 26	Boxing Day

Note.—Canadian holidays falling on a Saturday or Sunday are observed the following Monday.

In addition, the Northwest Territories observe a General Holiday, declared by the Commissioner, usually on the first Monday in August. Similarly, the Yukon Territory has a general holiday on "Discovery Day, usually August 17, to celebrate the discovery of gold in the Klondike.

Ice

Ice (Summer Conditions)

Although the winter pattern remains fairly constant, break-up in summer varies considerably from one year to the other. Certain areas clear regularly every summer, others are almost always severely congested; but the marginal, intervening area is rather extensive and is very important to navigation.

In general, it can be stated that a narrow waterway, or one studded with islets and shoals, is one where melting of the ice

depends upon air temperature and solar radiations. An example of this is Coronation Gulf where little ice motion can occur. On the other hand, in a broad, unrestricted waterway such as Parry Channel, wind conditions are by far the most important factor governing the timing and extent of break-up.

The main drift of ice in the Archipelago is to the S and E, but this is the very broadest generalization based on mean winds and average water currents and each channel and inlet has its own peculiarities. A permanent offshore current flows S through Nares Strait into Baffin Bay where it is joined by a minor drift from Jones Sound, and significantly, from currents in Lancaster Sound and Melville Bay. The resulting Canadian Current on the Baffin Island coast carries ice southward at about 5 miles per day through Davis Strait and along the Labrador coast. In the Arctic Ocean, a general clockwise water current (and ice drift) moves SW along the edge of the Archipelago toward Alaska. Weak branches of this current penetrate through the Queen Elizabeth Islands waterways into Parry Channel and then into Baffin Bay.

Since wind is a major factor influencing the extent of break-up in the broader waterways, it is apparent that favorable conditions in one area can result in very unfavorable conditions in an adjacent waterway if all the neighboring ice is carried into it. Such variations may or may not be temporary. Extensive clearing of ice in one area during one year can lead to difficult ice conditions in the same area the following year. Ice conditions in any one year will be a combination of different portions of such extremes.

Davis Strait and Baffin Bay

This large area is the main gateway to the Eastern Canadian Arctic and as such its ice regime is extremely important to the development and exploitation of that entire region. Water motion is one of several factors which must be considered in studying the ice regime of an area. In general, its importance can be said to vary with current strength. In this particular area the currents not only vary in strength but also in temperature. For instance, there is a relatively warm, N current along the west Greenland coast; a cold, S current along the Baffin Island coast; and a major polynya in Smith Sound at the north end of Baffin Bay. These variables, combined with the physical geography of the surrounding terrain, exert a particularly strong effect on the nature, extent, and severity of the ice regime.

The warm current flowing N along the Greenland coast, although very weak, slows the ice formation in eastern Davis Strait; this results in earlier break-up along the coast from Disko to Kap York and provides an early access route into the "North Water" of Smith Sound and NW Baffin Bay. At the same time the cold Canadian Current flowing southward along the Baffin Island coast is relatively strong and results in early ice formation, delayed break-up, and an extension of ice-covered waters far beyond the limits of Davis Strait.

The polynya in Smith Sound, which is commonly referred to as the "North Water," is maintained by N winds, water currents, and an ice bridge in the northern part of the sound. Vertical mixing of the warm and cold waters may also play a part. It recurs every year and is always present, although during calm periods in mid-winter it may be briefly covered by new or young ice. Because it occurs every year, it is called a recurring polynya.

As soon as air temperatures begin to rise in spring, this polynya expands southward and soon extends into the major area of Baffin Bay.

An opening in the ice at this time of year is important for various reasons. It is a source of waves which assist in the break-up of neighboring ice, and it provides an area into which the adjoining ice can disperse where it will melt more rapidly. Of even greater importance is the heat flow into the water which occurs because clear skies are common during the Arctic spring and days are long. A water surface absorbs most of the solar radiation reaching it, whereas an ice surface reflects most of this energy. A polynya is a heat source, and a focus for the disintegration of ice.

Freeze-up in Baffin Bay is a lengthy process beginning in mid-September in the NW sections. The growing ice cover spreads southward across the approaches to Jones Sound during the last week of September, across the approaches to Lancaster Sound during the second week of October, and along the Baffin Island coast across the approaches to Frobisher Bay by the second week of November. The first permanent ice in Melville Bay usually develops during the second week of October. A rapid seaward expansion of the ice cover occurs during the latter half of October and ice spreads to all but the west coast of Greenland by the end of November. This lead along the Greenland coast gradually retreats S to Upernavik in December and as far as Egedesminde by mid January. Only brief intrusions of ice driven by onshore winds occur along the Greenland coast from Egedesminde to Godthaab, though some fast ice does form in bays, fiords, and inlets.

Although ice from East Greenland (commonly called "storis") rounds Cape Farewell each winter, it rarely moves further north than 62˚N and reaches Godthaab only once in 20 to 30 years. The maximum extent of this ice occurs in late spring after the Baffin Bay ice has begun to retreat and the two areas of ice never mingle.

The undisturbed ice cover in Baffin Bay can grow to 120 to 200cm during the winter in the N portions and 75 to 150cm in the S, but the general southward drift of the offshore ice exerts its influence making the floes somewhat thinner off Lancaster Sound and thicker off Cape Dyer. Distortion of the floes in the form of ridges and hummocks results from the varying winter winds in the area.

Fast ice becomes well developed in the Kap York Upernavik sector of Greenland, often reaching 15 to 20 miles wide in Melville Bay. Despite the absence of offshore islands similar growth also occurs on the Baffin Island coast because of the frequency of winds having an onshore component. The width of this shore-fast ice varies mainly between 8 and 19 miles from Pond Inlet southward along the coast to Cape Dyer, except in Home Bay where it expands to 32 miles in places. Between Cape Dyer and Cape Mercy the shore-fast ice is much narrower.

In spring the "North Water" begins to expand southward toward Kap York and Bylot Island as the rate of formation of new ice decreases. At the same time, the warm current on the Greenland coast begins to form a lead northward beyond Disko. These two open water areas join during the last week of July and for the remainder of the summer the ice is exposed to wave action on three sides. While this is developing, it is normal to find a separation of the Baffin Bay and Davis Strait ice beginning at Cape Dyer where tidal motion is strong.

During July and August, the ice usually melts more quickly on the north Baffin Island coast than it does in the center of the bay, because its retreat is aided by water motion and the fact that the water coming from the north has been warmed by the sun for several months. The remaining "Middle Ice" extends from Cape Dyer and Home Bay northward to about 73˚30'N in early August, and is reduced to numerous offshore patches by the end of the month. The ice in the Cape Mercy/Cape Dyer area also melts gradually during this period with very little southward drift past Cape Mercy.

Complete clearing of Baffin Bay does not occur every year, but the floes remaining in late September are easily dispersed by autumn storms, and are nearly always carried out of the bay before the growing ice attains appreciable thickness. Also late in the season, intrusions of old ice can occur through Smith Sound into Baffin Bay. Patches of this ice can be carried into the Devon and Bylot Islands area in October to become a constituent of the growing ice. Some old ice has also been known to enter Baffin Bay from Lancaster Sound. The total area of such intrusions would amount to only a small percentage of the total ice cover.

Another feature of Baffin Bay is that it is the birth place for thousands of icebergs produced by the Greenland and Ellesmere Island glaciers.

Nares Strait

This northernmost waterway connecting Baffin Bay to the Arctic Ocean contains some of the heaviest ice in the entire Archipelago. There is a general clockwise drift of ice in the North American sector of the Arctic Ocean, and as a consequence, onshore pressure is common along the N coasts of Greenland and Ellesmere Island. A cold water current carries the severely deformed ice of the Lincoln Sea into Nares Strait whenever the ice is free to move, and often results in a drift of old ice into Baffin Bay in the autumn.

A recurring polynya, the "North Water," occupies the S end of Nares Strait, but because of the current and mean winds, its influence is felt mainly in Baffin Bay. The N edge of this polynya lies in the narrowest portion of Smith Sound at about 78˚30'N. From Kane Basin to the Lincoln Sea, the strait is covered in winter with a solid, non-moving layer of predominantly old ice, cemented together by locally formed first-year ice.

When melting begins in mid-June there is little change other than puddling for about one month, but limited areas of open water can appear at the head of some bays along the coast of Ellesmere Island.

Break-up develops in mid-July as the first-year floes become rotten and permit the old floes to drift about in response to winds and currents. The speed of the current changes as the waterway varies in width, resulting in specific areas where dispersed ice is most common, Kennedy Channel being one such area, and others where congested conditions develop easily. Nevertheless, wind drift is the important factor which modified ice motion, caused initially by the water current, can clear or congest specific areas, create leads, or stop southward transport of ice completely. The ice remains variable and mobile until freeze-up but differs from the other channels in its higher proportion of old Ice.

Freeze-up progresses slowly from early September, because autumn storms are common in Baffin Bay resulting in northerly winds in Nares Strait which thus prolong ice motion. Consolidation of the ice cover occurs most frequently during January.

Humboldt Gletscher, on the east side of Kane Basin, is an important source of icebergs which tend to collect in major groups awaiting favorable conditions before starting their southward journey through Smith Sound. Ice islands or their fragments can be carried into the waterway from the Arctic Ocean and have been known to temporarily block all ice motion by becoming lodged against the islands in Kennedy Channel.

Ice (Winter Conditions)

Sea ice presents a severe hazard to shipping over the region by late winter (March/April) when all but the extreme SE part is usually ice-covered. However, the greater part becomes ice-free by late summer (August/September) at which time the ice is confined to the W and N parts of the archipelago and to the oceanic area farther N. Changes in ice cover from one year to another in the same month are also considerable, especially in the channels within the archipelago.

Due to the relative narrowness of the channels, the ice becomes fast over the greater part of the Canadian Arctic Archipelago each winter; the exceptions are the Gulf of Boothia and most of Lancaster Sound.

Over the remainder of the region, outside the archipelago, the fast ice is confined to a relatively narrow strip along most coasts. The outer edge of the fast ice in the region cannot be generally related to any given depth contour, as it can in other regions where heavily-ridged old ice floes ground in relatively shallow water forming anchor points for the ice to become fast.

Although this process probably accounts for the position of the fast ice edge to the N and NW of the archipelago, it clearly cannot apply to the remainder of the pack ice zone where the ice normally melts each summer. In these latter areas the fast ice edge is usually located close inshore except where there are off-lying islands, as on the E side of Hudson Bay; even here the edge does not always extend from the mainland shore to the islands.

In parts of Baffin Bay, notably Home Bay and Melville Bugt, the fast ice edge is usually located over considerable depths, sometimes 200m or more, away from any islands. In these areas icebergs grounded on banks far offshore probably account for this abnormality.

In some areas the fast ice edge does not occupy the same approximate position every year. For example, fast ice sometimes covers Lancaster Sound and occasionally the ice in Amundsen Gulf does not become fast. This variability has a considerable effect on the time of break-up at both ends of the Northwest Passage. In the former case break-up may be delayed for almost two months; whereas, break-up may occur about 2 months earlier than normal. The fast ice edge in M'Clure Strait is sometimes found at about 119˚W; whereas, normally it occurs at about 125˚W.

The position of the fast ice edge varies, as its location probably depends on the winds during the early winter at the initial stages of ice development. It is thought that light winds during this period will allow the ice to become fast over the maximum area; whereas, strong winds will tend to delay or even prevent the process.

Hudson Bay and Hudson Strait

Although both areas are frozen over each winter, the ice always melts completely in summer, usually for a period of about 3 months. Break-up does not normally begin until late April when leads appear on the NW side of Hudson Bay and the N side of Hudson Strait, although strong offshore winds may temporarily open up leads off any coast in earlier months. The process of break-up is slow and by late June the greater parts of both areas are still ice-covered. Even thought long stretches of the coastline in Hudson Bay are usually ice-free at this time, the approaches to the bay are obstructed by close pack ice.

Open water appears on both the W and E sides of Hudson Bay at the end of June.

The greater part of melting in both the bay and the strait occur in July, and by the end of this month there is usually easy access through Hudson Strait to any port in Hudson Bay; both areas normally become completely ice-free by mid-August. In a bad season an easy passage through Hudson Strait may not be achieved until the end of August due to pack ice from Foxe Basin being driven across the W end of the strait by N winds. In such a season final clearance in Hudson Bay does not occur until early September.

The onset of the new ice season usually begins in early November in the NW part of Hudson Bay. By the end of that month the N part of the bay and the W part of the strait are usually ice-covered.

Davis Strait and Baffin Bay

The sea ice in Davis Strait is derived from two different sources. The greater part, known locally in Greenland as the "West Ice," is formed within Baffin Bay and Davis Strait. The remainder of the ice, known as the "East Ice" or "storis" is derived from off the E coast of Greenland; this ice rounds Kap Farvel under the influence of the current to affect parts of the area off the SW coast of Greenland. The "West Ice" usually reaches its greatest extent in March and April when the whole area, apart from the SE approaches to the Davis Strait, is ice-covered. The ice edge lies much farther S on the W side of Davis Strait than it does on the E. This is due to the disposition of the cold and warm currents in the area. At this time of greatest extent (March/April) the maximum limit, which is associated with persistent NW winds, lies a considerable distance from the mean, but the minimum limit, occurring when SE winds prevail, lies only about 50 to 100 miles NW from the mean. This restriction on the minimum limit is probably due to the cold, ice-bearing Canadian Current.

Small openings sometimes occur off the E coast of Baffin Island in March and April, mainly due to strong offshore winds, while a small open water area, or polynya, usually forms at the head of Baffin Bay at the end of April, although it may appear temporarily in any earlier month. This polynya, known as the "North Water," forms at the flaw between the fast ice in Smith Sound and the pack ice in Baffin Bay. Strong ENE winds, not uncommon in winter, drive the pack ice away from the Greenland coast towards Ellesmere Island, where it is carried S by the current. A lull in these winds allows the "North Water" to freeze again until a further strengthening of the winds repeats the clearance process.

During the months of May to July, the ice edge in Davis Strait retreats rapidly N and more slowly W, then trends to N to S orientation in June and July, forming a wide lead off the Greenland coast. This unusual configuration can only be attributed to the pattern of the currents in this area. However, the reduction in ice cover is not solely due to the NW retreat of the ice edge in Davis Strait. Ironically, melting also occurs from the N. As air temperatures rise in late winter, the re-freezing of the North Water" proceeds more slowly and as a result stretching begins to increase until, by late July there is usually a vast area of open water in the NW part of Baffin Bay. The pack ice between this open water and the wide lead off the coast of W Greenland is often referred to as the "Middle Pack." The "North Water" usually links up early in August with the open water farther S. A considerable degree of melting occurs during August and early September so that by mid-September, the whole area is usually ice-free. In a light ice season, Baffin Bay may become ice-free by late August, but in a severe season an area of ice off the E coast of Baffin Island may persist throughout the summer.

Although new freezing usually begins in the N in September, only the N part of Baffin Bay is ice-covered at the end of October. During November the ice edge advances SE at its maximum rate; thereafter the rate of advance slows up until the ice edge reaches its greatest SE extent in March and April. In a severe, early winter season, associated with NW winds and the persistence of some ice throughout the summer, pack ice may cover most of Baffin Bay and a substantial part of Davis Strait by the end of October, but in a light ice season, usually associated with SE winds, this position may not be reached until about mid-November.

The Storis or the East Ice usually rounds Kap Farvel during April, although it may do so by late November in a severe ice year, and recedes E of this cape early in August. It reaches its greatest NW extent in April and May, when the NW limit normally lies about 150 miles from Kap Farvel. The orientation of this tongue of ice varies from year to year. In some years it may point towards W and in others more towards NW. The Storis is usually widest in the SE where its width is normally 60 to 70 miles, and there is normally a lead along the coast extending as far SE as Frederiksdal. In a severe year the Storis may extend N to about 65˚N off the W coast of Greenland in May, June and July, but there its concentration is usually less than 5/10. Again there is normally a wide lead along the coast, except in the far SE, but onshore winds may close this lead from time to time. The minimum limit from April to August lies E of Kap Farvel. However, it would be wise to assume that even during a light season some ice penetrates W of Kap Farvel during these months, although it might be only in the form of a narrow tongue lying parallel to the coast.

The maximum limit at the end of March appears to link the "West Ice" with the Storis. This is a consequence of combining the worst conditions from different years. In any one severe ice season these two ice fields are unlikely to link together since that result in maximum conditions for the "West Ice, mainly NW winds, simultaneously produce minimum conditions for the Storis and vice versa.

Ice (Canadian Arctic Waters)

The severity of the Canadian Arctic winter is such that even unusual year to year variations in weather produce little change in the total ice cover. Thus the yearly variations are measured

by means of the thickness of the ice rather than by its extent or nature. But even here, the differences from season to season are of minor importance. It is generally not significantly easier for a vessel to penetrate 180cm of ice than 200cm. Yet in order to reduce ice thicknesses from 200 to 180cm, daily temperatures would have to range about 9˚C above normal for three entire months which is an appreciable variation. Therefore, the following description of winter ice conditions can be considered relatively accurate for most winters, regardless of weather variations.

In general, ice begins to form in early September. The dates vary from one year to another and one to another location, with the earliest formation occurring adjacent to old ice, unmelted floes, and in the northernmost shallow areas. Initial ice is very weak and easily broken up, but as temperatures continue to fall in September and October, it soon consolidates into a solid non-moving sheet over the most of the channels. First year ice grows to 45 to 90cm by the end of November, 90 to 150cm by the end of January, and to 120 to 200cm by the end of March. Maximum thicknesses occurring in mid- May reach the 150 to 225cm range in most areas.

Most of the channels in the Archipelago are solid and non-moving ice during the winter, except for Lancaster Sound and portions of Prince Regent Inlet and Gulf of Boothia where the ice is in restricted motion. Tides, currents, and wind in combination keep the ice in motion throughout the Arctic Ocean, Baffin Bay, Davis Strait, and Foxe Basin in the winter. In these areas flaw leads, pressure ridges, and slightly dispersed ice can develop at any time depending upon the wind regime. A major polynya, the North Water, is always present in Smith Sound as a result of ice motion. Limited polynyas can also develop as a result of tidal currents in Hell Gate and Penny Strait, but these have little relation to the overall winter regime. An extensive polynya, called the “Cape Bathurst Polynya,” develops in most years in Amundsen Gulf in spring as a result of the seasonal wind direction. It does not form every year, however, and its location can vary significantly. It is not usually present during winter months.

Ice Convoys

When ice conditions are severe, masters of ships may be requested to form their ships into convoy for escort by an icebreaker or icebreakers.

Masters of ships being escorted should provide the master of the icebreaker with the following information to give an approximate assessment of their vessels’ capabilities:

1. Tonnage (gross and net).
2. Open water speed.
3. Ice class, if any, and classification society.
4. Drafts forward and aft.
5. Number of propellers and rudders.
6. Shaft horsepower.
7. Propulsion plant, whether diesel or turbine, etc., and astern power expressed as a percentage of full ahead power.
8. Radiotelephone working frequencies.

Communication in Ice Convoys

It is essential that all vessels be equipped with radiotelephone transmitting and receiving facilities on the bridge. They should be capable of working medium frequencies 2134 available and considered necessary, and the organization of kHz, 2237 kHz, 2738 kHz, 2182 kHz, and very high frequencies 156.8 MHz and 156.3 MHz.

All ships under icebreaker escort should maintain a continuous radiotelephone watch on the bridge and all advice originating from the icebreaker should be acted upon immediately.

For further details consult the Canadian Coast Guard publication *Ice Navigation in Canadian Waters*.

Ice Reconnaissance

Shore-based aircraft and ship-based helicopters carry out regular ice reconnaissance throughout Arctic waters during the break-up to freeze-up period which is normally May to November. During winter months these trained ice observers, aided by remote sensing equipment, conduct monthly Arctic ice reconnaissance missions to monitor seasonal development.

Icebreaker Service

Masters are cautioned against attempting to save time by forcing a passage under full power through ice-congested areas unless the ice is in an obviously deteriorated condition. The indiscriminate use of full power in ice can inflict extensive damage to a vessel’s underwater shell and fittings.

Whenever conditions warrant, icebreaker escort or assistance will be provided. However, vessels disregarding routing advice or failing to advise the Ice Operations Office of their presence in the area will have low priority for icebreaker assistance if beset, unless safety of life is involved.

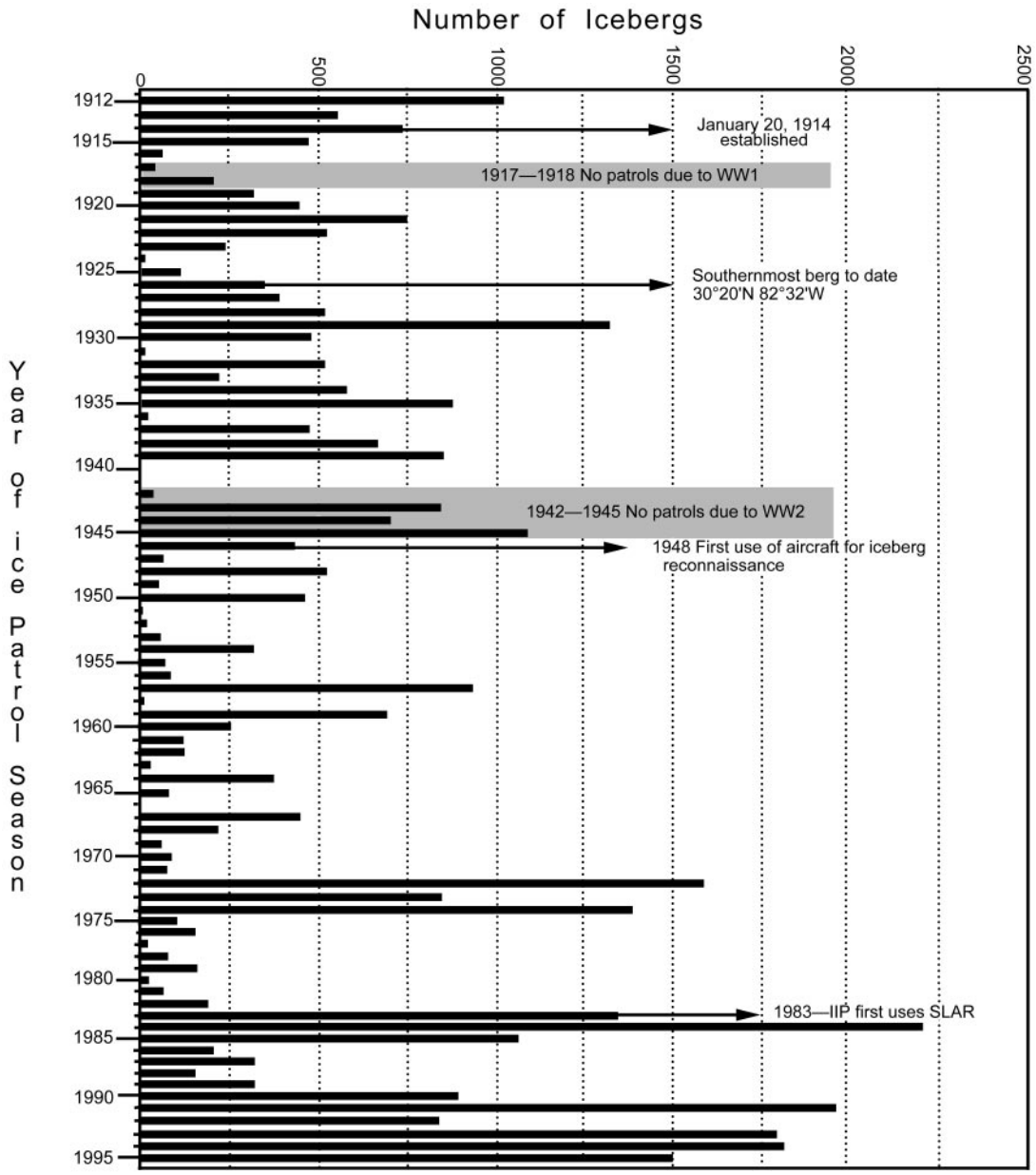
As the Canadian Coast Guard has only a limited number of icebreakers available for the escort and support of shipping, they cannot always be provided when requested. It is therefore important for the Arctic Canada System (NORDREG CANADA) to be fully informed as to the whereabouts and movement of ships when ice is present. Failure to follow the proper reporting procedures, by ships unable to cope with prevailing ice conditions on their own, will add to the difficulties of providing icebreakers and can lead to serious delays.

International Ice Patrol

International Ice Patrol (IIP) provides a service which monitors the extent of the iceberg danger in the vicinity of the Grand Banks of Newfoundland. This danger area is passed to interested shipping as a broadcast Limit of All Known Ice (LAKI). In order to define this limit as accurately as possible, IIP uses reports from various sources. These include icebergs detected by IIP and Canadian aircraft reconnaissance and reports from passing vessels. The path of reported icebergs since sighting is predicted using the momentum balance for each target and the deterioration of each iceberg is estimated using wave and sea surface temperature analyses from U.S. Navy models. The IIP watchstanders attempt to correlate new sightings with prior observations through the process of resights.

Ice Advisories and Forecasts

The Arctic Canada Traffic System (NORDREG CANADA) Center at Iqaluit, North West Territory (NWT) is staffed with an Ice Operations Officer during the Arctic navigation season. This office provides current information on ice conditions, advice on the best routes to follow, icebreaker support where convoys if required. The address for this center is:



Annual Counts of Icebergs Crossing 48˚N Latitude (1912-95)

NORDREG CANADA
Canadian Coast Guard
Department of Transport
P.O. Box 189
Iqaluit, Nunavet X0A 0H0
Telephone: (819) 979-5724 or (819) 979-5769
Facsimile: (819) 979-4236 or (819) 979-4264
Radiogram: NORDREG CANADA

The daily production of daily ice analysis charts and daily ice hazard bulletins is the responsibility of the Canadian Ice Service, Environment Canada, Ottawa. This ice information service coordinates the data recorded during aircraft reconnaissance flights with satellite imagery. These and other inputs are analyzed and used to develop both daily and weekly regional ice analysis charts of current conditions. From these charts and predicted meteorological parameters, plain language daily ice hazard bulletins and 30-day ice forecast bulletins are also prepared. All these ice products are available on the web site of the Canadian Ice Service. The mailing address for this office is:

The Canadian Ice Service
Environment Canada
Lasalle Academy
373 Sussex Drive
Block E, Third Floor
Ottawa, Ontario, KlA 0H3

Telephone: (800) 767-2885
(613) 996-1550
Facsimile: (613) 947-9160
E-mail: cis-scg.client@ec.gc.ca
Web address: http://ice-glaces.ec.gc.ca

The plain language daily ice hazard bulletins referred to above are broadcast by Canadian Coast Guard Radio Stations. For details of stations broadcasting these reports, broadcast times, frequencies used, and times of transmissions, consult the Canadian Coast Guard publications Radio Aids for Marine Navigation (Atlantic and Great Lakes) for the E part of the Arctic and Radio Aids for Marine Navigation (Pacific) for the W part of the Arctic.

Radio facsimile broadcasts of daily ice analysis charts are sent by Station VFF Iqaluit for the E part of the Arctic, Hudson Strait, and Labrador. Station VFR Resolute sends charts for the central and W parts of the Arctic. For further details, see Pub. 117, Radio Navigational Aids.

In distress, transmit the International Distress Call on 2182 kHz and/or 156.8 MHz (VHF channel 16). If transmission on these frequencies is impossible, any other available frequency on which to draw attention should be used. Any Coast Guard Radio Station or vessel that hears a distress message will respond to inform the relevant RCC.

The transmission of a distress message may start an extensive sea and air search which sometimes continues for days in hazardous weather. Therefore, in need of urgent assistance but not in distress, vessels transmit the urgency signal on the frequencies described above. For further details concerning distress and urgency communications consult Pub. 117, Radio Navigational Aids.

Ice Regime Routing Message

When the Arctic Ice Regime Shipping System is used, the Arctic Shipping Pollution Prevention Regulations (ASPPR) require that an Ice Regime Routing Message be sent to NORDREG. (See Vessel Traffic Service for further information on NORDREG.) This message can be brief; however, if the vessel's route includes areas on ice analysis charts with ice concentrations that may have negative Ice Numerals, the message should include additional pertinent information explaining the voyage plan (e.g., expectations of changes in conditions and/or other considerations). The message should be updated if the plan and/or ice conditions change significantly.

The Ice Regime Routing Message should include:

1. Ship name.
2. Ship call sign and IMO number.
3. The ice strengthening of the ship (Type/CAC/Arctic class, etc.).
4. Date and UTC time.
5. Ship's current position, course, and speed.
6. Anticipated destination.
7. Intended route.
8. A listing of the ice regimes and their associated Ice Numerals.
9. Source(s) of ice information.
10. Any other pertinent information or comments.
11. Name of any escorting vessel.
12. Name(s) of the Ice Navigator(s) on board.

When the Arctic Ice Regime Shipping System is used, in accordance with the ASPPR, an After Action Report is to be submitted. The report can be brief; however, in cases where the voyage has involved difficulties or unexpected occurrences, it will be valuable to include additional information. Unlike the routing message, the After Action Report is to be sent to Transport Canada, as follows:

Regional Director, Marine
Prairies & Northern Region—ANMS
Transport Canada, Place de Ville, Tower "C"
330 Sparks Street, 14th Floor
Ottawa, Ontario
K1A 0N5
Facsimile: (613) 991-4818

The After Action Report should include:

1. Ship name.
2. The ice strengthening of the ship (Type/CAC/Arctic class, etc.).
3. A description of the actual route, including transit speeds, the ice regimes encountered, and the Ice Numerals for each.
4. Copies of the ice information used.
5. Escort information, if applicable.
   a. Duration of the escort.
   b. Ice regime under escort.
   c. Characteristics of the track.
6. Weather conditions and visibility.
7. Any other important information.

Languages

English and French are the official languages.

Magnetic Field

Magnetic Variation and Local Anomalies

Most of the waters described in this publication are less than 1,000 miles from the North Magnetic Pole which, in 2000, was situated in the Arctic Ocean NNW of Ellef Ringnes Island; it is continuing to migrate NNW. Within this distance the magnetic compass not only becomes progressively more sluggish and less reliable for navigation; but, in many areas, like Hudson Bay, the magnetic variation also changes rapidly.

These adverse conditions may be accentuated by local magnetic anomalies which have been observed from time to time in a number of places off the W coast of Greenland, in Hudson Strait and Hudson Bay, the NW corner of Foxe Basin, the NW part of Baffin Bay, the E part of Parry Channel and in Admiralty Inlet, in Amundsen Gulf and in Coronation Gulf.

Magnetic fields in the Canadian Arctic are few and locations are uncertain. The isogonic curves close-in to merge and change measurements rapidly within short distances. As a result, charted variations in the Arctic are unreliable.

Magnetic storms are another source that cause compass error in the Arctic. Magnetic variation fluctuates constantly within the hour. Diurnal changes of 10˚ in variations have been observed.

The influence of frictional error is another directive force that cause the compass to dip. The frequency of combined disturbances decrease efficiency greatly, and become sluggish and unreliable. For this reason the compass performs better in a

smooth sea free from ice than in an ice-infested area where its equilibrium is frequently offset by the vessel's impact on ice.

Magnetic storms are often accompanied by the dawn of Aurora Borealis, cause fleeting disturbances. Magnetic storms affect the magnetism of a ship as well as that of the earth. Changes in deviation as much as 45˚ have been reported during severe magnetic storms, possibly a total error.

Local magnetic disturbances occur when a mass of magnetic ore, possibly a wreck that lies sufficiently close to, cause compass error. This error is seldom caused by visible land, but more often by the ship passing over such masses of magnetic ore lying in shallow waters. It occurs in certain known localities, usually noted on the charts. Whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

Navigational Information

Radiobeacons

In the N part of Hudson Bay and in Hudson Strait, there are several continuously operating marine or dual-purpose marine/air radiobeacons. For details see Pub. 117, Radio Navigational Aids. In addition, in the Canadian Arctic there are a number of aeronautical radiobeacons. The dual-purpose marine/air radiobeacons operate in the 200 to 405 kHz band. They transmit a continuous carrier which is modulated by a 1020 or 400 Hertz tone. This tone is interrupted six times a minute for the transmission of a one, two or three letter identifier.

North Warning System Beacons (NWSB) have been established for the Department of National Defence use and may be used by the public when available, if necessary for safe navigation. The beacons are uncertified and unmonitored. The beacons are radio activated on 131.15 MHz, and provide approximately 20 minutes of service, operating at 125 watts power output.

Diving Operations

The "Diver down" flag (red, with a diagonal white stripe from the top of the hoist to the bottom of the fly) is commonly used on floats, buoys, and by small vessels to indicate an area where scuba diving or other diving activity is in progress. Other vessels should pass well clear of such areas and at a slow speed. This flag is not a substitute for the Flag A required to be displayed by vessels engaged in diving operations by Rule 27(e) of the 72 COLREGS.

Hydrographic Charts

Attention is drawn to the Canadian charts and publications regulations, an abbreviated description of which is given in the Annual Summary of Admiralty Notices to Mariners. Many of the present Canadian Arctic charts are based on aerial photography. There also are some charts where discrepancies of appreciable magnitude exists, such as in the charted positions of islands in relation to the adjacent coast, and in distances between coastlines forming channels. In some places, prominent topographic detail such as hills, mountains, and glaciers are incomplete or lacking. Soundings on some charts are compiled from vessels track and depth recorder, except where harbors and landing places have been systematically sounded. These depths have often been obtained with difficulty. Although the depths obtained by vessels en route are accurate while navigating through ice, their positions may not be.

Most of Canada's Arctic waters have not been surveyed to modern standards, except for Lancaster Sound, Barrow Strait, the Beaufort Sea, Amundsen Gulf, and the approaches to settlements and some mining sites. Spot soundings through the ice or reconnaissance track soundings are the only survey data available in the Arctic. In the Beaufort Sea, a route through the area with a large number of pingos has been surveyed in greater detail.

Maritime Territorial Claims

The maritime territorial claims of Canada are, as follows:

Territorial Sea *	12 miles.
Contiguous Zone	24 miles.
Fisheries or Economic Zone	200 miles.
Continental Shelf	200 miles or the Continental Margin.

* All waters between Canadian islands in the Arctic are claimed as internal waters. Hudson Bay is claimed as historic waters

Offshore Drilling

Offshore Exploration

Oil, gas and mineral drilling and production rigs, whether permanent or temporary, fixed or floating, may be encountered in increasing numbers in Canadian Arctic and adjacent waters.

Pollution

Canadian regulations, which are strictly enforced, expressly forbid the discharge from ships of oil, oily mixtures, garbage, or pollutant substances into Canadian waters or fishing zones.

Any such discharge, or the danger of a discharge, must be reported by the quickest means available to a pollution prevention officer or steamship inspector. Violation of the Canadian regulations is punishable by a fine of up to $100,000.00.

All vessels navigating in Canadian waters are requested to report oil slicks or pollution of any type to the nearest coast radio station or VTS Center and include the following information:

1. Name of vessel.
2. Location of vessel.
3. Time of incident or sighting.
4. Location of pollution.
5. Extent and quantity of pollution, if known.
6. Name of source of pollution, including port of registry for a vessel.
7. Any other relevant information.

Regulations

Marine Transport Security and 96-Hour Notification Prior to Entering Canadian Waters

The *Marine Transportation Security Regulations* came into force on July 1, 2004. These regulations address marine security levels, ship reporting responsibilities, and the responsibilities of the Canadian Government for the provision of information to vessels pertaining to security.

The entire text of the *Canadian Marine Transportation Security Regulations* and the *Marine Transportation Security Act* can be found on the Transport Canada web site.

Transport Canada Home Page
http://www.tc.gc.ca

Application.—The *Canadian Marine Transportation Security Regulations* apply to vessels and marine facilities (ports) in Canada and Canadian ships outside Canada engaged on voyages between a port in one country and a port in another country and that:

1. Are more than 100 tons gross tonnage, other than a towing vessel.
2. Carry more than 12 passengers
3. Are towing vessels engaged in towing a barge astern or alongside or pushing ahead, if the barge is carrying certain dangerous cargoes means [dangerous goods], other than products, substances, or organisms identified in Class 3, 4, 8 or 9 of the schedule to the *Transportation of Dangerous Goods Act, 1992, that are carried in bulk or in such a quantity as to require an emergency response assistance plan under section 7.1 of the Transportation of Dangerous Goods Regulations.*

The regulations do not apply to pleasure craft, fishing vessels, vessels without a crew that are in dry-dock, dismantled or laid up vessels, or government vessels.

Maritime Security (MARSEC) Levels.—MARSEC levels are based on the International Maritime Organization's International Ship and Port Facility Security (ISPS) Code security levels and describe the levels of threat that necessitate that the master of a vessel, the operator of a marine facility, or a port administration (as defined in the Canadian Regulations) take steps to reduce the likelihood of a marine transportation security incident.

MARSEC Levels are defined in the *Marine Transportation Security Regulations*, as follows:

1. MARSEC Level 1—The level for which minimum security procedures are maintained at all times.
2. MARSEC Level 2—The level for which security procedures additional to those of MARSEC level 1 are maintained for a limited period as a result of heightened risk of a security threat or security incident.
3. MARSEC Level 3—The level for which security procedures additional to those of MARSEC Level 1 and MARSEC Level 2 are maintained for a limited period when a security threat or security incident is probable or imminent, regardless of whether the specific target is identified.

MARSEC Level 1 has been in effect since July 1, 2004. A vessel to which the regulations apply must operate under MARSEC Level 1 at all times unless directed by the Minister of Transport to increase to a higher MARSEC level.

The operator of a vessel shall, before the vessel enters a port or interfaces with a marine facility, ensure that all procedures are taken that are specified in the vessel security plan for compliance with the MARSEC level in effect for the port or marine facility.

Vessel Responsibilities.—Any vessel that is operating at a higher MARSEC level than that in effect in the port or marine facility it is interfacing with, or is about to interface with, shall report their MARSEC level to a Marine Communications and Traffic Services (MCTS) Center of the Canadian Coast Guard. MARSEC Reports shall include the following information:

1. Identification of the vessel (vessel's name and radio call sign).
2. Time and position of the vessel.
3. Destination of the vessel.
4. MARSEC level at which the vessel is operating.

If an MCTS Center advises that there is a change in the MARSEC level affecting any port or other area within Canadian waters and a vessel cannot comply with the written procedures as outlined in the vessel security plan, the vessel must notify an MCTS Center.

When at anchor or alongside a marine facility, if a vessel receives notice from a Port Administration or a marine facility security officer that the MARSEC Level in the port or marine facility in which the vessel is located or is about to enter or interface with is raised to a higher level, the master of a vessel shall ensure that the vessel complies, without undue delay, before interfacing with the facility and no later than 12 hours after being notified of the higher level, with all procedures specified in the vessel security plan for compliance with that higher MARSEC level.

If the vessel is in a Canadian port, alongside or at an anchorage, it shall ensure that the local Port Authority or the marine facility security officer who issued the notice is advised if the vessel cannot comply with the higher MARSEC level that has been implemented.

If the vessel is a Canadian ship in the waters of a contracting government, the vessel should communicate its MARSEC level information to the relevant maritime authority of that country. If the vessel is a Canadian ship in the waters of a non-contracting government, and the master has to use temporary procedures or upgrade the vessel's MARSEC level to maintain the safety of the vessel, the master shall communicate this information to a Canadian MCTS Center.

Pre-arrival Information (96-hour Notification).—All vessels (the master) subject to the Marine Transportation Security Regulations are required to submit their 96-hour Notification and a true copy of their International Ship Security Certificate or Interim Ship Security Certificate to a Canadian MCTS Center, as follows:

1. When en route to or transiting through Canadian territorial waters.
2. When en route to or transiting through Canadian territorial waters and bound for a Canadian or US port.
3. When 96 hours from entry to Canadian territorial waters.

If the duration of the segment of the voyage before entering Canadian waters is less than 24 hours, vessels are required to send a pre-arrival report as soon as practicable before entering

Canadian waters but no later than the time of departure from their last port of call

The 96-hour Notification does not apply in the following instances:

1. Non-SOLAS vessels on a voyage between US ports on the W coast of Canada.
2. Vessels already inside the Great Lakes and its connecting and tributary waters and the St. Lawrence River as far as the lower exit of the St. Lambert Lock at Montreal in the Province of Quebec.

The 96-hour Notification should be send to one of the addresses below:

1. Vessels transiting through Canadian territorial waters or inbound to a Canadian port on the W coast shall send a Pre-arrival Report to the Canadian Coast Guard Regional Marine Information Centre (RMIC) via one of the following methods:
   - E-mail: rmic-pacific@pac.dfo-mpo.gc.ca
   - INMARSAT: telex 04352586 “CGTC VAS VCR”
   - Any Canadian Coast Guard MCTS Centre (free of charge)
   - Directly to CVTS Offshore by fax: (604) 666-8453
2. Vessels inbound to Canadian waters on the E coast including a Canadian or American port in the Great Lakes shall send a Pre-arrival Report to ECAREG Canada via one of the following methods:

St. John’s MCTS Center
Telex: 016-4530
Facsimile: (709) 772-5369
Telegraphic Identifier: CCGTC SNF
E-mail: ecaregsnf@innav.gc.ca
Halifax MCTS Center
Telex: 019-22510
Facsimile: (902) 426-4483
Telegraphic Identifier: CCG MRHQ DRT
E-mail: hlxecareg1@innav.gc.ca

3. Vessels inbound to a port within the Canadian Arctic Zone shall send a Pre-arrival Report to NORDREG Canada via one of the following methods:

Iqaluit MCTS Center
Telex: 063-15529
Facsimile: (867) 979-4236
Telegraphic Identifier: NORDREG CDA
E-mail: iqanordreg@innav.gc.ca
Note.—The Iqaluit MCTS Center is open only during the navigation season (June 25 approximately to December 15 approximately)

All vessels are required to send their complete 96-hour Notification plus a copy of their International Ship Security Certificate or Interim Ship Security Certificate. Any vessel with incomplete 96-hour Notification or a missing International Ship Security Certificate or Interim Ship Security Certificate will be denied entry into Canadian waters. It is the responsibility of the master of the vessel to ensure that all the information provided to Transport Canada is complete and correct. Transport Canada will be in communication with the vessel only when seeking additional information. Any vessel that enters Canadian waters after being denied entry into Canadian waters may be subjected to the following control actions, at the discretion of Transport Canada:

1. The vessel may be detained.
2. The vessel may be redirected.
3. The vessel may be expelled.

The vessel’s Pre-arrival Report shall include the following information:

1. Vessel’s name.
2. Country of registry.
3. Name of vessel’s registered owner.
4. Name of vessel’s operator.
5. Name of vessel’s classification society.
6. Vessel’s international radio call sign.
7. Vessel’s International Ship Security Certificate, Canadian Vessel Security Certificate, or ship security compliance document number.
8. Date of issuance, date of expiry, and name of the issuing body of its International Ship Security Certificate, Canadian Vessel Security Certificate, or ship security document.
9. Vessel’s International Maritime Organization number, if it is a SOLAS ship.
10. Confirmation that the vessel has an approved vessel security plan.
11. Vessel’s current MARSEC level.
12. A statement of when its last ten declarations of security were completed.
13. Details of any security threats to the vessel during the last ten calls at marine facilities.
14. A statement as to whether the vessel consents to tracking by the Canadian Government.
15. Details of any deficiencies in its security equipment and systems, including the communication systems, and the way in which the master of the vessel intends to rectify them.
16. Name of vessel’s agent and contact person and their 24-hour telephone and facsimile numbers, if applicable.
17. Name of vessel’s charterer, if applicable.
18. Vessel’s position and time at which it reached that position.
19. Vessel’s course and speed.
20. Vessel’s destination and estimated time of arrival at its destination.
21. Name of a contact person at the marine facility that it will visit and their 24-hour telephone and facsimile numbers.
22. The following information in respect to each of the last ten marine facilities visited:
    a. Receiving facility.
    b. Marine facility visited.
    c. City and country.
    d. Date and time of arrival.
    e. Date and time of departure.

23. A general description of the cargo, including cargo amount.

24. The presence and description of any dangerous substances or devices on board, if applicable.

Any change in the vessel's MARSEC level during the transit from the vessel's location at 96 hours prior to arriving at the port facility must be immediately reported to an MCTS Center.

The vessel security officer shall ensure that all security threats and security incidents are reported and recorded in accordance with the *Marine Transportation Security Regulations*. When underway or at anchor in an uncontrolled anchorage, reports shall be made to an MCTS Center. When alongside or at anchor in a controlled anchorage, reports shall be made to the Port Administration and appropriate law enforcement. When the vessel is in a Vessel Traffic Services Zone, the vessel shall report to the MCTS Center.

If the master of a vessel is required to institute temporary procedures in response to a security threat, the master shall ensure, as soon as possible, that a report is made, as follows:

1. If the vessel is in Canadian waters, to the nearest MCTS Center.

2. If the vessel is a Canadian ship in the waters of a contracting government, to the relevant maritime authority of that government and an MCTS Center (ECAREG Canada on the East Coast or the Regional Marine Information Center (RMIC) on the Canadian West Coast).

3. If the vessel is a Canadian ship in other waters, to an MCTS Center.

MCTS Center Responsibilities.—When the MARSEC level increases from the normal MARSEC Level 1, the MCTS Centers will issue a broadcast informing vessels of the increase to either MARSEC Level 2 or MARSEC Level 3. Once the MARSEC level decreases, the MCTS Centers will issue a broadcast informing vessels of the downgrade in MARSEC levels.

In VTS zones, the MCTS Centers often play a role in regulating vessels at anchor on behalf of port authorities. Therefore MCTS Centers will be involved in informing ships or port authorities about the MARSEC levels at port facilities or of the vessel.

Ship Security Alert System.—If the security of a vessel is under threat or in any way compromised, the master or other competent authority on board may activate the Ship Security Alert System, a system that transmits an automated message from vessel to shore. This message identifies the vessel and provides position information. When a security alert is received by a Canadian Maritime Rescue Coordination Center, the appropriate shore authorities will be notified.

Practices and Procedures for Public Ports

Transport Canada, pursuant to Section 76 of the Canada Marine Act, has instituted practices and procedures to be followed by all ships entering, berthing, departing, maneuvering, or anchoring in the waters of all public ports. These practices and procedures, which have been developed for the purposes of promoting safe and efficient navigation and environmental protection within the limits of public ports, can be accessed through the Internet at the following web address:

Practices and Procedures for Public Ports
http://www.tc.gc.ca/programs/ports/practproc.htm

Transport Canada Marine Acts and Regulations

Further information on Marine Acts and Regulations issued by Transport Canada can be found at the website below.

Transport Canada Marine Acts and Regulations
http://www.tc.gc.ca/acts-regulations/marine/menu.htm

Chart and Publications Regulations

Extracts from the Canadian regulations are quoted below:

1. These regulations may be cited as the Chart and Nautical Publications Regulations, 1995.

6.1 Subject to subsection 6.3, the person-in-charge of the navigation of a ship in waters under Canadian jurisdiction shall use, in respect of each area to be navigated by the ship, the most recent edition of:

(a) the reference catalog i.e., Catalogue of Nautical Charts and Related Publications.

(b) the annual edition of the Notices to Mariners, published by the Department of Fisheries and Oceans.

(c) the following publications, namely:

(i) sailing directions, published by the Canadian Hydrographic Service.

(ii) tide and current tables, published by the Canadian Hydrographic Service.

(iii) lists of lights, buoys, and fog signals, published by the Department of Fisheries and Oceans.

(iv) where the ship is required to be fitted with radio equipment pursuant to any Act of Parliament or of a foreign jurisdiction, the Radio Aids to Marine Navigation, published by the Department of Fisheries and Oceans

(d) the documents and publications listed in the Schedule of Documents and Publications.

6.3 The documents and publications referred to in paragraphs 6.1(c) and (d) may be substituted for similar documents and publications issued by the government of another country, if the information contained in them that is necessary for the safe navigation of a ship in the area in which a ship is to be navigated is as complete, accurate, intelligible, and up-to-date as the information contained in the documents and publications referred to in those provisions.

7. The master of a ship shall ensure that the charts, documents, and publications required by these regulations are, before being used for navigation, correct and up-to-date, based on information that is contained in the Notices to Mariners, Notices to Shipping, or Radio Navigational Warnings.

Schedule of Documents and Publications

1. Ice Navigation in Canadian Waters, published by the Department of Transport, where the ship is making a voyage during which ice may be encountered.

2. Table of Life-Saving Signals, published by the International Maritime Organization and reprinted by the Department of Transport, where the ship is making a foreign voyage, a home-trade voyage, Class I, II, or III, or an inland voyage, Class I.

3. The Merchant Ship Search and Rescue Manual (MERSAR), published by the International Maritime Organization, where the ship is making a foreign voyage or a home-trade voyage, Class I or II.

4. Where the ship is required to be fitted with radio equipment and is making a foreign voyage or a home-trade voyage, Class I or II, the following publications, published by the International Maritime Organization and reprinted by the Department of Transport:

(a) the International Code of Signals

(b) the Standard Marine Navigational Vocabulary

Conservation of Marine Mammals

The Federal Department of Fisheries and Oceans ensures the protection and conservation of marine mammals in Canadian waters. Harassing whales changes or interferes with their behavior, forces them away from their habitat at critical times in their annual reproduction and feeding cycles, and may cause them injury.

The Marine Mammal Regulations of the Fisheries Act (R.S.C., 1985, c.F.-14. Amended 1993) prohibit any form of harassment of cetaceans, including repeated attempts to pursue, disperse, or herd whales and any repeated intentional act of negligence resulting in disruption of their normal behavior. Individuals who contravene the Marine Mammal Regulations are guilty of an offense and liable to a fine not exceeding $500,000 and twenty four (24) months imprisonment (Fisheries Act sec. 78).

The following are general guidelines for dealing with marine mammals:

1. Do not hunt, chase, follow, disperse, drive, herd, or encircle whales.
2. Avoid any sudden changes of course or speed.
3. Avoid heading directly toward a whale.
4. If in an area known to be frequented by whales, be on the lookout to avoid collisions.
5. Travel parallel to whales' direction of travel.
6. The whales may come close to you; if they do, do not chase them. These animals may be calves that approach while their mothers are submerged feeding. Keep clear of the tail.
7. If you are operating a sailing vessel with an auxiliary motor, leave it in idle or turn on the echo sounder to signal your presence.
8. If it is impossible to detour around a whale or group of whales, slow down immediately and wait until you are more than 400m away before resuming speed.

Search and Rescue

The Canadian Armed Forces are responsible for coordinating all Search and Rescue (SAR) activities in Canada, including Canadian waters and the high seas off the coasts of Canada. A Joint Rescue Coordination Center (JRCC) are situated in the Canadian Forces base at Halifax, Nova Scotia to coordinate activities in the region. The JRCC is the headquarters of a coordinated network of agencies trained and responsible to search for and aid vessels in distress. There are Canadian Coast Guard officers at the JRCC who are on continuous watch to arrange the response to marine SAR incidents.

Maritime Rescue Coordination Subcenters (MRSC) are maintained at St. John's, Newfoundland and Quebec City. These centers function as subcenters of the above-mentioned JRCC. MRSC St. John's will coordinate the necessary response measures during marine SAR incidents in the waters off the coasts of Newfoundland and Labrador. MRSC Quebec will similarly respond to SAR incidents in the waters off the province of Quebec.

All distress situations and requests for assistance should be directed to the appropriate MRSC or JRCC via the nearest Canadian Coast Guard Radio Station, Vessel Traffic System Center, or by any other available means. The MRSCs can be contacted by e-mail, as follows:

MRSC St. John's:	mrscs@dfo-mpo.gc.ca
MRSC Quebec City:	opcentremrscqbc@dfo-mpo.gc.ca

All Canadian government ships and aircraft are available for search and rescue duties when required, as are all Canadian registered ships in accordance with the Canada Shipping Act.

In addition, the Canadian Coast Guard operates a number of specialized vessels whose prime mission is search and rescue.

Signals

Mariners are informed that, if it is necessary for the Department of National Defense to take control of certain Canadian ports, signals will be displayed from a conspicuous position at or near the ports concerned or by an Examination or Traffic Control Vessel, as follows:

Canada—Port Control Signals

Meaning	Day signal	Night signal
Entry prohibited	Three red balls, vertically displayed	Three flashing red lights vertically displayed and visible all around the horizon
Entry permitted	—	Three green lights vertically displayed and visible all around the horizon
Movement within a port or anchorage prohibited	Blue flag	One green light between two red lights vertically displayed and visible all around the horizon

The lights described above will be carried in addition to the ordinary navigation lights of Examination Vessels.

Masters of vessels are warned that should they approach the entrance to a port which is being controlled by the Department of National Defense they should not enter a declared Dangerous Area or approach boom defenses without permission, nor should they anchor or stop in a dangerous area or prohibited anchorage unless instructed to do so.

Masters are advised therefore to communicate with any government or port authority vessel found patrolling in the area to ascertain the recommended approach route to the port.

In certain circumstances, it may be necessary to take special measures to examine, or to establish the identity of, vessels desiring to enter ports and to control their entry. This is the function of the Examination Service, whose officers will be afloat in Examination Vessels or Traffic Control Vessels.

These vessels will wear the distinguishing flags of the Examination Service. The examination service special flag consists of a red and white center with a blue border, and the national flag of Canada.

Canadian signal regulations are subject to frequent additions and changes. U.S. Notice of Mariners No. 1 for the current year should be consulted.

Tides

The character and range of the tide vary greatly over the area covered by this publication. In general, it can be said that the theoretical semi-diurnal tide at the North Pole is zero; from this it can be expected that the range of the tide decreases as latitude increases.

This is largely true except that, in Kane Basin (79˚30'N., 70˚00'W.), the mean spring range reaches maximum of about 3.5m; to the N of this, however, the range decreases rapidly. Elsewhere on the W coast of Greenland, the tide is mainly semi-diurnal, the mean spring range being between 2 and 3m.

The greatest ranges are found in Ungava Bay, at the head of which the mean spring range is nearly 12m. In Hudson Strait the range varies between about 4 and 9m; in Hudson Bay it is between 2 and 4m, and in Foxe Channel it is about 5.5m. In all these areas the character of the tide is predominantly semi-diurnal. Farther N, in the Canadian Arctic Archipelago, the diurnal tide becomes more apparent, although it never completely predominates; in these areas the range decreases and seldom exceeds 1.5m. To the W of Boothia Peninsula and Prince of Wales Island it is less than 1m.

Tidal currents in the area vary considerably, depending on local conditions; details are given in the appropriate places in the text.

Time Zone

The Canadian Arctic is covered by multiple Time Zones. Information is given in the accompanying table.

Canada—Time Zones

Location	Standard Time	Daylight Savings Time
Atlantic Zone—East coast of Baffin Island	QUEBEC (+4)	Not observed.
Eastern Zone—Nunavet E of longitude 85˚W (except Southampton Islands and the islands adjacent to Southampton Island), eastern Ontario, western Quebec, and Anticosti W of longitude 63˚W	ROMEO (+5)	QUEBEC (+4) Observed from the first Sunday in April until the Saturday before the last Sunday in October.
Eastern Zone—Nunavet (Southampton Islands and the islands adjacent to Southampton Island) and western Ontario	ROMEO (+5)	Not observed.
Central Zone—Manitoba and Nunavet between longitude 85˚W and longitude 102˚W (except Southampton Island, the islands adjacent to Southampton Island, and all areas lying within the Kitikmeot Region)	SIERRA (+6)	ROMEO (+5) Observed from the first Sunday in April until the Saturday before the last Sunday in October.
Mountain Zone—Northwest Territories, Nunavet W of longitude 102˚W, and all areas lying within the Kitikmeot Region	TANGO (+7)	SIERRA (+6) Observed from the first Sunday in April until the Saturday before the last Sunday in October.

Canada—Time Zones		
Location	**Standard Time**	**Daylight Savings Time**
Pacific Zone—Yukon Territory	UNIFORM (+8)	TANGO (+7) Observed from the first Sunday in April until the Saturday before the last Sunday in October.

U.S. Embassy

The U.S. Embassy is situated at 490 Sussex Drive, Ottawa, Ontario.

The mailing address is P.O. Box 5000, Ogdensburg, NY 13669-0430.

U. S. Embassy Canada Home Page
http://www.usembassycanada.gov

Vessel Traffic Service

The purpose of this section is to describe the ship reporting procedures to be followed by vessels when within or intending to enter the waters of Eastern Canada or Arctic Canada to which the *Arctic Waters Pollution Prevention Act* applies.

Responsibilities

There is no intention on the part of the Canadian Coast Guard to attempt to navigate or maneuver ships from a shore station and nothing in this publication overrides the authority of the master for the safe navigation of the ship. Information passed to the master is intended to assist in the safe conduct of his ship.

A Marine Communications and Traffic Services (MCTS) Officer may, under specific circumstances:

1. Direct the master, pilot, or person in charge of the deck watch of the vessel to provide any pertinent information in respect of that vessel that may be specified in the direction.
2. Direct the vessel to use any radio frequencies in communications with coast stations or other vessels that may be specified in the direction.
3. Direct the vessel, at the time, between the times or before or after any event that may be specified in the direction to:
   a. Leave a VTS Zone.
   b. Leave or refrain from entering any area within a VTS Zone that may be specified in the direction.
   c. Proceed to or remain at any location within a VTS Zone that may be specified in the direction.

A vessel, as well as the master, pilot, or person in charge of the deck watch of the vessel, shall comply with a direction given to it or them by the MCTS Officer. Notwithstanding, the master, pilot, or person in charge of the deck watch of the vessel may take any action that may be required to ensure the safety of the ship or any other ship.

The master of a ship shall ensure that before the ship enters a VTS Zone the ship's radio equipment is capable of receiving and transmitting radio communications on the appropriate VTS sector frequency.

Traffic Clearance

A Traffic Clearance is an authorization for a ship to proceed subject to such conditions as may be included in the authorization. The Traffic Clearance is predicated upon ship report information and known waterway/traffic conditions. A traffic clearance does not eliminate the need for other authorizations required by legislation or by-laws.

Should any factor upon which the clearance is predicated alter to the detriment of safe navigation, the clearance may be delayed or other conditions may be attached to the clearance.

A traffic clearance is required prior to:

1. Entering a VTS Zone.
2. Commencing a departure maneuver.
3. Commencing a maneuver that may be detrimental to safe navigation.
4. Proceeding after being stranded, stopped due to breakdown of main propulsion machinery or steering gear, or having been involved in a collision.

Communications

Radiotelephone procedures used in communicating with an MCTS center are those specified by the International Telecommunications Union in the *Manual for Use by The Maritime Mobile and Maritime Mobile Satellite Services.*

A continuous listening watch shall be maintained on the appropriate VTS sector frequency on radio equipment located:

1. At any place on board the ship, where the ship is at anchor or moored to a buoy.
2. In the vicinity of the ship's conning space, where the ship is underway.

The continuous listening watch may be suspended if an MCTS officer directs the ship to communicate with coast stations and/or other ship stations on a different VHF radio frequency.

All times given in VHF reports should be in local time and in accordance with the 24-hour clock system.

Navigation safety calls on the designated VTS frequencies should be kept to the minimum consistent with the safety requirement of the situation.

Communication Difficulties.—Where a ship, for any reason other than shipboard radio equipment failure, is unable to obtain the required Traffic Clearance or after receiving a Traffic Clearance, is unable to maintain direct communication with the appropriate MCTS Center, the master may nevertheless proceed along the route, but shall take all reasonable measures to communicate with the appropriate MCTS Center as soon as possible.

Shipboard Radio Equipment Malfunction.—In the event of a shipboard radio equipment failure where the ship is unable to obtain the required Traffic Clearance or, after receiving a Traffic Clearance, is unable to maintain direct communication with the appropriate MCTS Center, the vessel shall:

1. If it is in a port where repairs can be made, remain in the port until the vessel is able to establish communications in accordance with the *Vessel Traffic Services Zone Regulation*s and/or the *Eastern Canada Vessel Traffic Services Zone Regulations*.

2. If it is not in a port where repairs can be made, proceed to the nearest reasonably safe port or anchorage on its route and remain their until the vessel is able to establish communications in accordance with the *Vessel Traffic Services Zone Regulations* and/or the *Eastern Canada Vessel Traffic Services Zone Regulations*.

Zone Descriptions

Eastern Canada.—The Eastern Canada VTS Zone (ECAREG) consists of Canadian waters on the E coast of Canada S of the parallel of 60˚N latitude and in the St. Lawrence River E of the meridian of 66˚W longitude, except the waters within Ungava Bay and the waters within the VTS Zones referred to in the *Vessel Traffic Services Zone Regulations*.

Arctic Canada.—The Arctic Canada VTS Zone (NORDREG) includes those waters of Ungava Bay, Hudson Bay, and James Bay S of the parallel of 60˚N latitude and the waters to which the *Arctic Waters Pollution Prevention Act* apply. It excludes MacKenzie Bay and Kugmallit Bay S of the parallel of 70˚N latitude and E of the meridian of 139˚W longitude.

Local Zones.—East Coast VTS Local Zones have been established for traffic to St. John's, Placentia Bay, Port aux Basques, the Strait of Belle Isle, the Strait of Canso, Halifax, Northumberland Strait, the Bay of Fundy, and St. Lawrence Waterway. The appropriate Sailing Directions (Enroute) volumes should be consulted.

Zone Application

Eastern Canada VTS Zone (ECAREG).—With respect to ECAREG, in which participation is mandatory, the *Eastern Canada Vessel Traffic Services Zone Regulations apply in respect of:*

1. Every ship of 500 gross tons or more.

2. Every ship that is engaged in towing or pushing one or more vessels, where the combined tonnage of that ship and its tow amounts to 500 gross tons or more.

3. Every ship carrying a pollutant or dangerous goods, or engaged in towing or pushing a vessel carrying a pollutant or dangerous goods as prescribed in the following:

   a. Oil Pollution Prevention Regulations.

   b. Pollutant Substances Regulations.

   c. Dangerous Goods Shipping Regulations.

   d. International Maritime Dangerous Goods Code (IMDG).

   e. Dangerous Chemicals and Noxious Liquid Substances Regulations.

Arctic Canada VTS Zone (NORDREG).—With respect to NORDREG, the provisions of this notice apply to every ship of 300 gross tons, or more. Participation is voluntary; however, mariners are encouraged to participate fully to receive the maximum benefit.

Local VTS Zones.—With respect to the VTS Zones specified in the *Vessel Traffic Services Zone Regulations*, these regulations apply in respect of:

1. Every ship 20m or more in length.

2. Every ship engaged in towing or pushing any vessel or object, other than fishing gear, where:

   a. The combined length of the ship and any vessel or object towed or pushed by the ship is 45m or more.

   b. The length of the vessel or object being towed or pushed by the ship is 20m or more in length.

With respect to the VTS Zones specified in the *Vessel Traffic Services Zone Regulations*, these regulations do not apply in respect of:

1. A ship engaged in towing or pushing any vessel or object within a log booming ground.

2. A pleasure yacht that is less than 30m in length.

3. A fishing vessel that is less than 24m in length and not more than 150 gross tons.

Reporting Requirements

Change in information.—A report shall be made whenever a significant change occurs in the information previously provided in any report made pursuant to the *Eastern Canada Vessel Traffic Services Zone Regulations* or the *Vessel Traffic Services Zone Regulations* except where the report was made when departing from a VTS Zone.

Non-routine reports.—Pursuant to the *Eastern Canada Vessel Traffic Services Zone Regulations* or the *Vessel Traffic Services Zone Regulations*, a report indicating the vessel's name, position, and a description of the incident shall be made prior to the vessel proceeding, as soon as the master becomes aware of any of the following conditions:

1. The occurrence on board the ship of any fire.

2. The involvement of the ship in a collision, grounding, or striking.

3. Any defect in the ship's hull, main propulsion systems, steering systems, radars, compasses, radio equipment, anchors, or cables.

4. Any discharge or probable discharge of a pollutant from the ship into the water.

5. Another ship in apparent difficulty.

6. Any obstruction to navigation.

7. Any aid to navigation that is functioning improperly, damaged, off-position, or missing.

8. The presence of any pollutant in the water.

9. The presence of a ship that may impede the movement of other ships.

10. Any ice and weather conditions that are detrimental to safe navigation.

Note.—Items 6, 7, and 8 are not required if the information has been previously promulgated by a Notice to Shipping.

Mariners are encouraged to provide, on a voluntary basis, any information pertaining to charts and publications which may not be on board so that arrangements can be made to embark the necessary items.

ECAREG/NORDREG Information Requirements

ECAREG/NORDREG zone reports shall be communicated either directly or to the nearest Canadian Coast Guard MCTS Center. All times given in ECAREG/NORDREG zone reports shall be in Coordinated Universal Time (UTC).

Depending upon the reporting requirement, various elements of the following may be required to be reported:

1. The name of the ship.

2. The radio call sign of the ship.
3. The name of the master of the ship.
4. The position of the ship.
5. The time the ship arrived at the position.
6. The course of the ship, if any.
7. The speed of the ship, if any.
8. The prevailing weather conditions (including ice, if applicable).
9. The estimated time that the ship will enter the Eastern Canada VTS Zone.
10. The estimated time the ship will depart the berth.
11. The destination of the ship.
12. The ETA of the ship at the destination.
13. The route the ship intends to take through the Eastern Canada VTS Zone to arrive at the destination.
14. The name of the last port of call of the ship.
15. The draft of the ship.
16. Any dangerous goods, listed by class, or pollutant, that is carried on board the ship or vessel being towed or pushed by the ship.
17. Revoked.
18. Any defect in the ship's hull, main propulsion machinery, steering system, radars, compasses, radio equipment, anchors or cables.
19. Any discharge, or threat of discharge, of a pollutant from the ship into the water, and any damage to the ship that may result in the discharge of a pollutant from the ship into the water.
20. The name of the Canadian or United States agent of the ship.
21. The date of expiration of a certificate referred to in Article VII of the International Convention on Civil Liability for Oil Pollution Damage, 1969/1992; the International Oil Pollution Prevention Certificate; the International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk; the Certificate of Fitness; the Certificate of Compliance; and the ISM Safety Management Certificate and the ISM Document of Compliance, if any, issued to the ship.

Search and Rescue authorities have requested that ships entering Canadian waters for the first time answer the following question; this information is only required to be supplied once and updated when the situation changes.

Is your vessel EPIRB equipped? If not, please supply the following information:

1. Number of crew and passengers.
2. Number of lifeboats and life rafts plus make and capacity.
3. Color of hull and superstructure.
4. Distinctive features.

ECAREG Zone Reports

Prior to Entering the Zone.—A report containing all the required information listed under **ECAREG/NORDREG Information Requirements**, except Item 10, shall be made 24 hours prior to entering the zone, or as soon as practicable where the estimated time of arrival of the ship at the zone is less than 24 hours after the time the ship departed from the last port of call.

This report is not required where:

1. The ship is on a voyage between two ports within the zone, and
2. The ship is entering the zone directly from the Arctic Canada Traffic Zone, and is in possession of a valid NORDREG Clearance.

Entering at a Zone Boundary.—A report consisting of Items 1, 2, 4, 8, and 9 from the information listed under **ECAREG/NORDREG Information Requirements** shall be made immediately before the ship crosses the Zone Boundary when entering the VTS Zone.

This report is not required when entering directly from a Local VTS Zone.

Arrival at a Berth.—A report consisting of Items 1 and 2 from the information listed under **ECAREG/NORDREG Information Requirements**, as well as the port of arrival and the time of arrival, shall be made on arrival of the ship at a berth.

Departing a Berth.—A report containing all the required information listed under **ECAREG/NORDREG Information Requirements**, except Item 9, shall be made 2 hours before a ship departs a berth.

A traffic clearance to depart a berth is valid for 1 hour from estimated time of departure. Where a traffic clearance to depart a berth has expired because of a revised time of departure, a new traffic clearance is required. In this case, the report need only contain the ship's name, call sign, position and revised time of departure

This report is not required where the ship is proceeding to another berth in the same port.

Exiting the Zone.—A report consisting of Items 1, 2, 4, and 8 from the information listed under **ECAREG/NORDREG Information Requirements** shall be made immediately before the ship crosses the seaward boundary of the VTS Zone.

In a case where exiting a VTS Zone coincides with entering a Local VTS Zone, this report is not required. The Local VTS Zone reporting requirements procedures shall be followed.

NORDREG Zone Reports

NORDREG Reports shall be addressed to NORDREG CANADA and communicated either directly to NORDREG CANADA or to the nearest Canadian Coast Guard MCTS Center. The master of the ship shall ensure that these reports are made in accordance with the stated requirements.

Prior to Entering the Zone.—A report containing all the required information listed under **ECAREG/NORDREG Information Requirements**, except Item 10, but also including the following information:

1. Ice class (type or Arctic class category), if applicable, and Classification Society;
2. Amount of oil on board (fuel and cargo), if such amount exceeds 453 cu. m. (15,988 cu. feet); and
3. Date of issue of Arctic Pollution Prevention Certificate, if carried and name of Classification Society,

shall be made 24 hours prior to entering the zone, or as soon as practical where the estimated time of arrival of the ship at the zone is less than 24 hours after the time the ship departed from the last port of call.

If the ship is entering the zone directly from the Eastern Canada Vessel Traffic Services Zone, and is in possession of a valid ECAREG Clearance, only items 1, 2, and 3 above need be reported.

Entering at a Zone Boundary.—A report consisting of Items 1, 2. and 4 from the information listed under **ECAREG/NORDREG Information Requirements** shall be made immediately before the ship crosses the Zone Boundary when entering the VTS Zone.

Arrival at a Berth.—A report consisting of Items 1, 2, and 10 from the information listed under **ECAREG/NORDREG Information Requirements**, as well as the port of arrival and the time of arrival, shall be made on arrival of the ship at a berth.

Departing a Berth.—A report consisting of Items 1, 2, 8, 10, 11, 12, 13, and 16 from the information listed under **ECAREG/NORDREG Information Requirements**, as well as the amount of oil on board (fuel and cargo) if such amount exceeds 453 cu. m. (15,988 cu. feet), and any changes to previously-reported Items 18, 19, 20, and 21 from the information listed under **ECAREG/NORDREG Information Requirements**, shall be made not more than 2 hours and not less than 1 hour before departing a berth.

If the estimated time of departure changes by more than 1 hour, a report shall be made containing the revised estimated time of departure.

A report shall be made when the ship has departed the berth, giving the actual time of departure.

This report is not required where the ship is proceeding to another berth in the same port.

1600 UTC Report.—A report consisting of Items 1, 2, 4, and 8 from the information listed under **ECAREG/NORDREG Information Requirements** shall be made daily at 1600 UTC.

Exiting the Zone.—A report consisting of Items 1, 2, 4, and 8 from the information listed under ECAREG/NORDREG Information Requirements shall be made immediately before the ship crosses the seaward boundary of the VTS Zone.

ECAREG/NORDREG Reporting Contacts

See the accompanying table titled **ECAREG/NORDREG Contact Reporting Information**.

Local VTS Zone Reports

With respect to Local VTS Zones as specified in the *Vessel Traffic Services Zone Regulation*s, the master of a ship shall report to the MCTS Officer in accordance with the regulations described below.

Information Required.—Depending on the reporting requirements, the following information may be required to be reported:

1. The name of the ship.
2. The radio call sign of the ship.
3. The position of the ship.
4. Estimated time that the ship will enter the VTS Zone.
5. The destination of the ship.
6. Estimated time the ship will arrive at its destination.
7. Whether any pollutant or dangerous goods cargo is carried on board the ship or any vessel or object being towed or pushed by the ship.
8. The estimated time that the ship will depart the berth.
9. The estimated time at which the ship will next arrive at a location requiring a report.

Entering a Zone.—At least 15 minutes before a ship intends to enter a zone, a report shall be made specifying the information contained in Items 1, 2, 3, 4, 5, 6, and 7 above.

Ships in possession of a valid Traffic Clearance are not required to provide this report.

Arriving at a Calling-In-Point (CIP).—When a ship arrives at a CIP, a report shall be made specifying the information contained in Items 1, 3, and 9 above.

Arriving at a Berth.—As soon as practicable after a ship arrives at a berth, a report shall be made specifying the information contained in Items 1 and 3 above.

Departure Maneuvers.—A departure maneuver is defined as an operation during which a vessel leaves a berth and gets safely underway. Immediately before commencing a departure maneuver, a report shall be made specifying the information contained in Items 1, 2, 3, 5, 6, 7, and 8 above.

Immediately after completing a departure maneuver, a report shall be made specifying the information contained in Items 1, 2, and 9 above.

Maneuvers.—A Traffic Clearance is required 15 minutes prior to commencing any maneuver, such as:

1. A compass adjustment.
2. The calibration and servicing of navigational aids.
3. A sea trial.
4. A dredging operation.
5. The laying, picking up, and servicing of submarine cables; or any other maneuver that may be detrimental to safe navigation, a report shall be made specifying the information listed in Items 1 and 3 above, plus a description of the intended maneuver.

As soon as practicable after the maneuver is completed, a report describing the maneuver just completed shall be made.

Variations

Ferries and other vessels on a regularly scheduled voyage may be exempted from making routine reports. formal variations to reporting procedures will be granted only where alternate arrangement to provide essential information are made and where the equivalent procedure or practice is deemed to be as safe as that required in the regulations.

Formal variations may be obtained by submitting a written request to the appropriate Regional Director, Canadian Coast Guard.

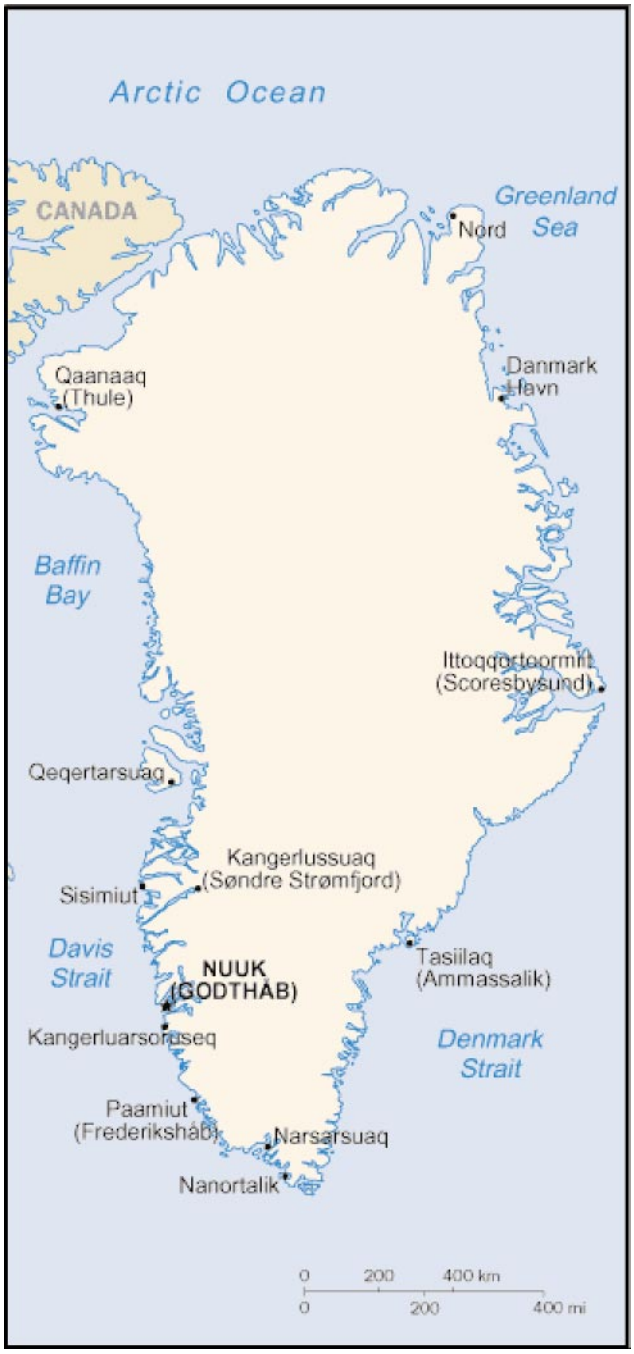
In circumstances other than those described above, informal variations may be granted from time to time on a one time only basis by an MCTS Officer where the procedure or practice requested is deemed to be as safe as that required in the regulations.

ECAREG/NORDREG Contact Reporting Information

Contact	Telephone	Telex	Facsimile	Telegraphic identifier
ECAREG				
St. John's MCTS Center	(709) 772-2083	016-4530	(709) 772-5369	CCGTC SNF

ECAREG/NORDREG Contact Reporting Information				
Contact	**Telephone**	**Telex**	**Facsimile**	**Telegraphic identifier**
Halifax MCTS Center	(902) 426-9750	019-22510	(902) 426-4483	CCG MRHQ DRT
Riviere-au-Renard MCTS Center	(418) 269-5686	316-0025	(418) 269-5514	—
NORDREG				
Iqaluit MCTS Center*	(867) 979-5724	063-15529	(867) 979-4236	NORDREG CDA
*Operational from mid-June until mid-December. At other times, contact St. John's MCTS Center.				

GREENLAND



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General

Greenland, the world's largest island, is known nationally as Gronland. It lies on the American continental shelf between 59˚45'N and 83˚40'N, and along 10˚50'W and 73˚00'W. The country of Greenland has a total area of 840,000 square miles, of which more than 80 per cent are ice-covered.

Buoyage System

The IALA Buoyage System (Region A) is in effect. See Chart No. 1 for further IALA Buoyage System information.

From 1990, all newly-erected and restored beacons which are required to be held to port in an incoming direction, will be fitted with topmarks in accordance with IALA rules. Hence, port beacons with red can topmarks and beacons with a triangle point down can be expected.

In marking of inner routes of Greenland, a lateral system of beacon towers is used along the coast. The beacon towers are about 5m in height and normally fitted with triangular topmarks. Most beacons are painted red and stand in a yellow barrel; some are painted yellow, but all are charted in red on Danish charts.

For the purpose of marking the terms "starboard-hand" and "port-hand" denote, respectively, the side on the right or left hand of the mariner when proceeding N along the coast, regardless of whether the route runs for a short distance in an E or W direction, and into harbor.

Starboard-hand beacons are triangular, point up.

Port-hand beacons are triangular, point down.

Waverider lighted buoys (special/spherical) may be encountered within the vicinity of Greenland and should be given a wide berth.

Caution is necessary as colored lights may appear white due to icing, snow, or hoar frost; the range of visibility may also be greatly reduced or disappear in these conditions.

Currency

The official unit of currency is the Danish krone, consisting of 100 ore.

Currents

In the S, the West Greenland Current runs at a considerable rate, especially close in to the coast. It is noted that this current runs stronger in September than it does in June, when its mean rate is not less than 3 knots close inshore and a few miles farther offshore it runs 1 to 2 knots. To the N of 62˚N the mean rate is reduced to less than knot. The Canadian Current usually runs at about 0.5 to 1 knot as far as Cape Dyer; to the S of it the current runs at 0.5 knot or less.

Geophysical Features

The icecap that covers the interior of Greenland is the largest single ice sheet in the N hemisphere. The sheet is 3,350m thick and lies on the rock floor at slightly below sea level. The icecap has two domes or foci of growth, both lying E of the center line of the island; one at 65˚N that rises to a height above 2,400m, and the other at 75˚N that rises to about 3,050m. Greenland can be divided into two natural regions-the interior, which is covered by an ice cap, and the coasts.

East Coast of Greenland

The E coast is indented and includes the longest fjord in the world. The coast is fringed with islets and islands of varying size and by a border of ice-free land of varying width that affords scanty opportunity for the maintenance of life of any kind.

The musk-ox is found in certain parts, and the seal frequents the fjords in season, but both animal and vegetable life are comparatively scarce due to ice. The E coast of Greenland is less accessible than the W coast.

In this ragged coastline with its many deep fjords, the wind is strongly affected by local topography, and different winds may be blowing at places only a short distance apart. The funneling of the wind through a steep fjord may produce winds much stronger than the general air flow, while other adjacent fjords provide good shelter and lighter winds.

Local wind flow in the region is the down-slope katabatic wind that develops from the drainage of cold air from the Greenland ice cap into the fjords and out to sea. This effect in the winter produces the most frequency of gales in the fjords, in the nature of a cold air avalanche.

Observations made at the head of a small fjord about 30 miles from Ammassalik, where a wind of 112 knots that blew away the anemometer cup and reached hurricane force for 11 days during October to April, was observed.

Most gales develop around midnight. The temperature changes 2˚C in most cases; but when foehn winds cross the ice cap, the temperature can change 10˚C.

The wind-chill hazard is severe in these storms. In the case of the down-slope katabatic gales, there is usually little warning from the barometer readings, but clouds of snow blowing on the edge of ice cap usually indicate that the gale is raging shortly before it reaches the lower level of the fjord.

South Coast of Greenland

During the months of October to April, at Torgilsbu in S Greenland, gales (force 9) are reported to last 4 to 7 days; they last 2 days or less during May to September.

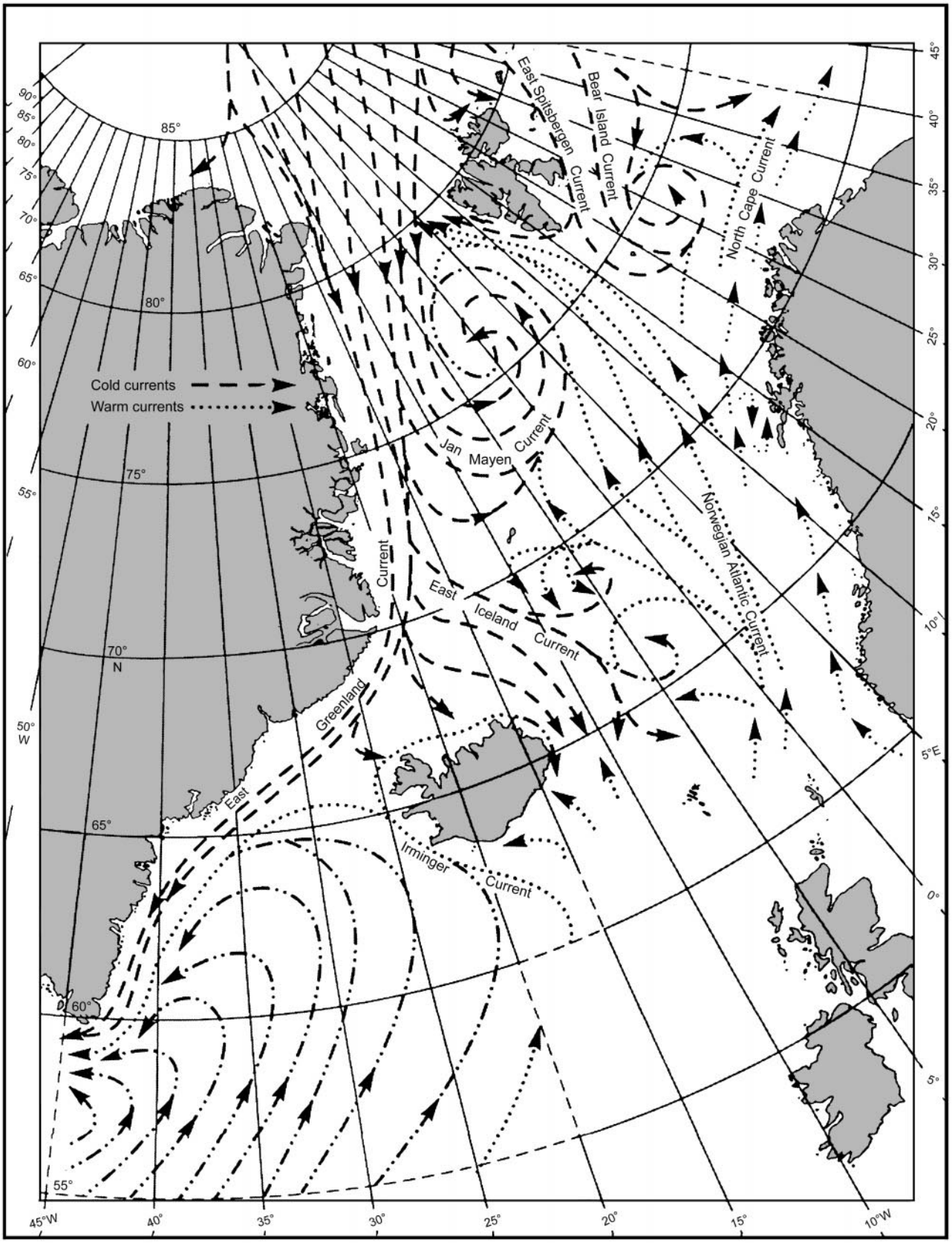
Sastrugi (sharp and irregular waves formed by persistent winds on a snow surface) is predominantly E along most of the N coast of Peary Land, although there are local winds in the valleys.

West Coast of Greenland

The W coastal region remains with an almost continuous ice-free belt, varying in width from about 1 mile to over 100 miles. Much of the coast is fringed with islands, mountainous and high, in places to a height of over 2,000m, that obscure all view of the ice cap from coastal waters. Raised beaches occur along the coast, but in recent times Greenland has been sinking, by as much as 10mm a year at Godhavn.

Between Kap Farvel, at the S end of the W coast, the average width of the ice-free belt is about 50 miles and consists of islands, promontories, and mountains penetrated by deep fjords. Conditions vary considerably in different localities and are described later in the text.

In the ice-free belt farther N, it is much narrower; around the shores of Melville Bugt, the coast is a nearly continuous wall



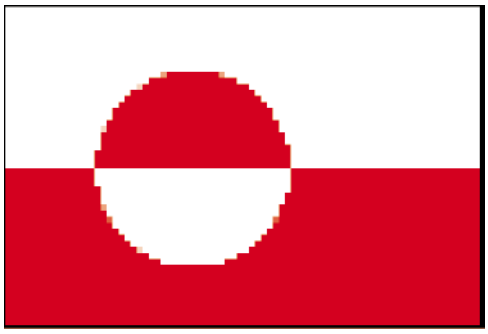
General Surface Water Circulation

of ice within which occasional steep rocky summits or nunataks protrude.

Farther N between **Kap York** (75˚55'N., 66˚25'W.) and the Humboldt Gletscher, the largest of the Greenland glaciers, the ice cap lies some distance from the coast and only through the larger valleys do glaciers push down to the sea.

The Humboldt Gletscher marks a change in the character of the coast. South of it mostly consists of gneiss, which is usually covered by sand and limestone, forming plateaus with escarpments. Beyond the Humboldt Gletscher, the NW coast of Greenland is mostly steep stratified cliffs, forming the outer edge of a broad belt of plateau that borders the icecap. Only occasional narrow valleys cut in between the plateau, and through these long, almost horizontal valleys, glaciers stretch down to the coast where, in many places, they merge imperceptibly with the sea ice.

Government



Flag of Greenland

Greenland is a self-governing overseas administrative division of Denmark. The country is divided into three districts and has 18 municipalities.

Greenland achieved Home Rule in 1979, while remaining within the framework of the unity of the Danish Realm. The country is governed by a Prime Minister elected by the Parliament. The unicameral Parliament consists of 31 directly-elected members, through a system of proportional representation, serving 4-year terms.

The legal system is Danish law.

The capital is Nuuk (Godthab).

Holidays

The following holidays are observed:

January 1	New Year's Day
January 6	Epiphany
Holy Thursday	Variable
Good Friday	Variable
Easter Sunday	Variable
Easter Monday	Variable
April 16	Queen's Birthday
General Prayer Day	Fourth Friday following Good Friday
May 1	Labor Day
Ascension Day	Variable
June 5	Constitution Day
June 21	National Day
Whitsunday	Variable
Whitmonday	Variable
December 24	Christmas Eve
December 25	Christmas Day
December 26	Boxing Day
December 31	New Year's Eve

Ice

Ice Charts

Vessels in Greenland waters may receive Facsimile Ice Charts from the Narssarssuaq Ice Center (61˚10'N., 44˚26'W.) at:

Telephone: +299-665244 (from 0800-1200 and 1300-1600 LT)

Note.—Urgent requests for information may be processed outside these hours.

Current ice charts of Greenland waters may be requested 24 hours by telefax from the Ice Center as, follows:

Chart 1 (Kap Farvel and inner waters)	+299-665344
Chart 2 (E or W coast of Greenland)	+299-665247

Ice Reconnaissance

Ice reconnaissance flights are carried out in the Frederikshab, Kap Farvel, and Tingmiarmiut areas; further information is contained in Pub. 117, Radio Navigational Aids. In addition, during the navigation season, ice air-reconnaissance (ISRECCO) is carried out from **Mestersvig** (72˚12'N., 24˚04'W.) for the benefit of ships bound for the coast between Ammassalik and Danmarkshavn.

Ships may establish communication with aircraft on ice reconnaissance or search duty. Request for instructions can be made from the nearest coast radio station.

The Danish Meteorological Institute transmits facsimile ice charts for Greenland waters. See Pub. 117, Radio Navigational Aids for further information.

Sea Ice

Sea ice presents serious hazard to navigation over much of the area covered by this publication throughout the year. Small or large icebergs may be encountered along the Greenland coast at any time. Seasonal variations do not influence iceberg movements, except to trap icebergs in pack ice.

The whole E coast of Greenland is ice-bound for the greater part of the average yea,; although the coast S of 70˚N is usually

almost ice-free in August and September. The coasts of Svalbard and Jan Mayen are usually ice-bound each winter, but the coasts of Iceland remain ice-free throughout the average year, except for the formation of ice in rivers and at the heads of some fjords. In severe seasons, ice reaches the N and E coasts of Iceland, closing Denmark Strait.

The East Greenland Current brings vast quantities of ice and cold water out of the Arctic basin, and accounts for the presence of ice off the E coast of Greenland over the greater part of the year; whereas, the relatively-warm Norwegian Atlantic Current, of Gulf Stream origin, prevents the formation of ice over the greater part of the Norwegian Sea and the S portion of the Barents Sea. Thus, the limits of the sea ice lie much farther S off the E coast of Greenland than elsewhere.

At the time of maximum extent the S progress of the ice flows, carried by wind and current, is more or less in balance with the degree of melting at the ice edge. Thereafter, as air and sea temperature rise, the ice edge steadily retreats due to the increased rate of melting at progressively higher latitudes, though in many areas wind and current will tend to carry the melting ice flows S.

Ice (Monthly Limits)

The ice limits is the demarcation at any given time between the open sea and sea ice of any kind, whether fast or drifting. The use of all data, were it available, would probably mean that the maximum and minimum limits would lie up to 30 miles beyond those shown in the graphics, at least in some areas.

The width of the zone between the maximum and minimum limits on each graphic indicates the degree of variability between conditions in a severe and a light ice season in the same month. The severity of the ice season is due to the result of the winds. When winds cross the ice edge for several weeks, the ice edge moves steadily seaward; whereas, when winds cross over the water toward the ice edge, the ice retreats to its minimum position. This pattern follows everywhere except lesser in the region off the SE coast of Greenland, and off the W coast of Spitsbergen. This is due to upwelling, the presence of relatively warm deep currents which converge against the cold ice-bearing current in these areas.

Any ice flows driven out over these warm currents by winds off the ice would melt fairly quickly. The width of the transition belt between ice-free conditions and an almost complete cover of sea ice depends on the winds and the season of the year. Winds off the ice tend to produce a gradual transition, whereas winds to the ice produce a compact ice edge. Over most of the area the mean wind directions are in most months roughly parallel to the ice edge, so the transition belt is usually only a few miles wide, perhaps less than 10 miles; however, in places it may exceed 50 miles. Seasonal melting also affects the width of the transition zone, and in general, it is greatest in July and August, when its width may span several hundred miles.

Ice (Monthly Distribution)

During September and October, sea ice usually reaches its least extent shortly after the end of August. At this time, a tongue of ice is carried S in the East Greenland Current off the Greenland coast as far as 71˚N, while the coast is usually almost ice-free from wind effect openings of polynyas. Therefore, navigation in this area should be avoided. If a sea breeze is expected then the ice can beset unexpectedly.

The remaining coasts in the area, except for the far NE of Svalbard, are ice-free. In a light ice year, the minimum limit lies considerably farther N, but it must be remembered that this is an average estimation of minimum ice limit; and in a light ice year only parts of the E coast of Greenland N of about latitude 74˚30'N may expected to be accessible.

In a severe winter year, the ice maximum limit encloses the E coast of Greenland almost as far as Kap Farvel; it also encloses the N and most of the E, including the coasts of Svalbard. The maximum limit of ice lies farther SE than the area S of 65˚N, leading up to 100 miles farther S at 25˚E in the Barents Sea.

During October, the ice edge advances S in all longitudes, making its greatest advance within the East Greenland Current and in the East Spitsbergen Current. In a severe year, almost the whole E coast of Greenland is enclosed by the maximum limit at this time. This maximum limit almost reaches Jan Mayen and, though it is held back N of 79˚N at about 6˚E, it encloses the coasts of Svalbard as it plunges S to Bjornoya. In a light ice year, the E coast of Greenland S of about 68˚N, and the whole of Svalbard, are almost ice-free.

In November, the greatest advance of the ice edge in all longitudes occurs, presumably due to the extensive cooling of the sea surface to its freezing temperature. In the average year almost the whole E coast of Greenland is enclosed by the ice edge by the end of this month; Jan Mayen and much of the coastline of Spitsbergen are also enclosed. A noteworthy feature in the shape of the ice edge at this time is the first indication of a bulge to the NE of Jan Mayen. This bulge, the Jan Mayen Ice Tongue (Jan Mayen Odden), is largely due to the freezing of the cold water in the Jan Mayen Current.

In a severe season, at the end of November, the Denmark Strait is almost closed and the Jan Mayen Ice Tongue extends well E of the Greenwich meridian. In the Barents Sea in such a year, the maximum limit lies S of Bjornoya, though the warmer waters of the West Spitsbergen Current hold it back at about 79˚N in along 6˚E. In a light season the ice is much less extensive over the Greenland Sea and the Barents Sea, and the coast of Greenland S of about 67.5˚N, Jan Mayen, and the whole of Svalbard are all almost ice-free.

From December to March, the ice edge advances only slowly over the greater part of the area. The ice edge usually reaches its greatest extent in February and March. The S limit off East Greenland gradually reaches Kap Farvel during January, and at the end of February lies about 20 miles S of the cape. In the Barents Sea, the ice edge reaches Bjornoya in December. From November to March, the position of the ice edge in the area S of Denmark Strait shows little change; this is largely due to the containing effect of the warm Irminger Current. Much of Svalbard is ice-bound by late December and the whole archipelago is enclosed by early January.

The Jan Mayen Ice Tongue extends E to reach its greatest extent in February. A noteworthy feature is the development of North Bay, a bight on the N flank of the Jan Mayen Ice Tongue. During March, North Bay usually extends SW, presumably due to the fact that the NNE winds which have prevailed during the earlier winter months are much stronger in March

By late March, the ice edge has advanced to within about 20 miles of the NW tip of Iceland, and lies about 30 miles SE of Jan Mayen.

Ice conditions from December to March show a high degree of variability between a light and a heavy year over the greater part of the area, except for the region SW of the Denmark Strait, where the maximum and minimum limits are separated by only 50 to 100 miles. Elsewhere, they are separated by up to about 300 miles.

In a severe season, the ice edge may lie up to 100 miles S of Kap Farvel, up to 80 miles SE of Jan Mayen, and up to 60 miles S of Bjornoya. Though this maximum limit may approach the N coast of Iceland as early as December, it does not effectively close Denmark Strait until March. The Jan Mayen Ice Tongue extends E to about 10˚E at the end of March in a severe winter year. Since its developments involve a prolonged period of W winds, that will simultaneously cause the ice edge S of Spitsbergen to retreat E, the large north-reaching bight in the ice edge centered about 7˚E is unlikely to become cut off. In the W part of the Barents Sea during a severe ice season the ice edge is located between 73.5˚ and 74.5˚N from December to February.

Though the E coast of Greenland, except for the extreme S, remains ice-bound even in a light season, the ice edge in such a season is located in the NW half of Denmark Strait and well NW from Jan Mayen throughout the period December to March. This minimum lies N of the N coast of Svalbard, as far as 20˚E; the whole of the W coast and much of the S coast are also ice-free. Though this limit lies well N of Bjornoya, it encloses Hopen throughout the period.

From early April, the ice edge gradually retreats N in the average year, reaching its minimum extent in most longitudes in early September. The rate of retreat is greater over the Greenland Sea W of about 5˚W and in the Barents Sea than it is elsewhere. From April to July the average rate is about 40 miles per month, and in the Barents Sea about 60 miles per month; the mean rates are much less in August.

There is little movement of the ice edge SW of the Denmark Strait from early April to late June; the total retreat in the average season varies between 20 and 60 miles in this period. Over most of the region W of Svalbard and N of 75˚N, the total ice edge retreat is only about 60 miles between early April and early September.

By early August, in the average season, the extent of ice cover over the Greenland Sea has been greatly reduced, but a relatively narrow belt of ice still encloses the whole E coast of Greenland S to and beyond Kap Farvel. During August the S portion of this narrow belt usually melts.

Drift ice in the Greenland Sea usually clears Jan Mayen late in April; at this time a small part of the NW coast of Spitsbergen is usually almost ice-free, but it is late May before most of the W coast becomes accessible. By late August, close to the time of minimum extent, the whole of Spitsbergen is usually almost ice-free.

By late August, the E coast of Greenland is accessible up to about 74˚N, apart from the area S of Kap Brewster. However, because the ice is not far away, fresh E to SE winds can cause it to close rapidly on the coast N of Scoresby Sund. Scoresby Sund usually becomes almost ice-free by mid-July and remains so till early October.

Shore leads, sometimes extending hundreds of miles, may open up off the coast of Greenland in almost any month when offshore winds prevail, while winds with an onshore component will rapidly close up these leads; the momentum of the ice is such that only riding on the ice would prevent destruction.

An interesting feature of the summer break-up pattern is the polynya that usually develops off the NE coast of Greenland. In the average year it first appears in May, during which month the NNE winds of winter are replaced by the NW winds which persist till August. The polynya usually reaches its greatest size by late June or July, and usually closes up entirely in September.

The foregoing paragraphs describe the summer break-up in the average year, but there are considerable departures from the mean condition in severe and light summer ice seasons, except in the region SW of Denmark Strait, where the variability is much reduced.

In a severe ice season, the maximum limit encloses the E coast of Greenland throughout the summer, except for the extreme S from August to October. Denmark Strait may remain closed till late July; the remainder of the N coast of Iceland, and parts of the E coast, may be affected by sea ice till early June. Jan Mayen may remain ice-bound till mid-August and the W coast of Spitsbergen may not become ice-free till late July; Hopen and the E coast of Svalbard may not become accessible till mid-August. The N coast of Spitsbergen, the whole of Nordaustlandet, and the E parts of Barentsoya and Edgeoya remain within the maximum limit throughout a severe summer season.

In a light season, parts of the E coast of Greenland may become ice-free by late May. By late July the minimum limit lies in about 76˚N off the E coast of Greenland. Though this limit is shown lying N of Bjornoya and NW of Jan Mayen in each month, this should not be interpreted as meaning that both islands have been ice-free throughout a complete year. In fact, at each island large quantities of sea ice have appeared for at least a few weeks each year.

Ice Development

The zone between the ice edge at the time of maximum and minimum extent is representative of the area in which the ice melts more or less completely in the average summer. If the occurrence of ice in this zone in the following winter were due solely to freezing of the sea surface there, then this area would become covered by first-year or younger forms of ice. That this is not so is due to the action of wind, current, and polar gyre (rotation of the Polar Ice Cap), which brings vast quantities of multi-year ice out of the polar basin. This effect is most marked in those parts affected by S currents, such as the East Greenland Current, the East Spitsbergen Current, and the Bear Island Current. In this zone, all stages of development may occur.

New to young ice will usually predominate at the ice edge, the ice flows gradually thickening with increasing distance from the edge to become first-year ice. Except in the body of the East Greenland Current, first-year ice predominates over the Greenland Sea by the end of winter, though old ice flows also occur with increasing frequency as the E flank of the East Greenland Current is approached. Within this current, old ice predominates; each winter and spring many old ice flows, known locally as Storis, are carried S to round Kap Farvel.

Old ice predominates N of the ice edge at the time of minimum extent, though the whole range of younger stages from new ice to first-year ice will also occur due to the re-freezing of small open water areas which are continuously formed by the differential movement of the ice flows constituting the pack ice.

In the Norwegian Sea and the W part of the Barents Sea, in areas in which the ice usually melts in summer, the predominant stage of development in winter is first-year ice, but some old ice flows will be found within and near to the East Spitsbergen Current and the Bear Island Current.

Icebergs (Distribution)

The chief source of icebergs in the area covered by this publication are the glaciers on the E coast of Greenland, which collectively produce enormous quantities of icebergs. Most are carried S in the East Greenland Current, some surviving the journey to round Kap Farvel, while some are carried towards the N and NE coasts of Iceland by the East Iceland Current. The largest numbers will be found close-in to the coast of Greenland; the frequency of icebergs decreasing to a few on the E flank of the East Greenland Current, which may perhaps be considered the average limit of icebergs. There is no record of icebergs having been carried SE or E in the Jan Mayen Current. Some icebergs which have originated from Spitsbergen and Zemlya Frantsa Iosifa are carried SW in the East Spitsbergen Current and the Bear Island Current towards Bjornoya, especially during the period May to October.

In general, this limit moves SE from September to April and then retreats till August, except on the SE side of the Denmark Strait, where it is held at about 65˚N by the Irminger Current throughout the year. During April, when the monthly maximum limit reaches an extreme position, it is located about 400 miles SE of Kap Farvel. There is insufficient data to define limits to the N of the Denmark Strait, but icebergs, sometimes grounded, are observed off the N and NE coasts of Iceland. Glacier debris, consisting of growlers and small pieces of land ice, is sometimes carried out of the fjords by the currents in late summer, when the S part of the E coast of Greenland is free of sea ice, in sufficient quantities to hamper the progress along the coast of small vessels.

Industries

Fishing and fish-processing are the most important occupations; the leading products are cod, wolf-fish, halibut, fish oils, shrimp, and salmon. There are many stations where cod is salted or dried, and several canneries and freezers for varieties of other products.

Hunting is also important; leading products are feather and eider down, skins, and furs. Some farming, principally of sheep, is carried on in the SW part of the country.

Cryolite, used in the electrolytic production of aluminum, was previously exported from Ivigtut, where the only known commercially-significant deposit in the world occurs.

Most of the country's trade is with Denmark and the United States. Exports consist of fishing, hunting, and mining products. Imports include machinery, transport, processed metals, fuel and lubricants.

Greenland is incorporated into the European Economic Community, due to integration with Denmark.

Languages

Both Danish and Eskimo are used; Eskimo in the written form is a recent introduction.

Meteorology

Fog and Visibility

Fog is a serious hazard to navigation in most of this region, especially on routes exposed to winds between the SW and SE. Maximum frequency over the open sea occurs during the period June to September and may persist for several days in some parts. The fog is often dense with visibility reduced to a few meters.

Large variations in the fog pattern occur along the Greenland coast. Reports on the route from Godthab to Upernavik indicate an average frequency of about 12 days per month during May to August.

Marked improvement in visibility usually gives welcome relief on the lee side of headlands and all areas sheltered from onshore winds.

Falling or drifting snow is a frequent cause of bad visibility especially in the N parts of the region. Considerable amounts of fine powdery snow may be raised by even moderate winds.

Land radiation fog may develop in valleys near the coast during the early weeks of the navigation season and in the autumn, but this hazard seldom occurs during the summer months.

Exceptionally good visibility is often reported and mountain ranges may be visible at a distance of 100 miles or more. On the other hand, it may be difficult to recognize landmarks at short distances when the ground is covered with deep snow.

On the coast of Greenland, S of 75˚N, there is a maximum of fog in summer, but farther N there is a more even distribution.

Generally, going from the mouth to the head of a fjord, the frequency of fog decreases rapidly. The seasonal variation is also different, and in winter, when fog is infrequent at the mouth of a fjord, it will usually be more frequent near the head, because of the radiation fog called "frost smoke."

In summer, fog is often brought on to the coast by onshore winds and may on occasions last for several days. Summer sea-fog is common and often persistent N of a line from S Greenland to N of Norway, including Icelandic waters. Maximum frequency occurs in July. It may occur in form of either maritime or continental air mass. The ice edge is a particularly foggy zone and a belt of fog on the horizon may indicate the ice edge. The highest frequencies of fog occur near the cold East Greenland Current, the cold East Spitsbergen Current of the Barents Sea, and the cold East Iceland Current, with SW winds.

Shipping may be held up for weeks during spells of fog near Jan Mayen and Bjornoya. About 20 per cent of observations report fog N of Iceland in early summer.

Winter fog hazard is much less frequent over most of the area. The worst affected region is the strip of cold water along the ice edge during E to SE winds. The N part of the Norwegian Sea is also shrouded in fog at times in light winds of Atlantic origin.

The clearance of sea fog in these high latitudes usually depends on a change of air supply or an increase in wind speed.

The development of land (radiation) fog rarely causes any serious hazard in this region. Patchy fog affects ports in the Barents Sea at times. Some fog may develop at the heads of fjords and in sheltered valleys in Iceland during winter nights. Radiation fog is almost unknown in Greenland.

Gale force winds are reported to frequent Jan Mayen and Spitsbergen. Condensation occurs when very cold air passes over much warmer water (a difference of 10˚C is required). These criteria exist with air coming directly off the Greenland Ice Cap. The fjords of Iceland and Svalbard are also affected at times. Sea smoke is usually patchy and shallow, but sometimes dense. It may extend above mast height in parts of the fjords and restrict the movement of shipping. A change of wind and/or a sharp rise of temperature will clear the fog.

Visibility is generally very good away from the fog areas, except when affected by precipitation and very low clouds. Periods of poor visibility are common in snow storms, but only 5 per cent of observations give visibility below fog limits in moderate rain, drizzle, or showers.

Reports of mirage and displays of Aurora Borealis are quite common in this region, especially in the N.

Pressure

The lowest average pressure occurs off SW Iceland throughout the year and is where the Icelandic Low is centered. Even so, the pressure varies considerably over short periods and occasional extensions of the Arctic anticyclone across the area will cause a substantial increase of pressure for a short period.

The greatest day to day variations occur off Iceland in winter as depressions and troughs move in and out of the area. Pressure may fall to between 920 and 930 mb at the center of a deep low, and maximum values of 1050mb or over are registered when an anticyclone becomes dominant.

Depressions are most frequent to the S and W of Iceland and over a wide belt of the Norwegian Sea from Iceland to the Barents Sea; their tracks over the area are extremely variable and often erratic.

Two main tracks predominate, one running N and the other S of Iceland. Only a few pass directly across Iceland. These tracks are derived from the average movement of a large number of depressions. Each individual low will travel at varying speeds and directions at different times depending on the general pressure contours over a large area.

A number of depressions on a track farther S of Iceland often recurve NW and remain off the SW of Iceland for several days. South of the Greenland Sea is the spawning area where it favors the birth of new depressions.

Many depressions reaching the area from the W Atlantic acquire fresh vigor in this region. In other instances a new depression will develop on the trailing front of a depression which has moved up Davis Strait and become a vigorous system.

The large temperature difference between the air from the S and the cold air from Greenland is most favorable for cyclonic development off Kap Farvel. An occasional depression will cross central Greenland from the NW and then continue to move E or SE.

Navigational Information

Maritime Territorial Claims

The maritime territorial claims of Greenland are, as follows:

Territorial Sea	3 miles.
Fisheries or Economic Zone	200 miles.
Continental Shelf	200 miles or the Limit of Exploitation.

Nautical Charts

Charts are mainly constructed from Danish surveys. Mariners requiring to enter the sounds or fjords of East Greenland are advised to obtain the appropriate Danish Charts.

Place Names

In 1988, the majority of the place names in West Greenland had been changed to Inuit (Eskimo) names; the same applies to Arctic Canada, but less extensively. Former names may still be found on charts for some time.

Listed below are Inuit names commonly used for major ports in West Greenland.

Obsolete name	New name
Egedesminde	Aaslaat
Jakobshavn	Ilulissat
Ivigtut	Ivittuut
Faeringehavn	Kangerluarsoruseq
Gronnedal	Kanggilinnguit
Sukkertoppen	Maniitsoq
Narssaq	Narsaq
Frederiksdal	Narsaq Kujalleq
Godthab	Nuuk
Frederikshab	Paamiut
Thule	Qaanaaq
Julianehab	Qaqortoq
Christianshab	Qasigiannguit
Godhavn	Qeqertarsuag
Holsteinborg	Sisimiut
Umanak	Uummannaq

Offshore Drilling

Offshore Exploration

Oil, gas, and mineral drilling and production rigs, whether permanent or temporary, fixed or floating, may be encountered in increasing numbers in Greenland waters.

Pilotage

Pilotage in Greenland is not compulsory but is advisable. There is no official pilotage but the port authority of each port will assist when required.

Regulations

Special Regulations

No visitors are allowed to enter the country without special permission from the Danish Government.

Non-Danish vessels do not have access to the harbors of W Greenland unless a special permit is granted by the Danish Government.

Vessels sailing under Danish flag can only apply for special permission to engage in commercial whaling, sealing, fishing, or hunting.

All vessels arriving at ports in Greenland should give 24 hour notice of their ETA to the port authority.

Special harbor regulations exist in all Greenland ports; copies can be obtained from the harbor authorities.

Before sailing for Greenland, a vessel must obtain a Health Certificate at the port of departure from an authorized medical practitioner stating that at the time of departure, no dangerous or infectious disease was found or detected in the port or its surroundings, and none on board had a venereal or other infectious disease, in an infectious stage.

The Health Certificate is valid only if it bears the stamp and signature of the Danish consul or vice-consulate situated within the jurisdiction of the port of departure.

On arrival in Greenland, the master must immediately report to the Port Authority and present the Health Certificate.

The Health Certificate may also be issued by a doctor in the first port of call in Greenland.

Fishing

Commercial fishing is prohibited inside 12 miles from the baselines, fixed as the basis for measuring the fishing limit; however, with the exception to persons residing in Greenland, or persons having businesses established in Greenland, and persons who have permanent connection with the Greenland community.

Fishing vessels entering the above mentioned area of sea without the right to fish must have all working gear stowed inboard and head in the direction of exiting the area.

Reporting of Pollution

In Greenland waters, Danish regulations require ship masters and managers of oil rigs to immediately report any incident caused, or suspect to cause, oil spillage or any other type of pollution. The report should include all details that might be of use to the environmental agency.

Search and Rescue

Sea Rescue

The Danish Armed Forces Command conduct sea rescue operations in Greenland waters from the Sea Rescue Center at Gronnedal on Arsuk Fjord. When aerial assistance is required, the State Air Authority at the Air Rescue Center in Sondre Stromfjord is called.

The Danish police in Greenland organize and control sea rescue operations in local waters.

The responsibility for conducting search and rescue operations is divided between:

1. Island Commander Greenland.
2. Air Rescue Coordination Center Sonderstrom.
3. Chief Constable in Greenland.

The Island Commander Greenland can be contacted by e-mail, as follows:

mrcc@glk.gl

Ship Reporting Systems

Two mandatory ship reporting systems have been established for the safety of shipping in Greenland waters and to assist in the coordination of search and rescue efforts, as follows:

1. GREENPOS—All vessels on a voyage to or from Greenland ports and places of call. The reporting area is the area covered by the Exclusive Economic Zone of Greenland (200 miles).
2. COASTAL CONTROL (KYSTKONTROL)—All vessels of 20 grt and over, as well as all fishing vessels, on a coastal voyage between Greenland ports and places of call.

Other vessels are invited to participate in the system. Ships on Atlantic voyages can remain in the GREENPOS system when on passage between ports in Greenland by agreement with the Island Commander Greenland.

The Island Commander Greenland/MRCC Gronnedal is the responsible authority for the radio reporting systems and for initiating and carrying out maritime search and rescue operations in Greenland waters outside local areas, with the police being the responsible authority in local areas, as follows:

1. GREENPOS—If a report from a participating vessel is not received and it is not possible to establish communications with the vessel, or an emergency is reported, MRCC Gronnedal is responsible for initiating search and rescue action, including the involvement of other participating vessels known to be in that particular area.
2. COASTAL CONTROL (KYSTKONTROL)—If a report from a participating vessel is not received and it is not possible for the coast radio station to establish communications with the vessel, or an emergency is reported, the police of the port of destination shall be informed. Local police are responsible for initiating search and rescue action, including the involvement of other participating vessels known to be in that particular area.

Ship Reporting System—GREENPOS

There are four types of GREENPOS reports:

1. **Sailing Plan (SP).—**The SP contains the basic information needed to enter the vessel into GREENPOS. The report should be made when the vessel enters the GREENPOS area from sea, upon final departure from a port in Greenland, or when a ship not subject to compulsory reporting wishes to participate in the system.
2. **Position Report (PR).—**The PR should be sent four times daily, as follows:
   a. 0000-0030 UTC.
   b. 0600-0630 UTC.

c. 1200-1230 UTC.
d. 1800-1830 UTC.

3. **Deviation Report (DR).—**The DR should be sent when the vessel's position differs significantly from the position which would have been predicted from previous reports.

4. **Final Report (FR).—**The FR should be sent upon leaving the reporting area, on arrival at its destination in Greenland, or when a ship not subject to compulsory reporting wishes to leave the system.

GREENPOS messages should be addressed to Island Commander Greenland (GLK) via Gronnedal Naval Radiostation (OVC), which can be contacted through telefax, e-mail, and INMARSAT-C. Island Commander Greenland (GLK) is responsible for monitoring the voyage from the time of receiving the first SP until the time of receiving the FR.

The first line of a GREENPOS message is one of the following:

Type of Report	Format
SP	GREENPOS/SP//
PR	GREENPOS/PR//
DR	GREENPOS/DR//
FR	GREENPOS/FR//

Telegrams prefixed as above are sent free of charge and as carrying the priority URGENT.

See the Appendix for more information on the format of GREENPOS messages.

Ship Reporting System—COASTAL CONTROL (KYSTKONTROL)

There are four types of COASTAL CONTROL reports:

1. **Sailing Plan (SP).—**The SP is sent as a first report upon departure.

2. **Position Report (PR).—**If the voyage will be over 24 hours in duration, and the vessel is equipped with a radio, a PR will be sent at least once every 24 hours to the Coast Radio Station to which the SP was addressed.

3. **Deviation Report (DR).—**A DR will be sent to the Coast Radio Station to which the SP was addressed, as follows:

a. If there are any changes to the information given in the SP.
b. If the arrival time increases by more than 1 hour.

4. **Final Report (FR).—**The FR is sent to the Coast Radio Station to which the SP was addressed immediately upon arrival at the vessel's destination.

For the purpose of transmitting COASTAL CONTROL messages, Greenland waters have been divided into a number of control areas, each based on a Coast Radio Station. The limits these areas are, as follows:

1. Coast Radio Station Ammassalik (OZL)—East coast N of 60˚31'N.

2. Coast Radio Station Qaqortoq (OXF)—East coast S of 60˚31'N and W coast S of 61˚30'N.

3. Coast Radio Station Aaslaat (OYR)—West coast N of 61˚30'N.

All reports should be addressed to the appropriate Coast Radio Station situated in the same control area as the destination. This Coast Radio Station is responsible for monitoring the voyage from the time of receiving the first SP until the time of receiving the FR.

The first line of a COASTAL CONTROL message is one of the following:

Type of Report	Format
SP	COASTAL CONTROL/SP//
PR	COASTAL CONTROL/PR//
DR	COASTAL CONTROL/DR//
FR	COASTAL CONTROL/FR//

Telegrams prefixed as above are sent free of charge and as carrying the priority URGENT.

See the Appendix for more information on the format of COASTAL CONTROL messages.

Tides

On the E coast of Greenland, the time of the tide gets progressively later to the N and the range decreases from about 2.5m at Kap Farvel to about 1m at Danmarkshavn.

Farther N, little is known about the tides, but at Kap Morris Jesup, the range is about 0.2m.

Time Zone

The Time Zone description is PAPA (+3). Daylight Savings Time (OSCAR (+2)) is maintained from the Saturday before the last Sunday of March until the Saturday before the last Sunday of October.

The following areas maintain a different local time:

1. Thule maintains ZULU (UTC). Daylight Savings Time is not observed.

2. Scoresby Sound maintains NOVEMBER (+1). Daylight Savings Time (ZULU (UTC)) is maintained from the last Sunday in March until the last Sunday in October.

3. Danmarkshavn maintains ZULU (UTC). Daylight Savings Time is not observed.

U.S. Embassy

There is no U.S. diplomatic representation. Greenland is a self-governing overseas administrative division of Denmark.

Appendix

GREENPOS/COASTAL CONTROL (KYSTKONTROL) Message Reporting Format

Format	Sailing Plan	Position Report	Deviation Report	Final Report	Remarks
A/Vessel name/call sign//	R	R	R	R	
B/Date and time of report//	R	R	R	R	See Note 1.
C/Position by latitude/longitude//	R	R	R	R	See Notes 2 and 4.
D/Position by geographic location//	R	R	R	R	See Notes 3 and 4.
E/True course//	R	R			See Notes 5 and 7.
F/Speed in knots//	R	R			See Notes 6 and 7.
I/Destination and ETA//	R				Express ETA as in Note 2.
L/Planned passage//	R				See Note 8.
Q/Defects or limitations//					See Note 9.
S/Weather and ice conditions//	R	R	R	R	See Note 10.
X/Up to 65 characters of amplifying comments//	R	O	O	O	See Note 11.

KEY

R Required
O Optional

NOTES

1. Expressed as a six-digit group, DDHHMM, using UTC, where DD is the date (from 00 to 31), HH is the hour (from 00 to 23) and MM is minutes (from 00 to 59), followed by Z.
2. Latitude is expressed as a four-digit group, DDMM, where DD is degrees (from 00 to 90) and MM is minutes (from 00 to 59), followed by N or S.
3. Longitude is expressed as a five-digit group, DDDMM, where DDD is degrees (from 000 to 179) and MM is minutes (from 00 to 59), followed by E or W.
4. Either Line C or Line D may be used.
5. Expressed as a three-digit group.
6. Expressed as a two-digit group.
7. COASTAL CONTROL—This information is required only in the Sailing Plan.
8. An abbreviated statement of planned route, e.g.: present position—great circle route to 100 miles S of Kap Farvel.
9. Details of any defects affecting ship's safety, e.g.: radar or VHF disabled.
10. Abbreviated details of weather conditions at time of report and ice conditions since last report, e.g.: SW5, ice edge seen from 6100N 03905W—state if ice not seen.
11. For Sailing Plan, number of persons on board (e.g. POB 16). May also add other relevant information affecting safety of own or other vessels.

ICELAND



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General

Iceland, the national name of which is Island, lies between 62˚23'N and 66˚33'N, and 13˚28'W and 24˚32'W. The shortest distances between the coast of Iceland and selected places are, as follows:

1. East Greenland—150 miles.
2. Norway—550 miles.
3. The Faeroe Islands—250 miles.

The total area of Iceland is about 39,758 square miles. Iceland is the most sparsely-inhabited country in Europe; over 60 per cent is uninhabited and likely to remain so, as it contains a large area of ice, lava, and sand. The country lies just S of the Arctic Circle, and in the most N districts the sun is visible above the horizon all day for about 2.5 weeks in the month of June.

Buoyage System

The IALA Buoyage System (Region A) is in effect within Icelandic waters. See Chart No. 1 for further IALA Buoyage System information.

Waverider lighted buoys (special/spherical) may be encountered within the vicinity of Iceland and should be given a wide berth.

Beacons indicating danger areas or other closed areas carry topmarks painted black and yellow in bands; front, triangle point up, rear triangle point down.

Beacons indicating submarine pipelines carry yellow diamond topmarks, front and rear.

Range and anchorage beacons carry triangular topmarks, point up on the front, point down on the rear; they also may exhibit lights and be fitted with light reflectors.

Submarine cables are indicated by beacons standing close to the positions at which they are landed, and indicating the direction in which they are laid. The posts are painted with red and white bands; the rear topmark is a red disc with a white border above a white diamond with a red border, and the front topmark is a red disc with a white border. When in line, the topmarks appear as a white diamond between two red discs, disposed vertically.

Caution is necessary as colored lights may appear white due to icing, snow, or hoar frost; the range of visibility may also be greatly reduced or disappear in these conditions.

Currency

The official unit of currency is the krona, consisting of 100 aurar.

Currents

Tidal Currents

The resultant current around Iceland is the combination of the tidal current and the offshore current.

The tidal currents have an apparently circular movement around Iceland; the current which precedes the tidal wave runs clockwise, and that which follows it runs counterclockwise. As described later, the current flows clockwise round the entire coast of Iceland, and neutralizes or at least greatly diminishes the opposing tidal current. Thus it is always quicker to navigate around the island in a clockwise direction.

In Icelandic waters, the tidal currents do not run with the regularity to be expected, for example, on the coasts of England, since Iceland lies in the middle of an ocean where storms can influence great masses of water. Furthermore, the island is of considerable size, the mountains frequently form meteorological boundaries, and it may happen that a storm on the S coast coincides with a calm on the N coast; or it may blow very hard out of a fjord while there is a dead calm just outside the entrance. Such circumstances cause irregularity in the behavior of the tidal currents.

On the coast, and in the fjords, the tidal currents turn at about the time of high and low water. At sea, they turn at different times; off Vestmannaeyjar the tidal current turns about 1 hour before high water on the coast; off Faxafloi, at the same time as high water; and then round the island the time of the turn gets later, increasing gradually to 1, 2, and 3 hours after high water on the coast. As a result, tidal currents on the coast and off the coast may run in the same direction during one part of the tidal cycle, and in opposite directions during another part.

In the coastal areas where tidal current counteracts at a fjord entrance, it forces into the fjord along the upstream side, and runs out along the downstream side.

As usual, the highest rates occur with spring tides, and they are 3 or 4 times stronger than those of neap tides. Off salient points, or where the current is restricted by islands or shoals, the rate may be as much as 5 to 7 knots at springs. As the distance from such places is increased, the rate falls rapidly to 2 to 3 knots. The maximum rate off the open coast, where there are no obstructions, is about 3 knots.

Fishing Areas

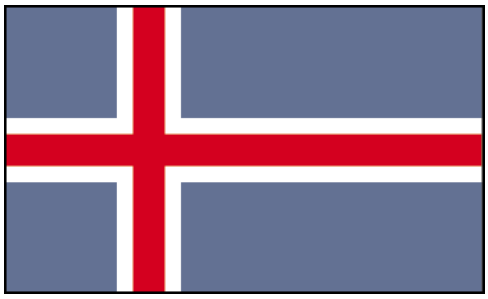
Spring trawling begins off the S coast of Iceland; during this time long-line and net fishing takes place off the SW coast.

In autumn the trawlers are found around Horn (66˚25'N., 22˚23'W.), moving in the winter past Langanes to the E coast, and keeping S of the ice.

Government

Iceland is a republic. The country is divided into eight regions.

Iceland is governed by a directly-elected President who serves a 4-year term. The Prime Minister is appointed by the President. The Cabinet is appointed by the Prime Minister and approved by the Parliament. The unicameral Parliament consists of 63 directly-elected members serving 4-year terms.



Flag of Iceland

The legal system is based on Danish law.
The capital is Reykjavik.

Holidays

The following holidays are observed:

January 1	New Year’s Day
Maundy Thursday	Variable
Good Friday	Variable
Easter Saturday	Variable
Easter Monday	Variable
First Thursday in April	First Day of Summer
May 1	International Labor Day
Ascension Day	Variable
Whitmonday	Variable
June 17	Independence Day
First Monday in August	Icelandic Bank Holiday
December 24	Christmas Eve (half day)
December 25	Christmas Day
December 26	Boxing Day
December 31	New Year’s Eve (half day)

Ice

Ice Distribution

September and October

Over the area covered by this region, sea ice usually reaches its least extent shortly after the end of August. At this time a tongue of ice, carried S in the East Greenland Current, still persists off the Greenland coast as far as 71˚N, though the coast itself is usually almost ice-free from wind effect opening polynya. Therefore, navigation in this area should not be attempted if sea breezes are expected, as the ice, through wind friction, can compact quickly.

The remaining coasts in the area, except for the far NE of Svalbard, are ice-free. In a light ice year, the minimum limit lies considerably farther N; but, it must be remembered that this is a composite minimum limit, and in a light ice year, only parts of the E coast of Greenland N of about 74.5˚N may be expected to be reasonably accessible. In a severe year the maximum limit encloses the E coast of Greenland almost as far as Kap Farvel; it also encloses the N and most of the E coasts of Svalbard. Earlier diagrams show the maximum limit lying farther SE than the maximum limit shown on the ice limit diagram over the area S of 65˚N, and up to 100 miles farther S at 25˚E in Barents Sea.

During October the ice edge advances S in all longitudes, making its greatest advance within the East Greenland Current and in the East Spitsbergen Current. In a severe year almost the whole E coast of Greenland is enclosed by the maximum limit at this time. This maximum limit almost reaches Jan Mayen and, though it is held back N of 79˚N at about 6˚E, it encloses the coasts of Svalbard as it plunges S to Bjornoya. In a light ice year, the E coast of Greenland S of 68˚N, and the whole of Svalbard, are almost ice-free.

November

The greatest advance of the ice edge in all longitudes occurs in November, presumably due to the extensive cooling of the sea surface to its freezing temperature. In the average year, almost the whole E coast of Greenland is enclosed by the ice edge by the end of November; Jan Mayen and much of the coastline of Spitsbergen are also enclosed. A noteworthy feature in the shape of the ice edge at this time is the first indication of a bulge to the NE of Jan Mayen. This bulge, the Jan Mayen Ice Tongue, known as the Jan Mayen Odden, is largely due to the freezing of the cold water in the Jan Mayen Current.

In a severe season, at the end of November, the Denmark Strait is almost closed and the Jan Mayen Ice Tongue extends well E of the Greenwich Meridian. In the Barents Sea, in such a year, the maximum limit lies S of Bjornoya.

December to March

From December to March, the ice edge advances slowly over the greater part of the area. The ice edge usually reaches its greatest extent in February and March. The S limit off East Greenland usually reaches Kap Farvel during January, and at the end of February lies about 20 miles S of the cape. In Barents Sea the ice edge reaches Bjornoya in December. From November to March the position of the ice edge in the area S of Denmark Strait shows little change; this is largely due to the containing effect of the warm the Irminger Current.

Much of Svalbard is ice-bound by late December and the whole archipelago is enclosed by early January.

Jan Mayen Ice Tongue extends E to reach its greatest extent in February. A noteworthy feature is the development of North Bay, a bight on the N flank of Jan Mayen Ice Tongue. During March, North Bay usually extends SW, presumably due, directly and indirectly to the fact that the NNE winds which have prevailed during the earlier winter months are much stronger in March. By late March the ice edge has advanced to within about 20 miles of the NW tip of Iceland, and lies about 30 miles SE of Jan Mayen.

Ice conditions from December to March show a high degree of variability between a light and a heavy year over the greater part of the area, except for the region SW of Denmark Strait, where the maximum and minimum limits are separated by only 50 to 100 miles; elsewhere they are separated by up to about 300 miles.

In a severe season the ice edge may lie up to 100 miles S of Kap Farvel, up to 80 miles SE of Jan Mayen, and up to 60 miles S of Bjornoya. Though this maximum limit may approach the N coast of Iceland as early as December, it does not effectively close Denmark Strait until March. Jan Mayen Ice Tongue extends E to about 10˚E, at the end of March, in a heavy ice year. Since its development is associated with a prolonged period of W winds, which will simultaneously cause the ice edge S of Spitsbergen to retreat E, the large N-reaching bight in the ice edge centered about 7˚E is unlikely to become cut off. In the W part of Barents Sea, during a severe ice season, the ice edge is located between 73.5˚ and 74.5˚N from December to February.

Though the E coast of Greenland, except for the extreme S, remains ice-bound even in a light season, the ice edge in such a season is located in the NW half of Denmark Strait and well NW from Jan Mayen throughout the period December to March. This minimum lies N of the N coast of Svalbard, as far as 20˚E; the whole of the W coast and much of the S coast are also ice-free. Though this limit lies well N of Bjornoya, it encloses Hopen throughout the period.

April to August

From early April the ice edge gradually retreats N in the average year, reaching its minimum extent in most longitudes in early September. The rate of retreat is greater over Greenland Sea W of about 5˚W and in Barents Sea than it is elsewhere. From April to July the average rate is about 40 miles per month, and in Barents Sea about 60 miles per month; the mean rates are much less in August. There is little movement of the ice edge SW of Denmark Strait from early April to late June; the total retreat in the average season varies between 20 and 60 miles in this period. Over most of the region W of Svalbard and N of 75˚N, the total ice edge retreat is only about 60 miles between early April and early September.

By early August, in the average season, the extent of ice cover over Greenland Sea has been greatly reduced, but a relatively narrow belt of ice still encloses the whole E coast of Greenland S to and beyond Kap Farvel. During August the S portion of this narrow belt usually melts.

Drift ice in Greenland Sea usually clears Jan Mayen late in April; at this time a small part of the NW coast of Spitsbergen is usually almost ice-free, but it is late May before most of the W coast becomes accessible.

By late August, close to the time of minimum extent, the whole of Spitsbergen is usually almost ice-free. By late August the E coast of Greenland is accessible up to about latitude 74˚N, apart from the area S of Kap Brewster. However, because the ice is not far away, fresh E to SE winds can cause it to close rapidly the coast N of Scoresby Sund. Scoresby Sund usually becomes almost ice-free by mid-July and remains so till early October.

Shore leads, sometimes extending hundreds of miles, may open up off the coast of Greenland in almost any month when offshore winds prevail, while winds with an onshore com-

ponent will rapidly close up these leads, and the momentum of the ice is such that only riding on the ice would prevent destruction.

An interesting feature of the summer break-up pattern is the polynya which usually develops off the NE coast of Greenland. In the average year it first appears in May, during which month the NNE winds of winter are replaced by the NW winds which persist till August.

The polynya usually reaches its greatest size by late June or July, and usually closes up entirely in September.

The foregoing paragraphs describe the summer break-up in the average year, but there are considerable departures from the mean condition in severe and light summer ice seasons, except in the region SW of Denmark Strait, where the variability is much reduced.

In a severe ice season the maximum limit encloses the E coast of Greenland throughout the summer, except for the extreme S from August to October. Denmark Strait may remain closed till late July; the remainder of the N coast of Iceland, and parts of the E coast, may be affected by sea ice till early June. Jan Mayen may remain ice-bound till mid-August and the W coast of Spitsbergen may not become ice-free till late July; Hopen and the E coast of Svalbard may not become accessible till mid-August. The N coast of Spitsbergen, the whole of Nordaustlandet, and the E parts of Barentsoya and Edgeya remain within the maximum limit throughout a severe summer season. In a light season, parts of the E coast of Greenland may become ice-free by late May. By late July the minimum limit lies in about 76˚N off the E coast of Greenland. Though this limit is shown lying N of Bjornoya and NW of Jan Mayen in each month, this should not be interpreted as meaning that both islands have been ice-free throughout a complete year. In fact, at each island large quantities of sea ice have appeared for at least a few weeks each year.

The glaciers on the E coast of Greenland, which collectively produce enormous quantities of icebergs, are carried S in the East Greenland Current, some surviving the journey to round Kap Farvel, while some are carried towards the N and NE coasts of Iceland by the East Iceland Current. The largest numbers will be found close in to the coast of Greenland, the frequency of icebergs decreasing to become few on the E flank of the East Greenland Current, which may perhaps be considered the average limit of icebergs; there is no record of icebergs having been carried SE or E in the Jan Mayen Current. Some icebergs which have originated from Spitsbergen and Zemlya Frantsa Iosifa are carried SW in the East Spitsbergen Current and the Bear Island Current towards Bjornoya, especially during the period of May to October.

In general, ice limit moves SE from September to April and then retreats till August, except on the SE side of Denmark Strait, where it is held at about 65˚30'N by the Irminger Current throughout the year. During April, when the monthly maximum limit reaches an extreme position, it is located about 400 miles SE of Kap Farvel. There is insufficient data to define limits to the N of the Denmark Strait, but icebergs, sometimes grounded, are not infrequently observed off the N and NE coasts of Iceland

Glacier debris, consisting of growlers and small pieces of land ice, is sometimes carried out of the fjords by the currents in late summer, when the S part of the E coast of Greenland is free of sea ice, in sufficient quantities to hamper the progress along the coast for small vessels.

Ice Limits

Sea ice presents a serious hazard to navigation over much of the area. It should also be borne in mind that small, possibly large, icebergs may be encountered along the Greenland coast at any time. Seasonal variations do not influence iceberg movements, except to trap icebergs in pack ice.

The whole E coast of Greenland is ice-bound for the greater part of the average year, though the coast S of 70˚N is usually almost ice-free in August and September. The coasts of Svalbard and Jan Mayen are usually ice-bound each winter, but the coasts of Iceland remain ice-free throughout the average year, except for the formation of ice in rivers and at the heads of some fjords. In severe seasons, ice reaches the N and E coasts of Iceland, thereby closing Denmark Strait.

The East Greenland Current brings vast quantities of ice and cold water out of the Arctic basin, and accounts for the presence of ice off the E coast of Greenland over the greater part of the year; whereas, the relatively-warm Norwegian Atlantic Current, of Gulf Stream origin, prevents the formation of ice over the greater part of Norwegian Sea and the S portion of Barents Sea. Thus the limits of the sea ice lie much farther S off the E coast of Greenland than elsewhere.

At the time of maximum extent, the S progress of the ice floes, carried by wind and current, is more or less in balance with the degree of melting at the ice edge. Thereafter, as air and sea temperature rise, the ice edge steadily retreats due to the increased rate of melting at progressively higher latitudes, though in many areas wind and current will tend to carry the melting ice floes S.

The ice edge is the demarcation at any given time between the open sea and sea ice of any kind, whether fast or drifting. The severity of the ice season is due, to a very large extent, to the winds. When winds having a major component across the ice edge prevail for a week, or even more effectively for several weeks, the ice edge moves steadily seaward; whereas, when winds blowing off the water onto the ice prevail, the edge retreats towards or even to its minimum position. Any ice floes driven out over these warm currents by winds off the ice usually melt fairly quickly. It should be noted that since the factors which contribute towards heavy or light ice conditions are unlikely to prevail over the whole area at the same time, it is highly improbable that the maximum or minimum conditions will occur over the whole area in any one year.

The width of the transition belt between ice-free conditions and an almost complete cover of sea ice depends on the winds and on the season of the year. Winds off the ice tend to produce a gradual transition, whereas winds blowing onto the ice produce a compact ice edge. Over most of the area the mean wind directions are in most months roughly parallel to the ice edge, so the transition belt is usually only a few miles wide, perhaps less than 10 miles, though in places it may exceed 50 miles. Seasonal melting also affects the width of the transition zone, and in general, it is greatest in July and August, when its width may be several hundred miles.

Ice Reconnaissance

Ice reconnaissance operations are carried out by air in the Frederikshab-Kap Farvel-Tingmiarmiut area. In addition, dur-

ing the navigable season, ice air-reconnaissance (ISRECCO) is carried out from Mestersvig (72˚12'N., 24˚04'W.) for the benefit of ships bound for the coast between Ammassalik and Danmarkshavn.

Vessels can establish communication with aircraft on ice-reconnaissance or search duty. The Danish Meteorological Institute transmits facsimile transmissions of ice charts for Greenland waters. For details see Pub. 117, Radio Navigational Aids.

Industries

Fish processing is the most important industry within Iceland. The Icelanders depend almost entirely on the sea for their livelihood; they are excellent seamen, and fish for cod on a relatively large scale, especially in Isfafjardhardjup.

Diversification of the economy has resulted in the increase of aluminum ingot, nitrate fertilizer, and diatomite production; in addition, a number of light industries are developing well.

In the past, sulfur and Iceland spar (a transparent calcite) were exported. Beds of coal (lignite) of inferior quality are not uncommon, and iron and kaolin (china clay) have been worked in a small way for local use.

The chief exports are frozen fish, salted fish, fish meal, and fish oil. The chief imports are fuel oil, foodstuffs, motor vehicles, wood, etc.

Languages

Islenzka (Icelandic) is the official language.

Magnetic Field

Magnetic Anomalies

Reports were received of two cases in which the permanent magnetism of the vessel was temporarily affected as the disturbance continued. In the first case, the disturbance lasted for some hours; and in the second, it lasted for several days. Strong disturbances were noted in the vicinity of Iceland, in the areas where the depths were as much as 135m.

Maritime Environment

The North Atlantic Ocean washes the S and W coasts of Iceland, and the E coast of Greenland as far N as Kap Nansen. Greenland Sea and Norwegian Sea, divided by a line joining the S end of Spitsbergen, Jan Mayen, and the E extremity of Iceland, lie between the E coast of Greenland, N of Kap Nansen on the W, Spitsbergen on the NE, and Norway on the SE; together they form a basin in the greater part of which the depths are over 1,800m.

This basin is separated from the North Atlantic Ocean by a ridge over which the depths are less than 550m, and on which lie the Faeroes and Iceland. On the E, depths between Norway and Spitsbergen are less than 360m, but to the N, Greenland Sea is connected to the Arctic Ocean by Lena Trough, in which the depths are between 180m and 3,600m. There is also a narrow gully between the Faeroes and Scotland, with depths of over 1,000m.

Vesterisgrunnen (73˚30'N., 9˚10'W.) is a seamount with a least depth is 123m.

The positions, coastline, hydrography, and topography on some Iceland charts are inaccurate in places; the charts must be used with caution. The heights of lights given on the charts of Iceland coasts, in Pub. 115, Lists of Lights, and in this publication are approximate only. When entering or leaving Icelandic ports, except the port of Reykjavik, larger-scale Icelandic charts should be used.

Denmark Strait separates Iceland from Greenland; the general depths are between 180 and 540m. A depth of 110m was reported almost in the middle of the strait (65˚53'N., 29˚40'W.).

Around the coast of Iceland, sand is the most common material, forming an almost continuous belt around the island. Interspersed over the sand are patches of shell, gravel and mud, with rock occasionally fronting the coast. There would appear to be no general pattern to the distribution of the sediment except that there is a decrease in grain size with the increase in the depth of water. Across the entrances to the fjords, mixtures of sand and gravel are frequently found, but within the fjords mud and silt form the bottom, with little evidence of coarser materials.

The nature of the seabed varies considerably with the depth of water. Along the coast of East Greenland, coarse material deposits alternate with areas of rock stripped bare by grounding ice, and the whole of this coastal belt is bounded by a mixture of mud and sand. In the deep oceanic waters to the S and N of Iceland, ooze or very soft mud is generally widespread, but notable areas of coarser materials occur. In the neighborhood of the mid-oceanic ridge, rock, sand and gravel are found. Similar coarse debris transported by icebergs are found dispersed over the ooze. In the shallow approaches to Barents Sea, the ooze is replaced by mixtures of mud, sand, gravel, and shell.

The surface waters are influenced to a depth of about 300m by two contrasting water masses; warm saline water of Gulf Stream origin, and cold fresh waters from the Polar Basin. The Gulf Stream waters are distributed by the North Atlantic Current system to become widespread to the S of Iceland and along the E sector of the area. The polar waters are transported S by the ice-bearing East Greenland Current and bifurcate to the N of Iceland. At the boundary of the two water masses is the Polar Front, a transition zone where the warm water tends to overlie the denser cold water, resulting in sharp negative temperature/depth and salinity/depth gradients. The values at 1.75 and 1.76 are for the surface or under ice. Variations of salinity and density will be found at the ice edge due to the melting ice.

For an explanation of density as applied to seawater, see Pub. 9, American Practical Navigator (Bowditch). In winter, values of between 1.02750 gm/cm^3 to 1.02775 gm/cm^3 in the E of the area, a value of 1.02725 m/cm^3 in the S of the area, and values between 1.02725 gm/cm^3 and 1.02775 gm/cm^3 in the N are observed. The density decreases towards the E coast of Greenland, with a minimum value of 1.02575 gm/cm^3 in the N. There is an area of more dense water S of Svalbard, with values greater than 1.02800 gm/cm^3. In summer, the values are 1.02675 gm/cm^3 to 1.02700 gm/cm^3 in the E, 1.02675 gm/cm^3 in the S and less than 1.02450 gm/cm^3 in the N of the area. At the Greenland coast the density decreases to less than 1.02500 gm/cm^3.

Navigational Information

The maritime territorial claims of Iceland are, as follows:

Territorial Sea	12 miles.
Fisheries or Economic Zone	200 miles.
Continental Shelf	200 miles or the Continental Margin.

Regulations

Fishery protection vessels constantly cruise in Icelandic waters.

Offenders against the fishery laws are subject to heavy fines and imprisonment. In Iceland, the eiderduck is protected by law, particulars of which are exhibited at the offices of the Police Superintendents.

Quarantine regulations are strictly enforced and should be understood before a vessel leaves the last port-of-call for Iceland. If a clean bill of health is not obtainable, vessels are quarantined and may request to the port health authority for re-examination.

Vessels bound for Iceland from a foreign port should proceed to one of the following ports for port entry clearance:

Akranes	64˚19'N, 22˚05'W.
Akureyri	65˚45'N, 18˚05'W.
Eskifjordhur	65˚04'N, 14˚00'W.
Hafnarfjordhur	64˚04'N, 22˚00'W.
Husavik	66˚03'N, 17˚21'W.
Isafjordhur	65˚50'N, 22˚28'W.
Keflavik	64˚00'N, 22˚33'W.
Neskaupstadhur	65˚09'N, 13˚41'W.
Patreksfjordhur	65˚36'N, 24˚01'W.
Reykjavik	64˚09'N, 29˚56'W.
Seydhisfjordhur	64˚15'N, 13˚55'W.
Siglufjordhur	66˚09'N, 18˚52'W.

All vessels, after clearing for port entry, may load and/or unload without further permission, and a clearance on departure may also be requested at the following ports:

Blonduos	65˚40'N, 20˚18'W.
Bolungarvik	66˚10'N, 23˚14'W.
Borgarnes	64˚32'N, 21˚56'W.
Djupivogur	64˚40'N, 14˚15'W.
Faskrudhsfjordhur	64˚54'N, 13˚38'W.
Flateyri	66˚03'N, 23˚31'W.
Hofn	64˚16'N, 15˚13'W.
Holmavik	65˚44'N, 21˚41'W.
Hvammstangi	65˚24'N, 20˚57'W.
Isafjordhur	65˚50'N, 22˚28'W.
Olafsfjordhur	66˚05'N, 18˚39'W.
Olafsvik	64˚54'N, 23˚43'W.
Patreksfjordhur	65˚36'N, 24˚01'W.
Raufarhofn	66˚27'N, 15˚57'W.
Reydharfjordhur	64˚56'N, 13˚41'W.
Saudharkrokur	65˚45'N, 19˚39'W.
Seydhisfjordhur	64˚15'N, 13˚55'W.
Siglufjordhur	66˚09'N, 18˚52'W.
Stykkisholmur	65˚05'N, 22˚44'W.
Sudhureyri	65˚37'N, 23˚51'W.
Thingeyri	65˚52'N, 23˚29'W.
Thorlakshofn	63˚51'N, 21˚22'W.
Vopnafjordhur	65˚45'N, 14˚49'W.

Permission must be obtained from the Customs Authorities to land or load at other places.

Vessel Reporting System

All vessels en route to a port in Iceland must report to the Icelandic Coast Guard (ICG) at least 24 hours before entering port. Fishing vessels should report their position 6 hours before entering the Icelandic Exclusive Economic Zone (IEZ) and every 12 hours while inside the IEZ. The information required in the report is given in the accompanying table. Reports can be sent to the ICG, as follows:

1. E-mail:

sar@lhg.is
vms@lhg.is

2. INMARSAT-C: +581-425101519
3. Coast radio stations

Note.—Telefax transmissions of the required information to the ICG will not be accepted.

Iceland Reporting System Message Format

Line	Description
A	Vessel name, IMO registration number, and call sign
B	Nationality
C	Vessel type
D	Date of transmission (6 digits—day of month (2 digits), month (2 digits), and year (2 digits))

Iceland Reporting System Message Format	
Line	**Description**
E	Time of transmission in UT(GMT) (4 digits—hour (2 digits) and minutes (2 digits))
F	Current position—latitude (4 digits followed by N) and longitude (5 digits followed by E/W)
G	Last port of call
H	Destination (port in Iceland)
I	ETA at first port in Iceland (date and time as expressed in D and E)
J	Other ports of call in Iceland
K	Port of departure in Iceland
L	ETD from last port in Iceland (date and time as expressed in D and E)
M	Destination after Iceland
N	Agent in Iceland
O	Crew/passenger list in this order: 1. Nationality 2. Last name 3. First name 4. Date of birth 5. Sex 6. Passport number 7. Rank (if crew member) Every change in the crew list or the passenger list should be reported to the Icelandic Coast Guard.
P *	Total catch on board, by type
Q *	Estimated date, time, and position when sailing into the IEZ
R *	Former fishing area
S *	Services needed in Iceland
T *	All vessels shall confirm departure time at least 6 hours before leaving last port in Iceland
* Fishing vessels only	

Routes

Vessels bound for the W coast of Iceland from Europe are advised to steer for Dyrholaey (63˚24'N., 19˚08'W.) or Vestmannaejar, 30 miles W. The practice of keeping a distance from the S coast of Iceland cannot be over-emphasized.

Vessels bound for the E coast should attempt to make a landfall between Gerpir (65˚05'N., 13˚30'W.) and Glettinganes, 25 miles N; there are many prominent landmarks in this coastal stretch, free from off-lying dangers.

Vessels bound for the S fjords along the E coast, can make a landfall in the vicinity of Vestrahorn (64˚16'N., 14˚57'W.) or Eystrahorn, 15 miles NE, but fogs suspend frequently. If fog is encountered anywhere on the E coast, off the S part of Iceland, vessels should keep outside the charted 200m curve, unless the ship's position is certain.

Drift ice may be encountered off the E coast, and if there are strong N winds, drift ice may also be encountered S of 66˚N on the W coast. Due to up-welling, no ice forms on the S or W coasts.

Vessels bound for the N coast of Iceland should avoid rounding Langanes (66˚23'N., 14˚32'W.) without first making a landfall, or until soundings indicate it is safe.

When the fishing and commercial vessels begin to arrive off the E coast during mid-March, the coast is occasionally blocked with ice; keep out to seaward to avoid being beset into ice breaking off land; alternatively, head for Berufjordhur (64˚41'N., 14˚15'W.).

If the N coast of Iceland is blocked, the ice will be met at Langanes. Any attempt to sail round it to the N can be devastating, leaving no alternative but to keep to sea or at anchor at Berufjordhur. An attempt to seek a port farther N must be avoided as ice closes the port of Langanes. Subsequently, vessels suffer damage, even those waiting in Vopnafjordhur.

Vessels bound for the midwest coast from the S, should navigate around the S and W coast and make the approach from the W. As the ice drifts E, this course has often been successful, and the advantage is that if the way to Horn is blocked, a secure anchorage can be found in one of the W ports.

Later in the year, when the ice does not form and become a compact mass, entering the ice has been successful near Langanes after a day of difficult navigation. Open waters are found especially on the W coast where ice may leave a narrow channel between it and the shore. However, experience is required for such maneuvers, as entering the ice entails the risk of being crushed, and using a shore lead may result in being driven ashore. With a prospect of S and W winds and spring tides, it appears less risky to go through an open water channel between the shore and the ice, rather than entering the ice, even if it is moderately open.

Search and Rescue

Two Maritime Rescue Coordination Centers (MRCC) coordinate search and rescue operations, as follows:

1. MRCC Oceanic (Joint Icelandic Coast Guard Operations Center) is responsible for ocean rescue and can be contacted by e-mail, as follows:

sar@Ihg.is

vms@Ihg.is

2. MRCC Coastal (Icelandic Ship Reporting System Operations Center) is responsible for the coastline and coastal waters and can be contacted by e-mail, as follows:

sjostjorn@landsbjorg.is

A network of coast radio stations, which are remotely controlled from Reykjavik, maintain a continuous listening watch on international distress frequencies.

The National Life Saving Institution (NLSI)

The NLSI of Iceland, founded in 1928, is responsible for all rescue operations, both offshore and inland. Their rescue teams are trained, well equipped, thoroughly conversant with local conditions, and equipped with modern telecommunications, large four-wheel drive vehicles, motor sledges, motor lifeboats, permanently-inflated dinghies, and other suitable rescue equipment.

The following list provides the location of the NLSI rescue teams around the Icelandic coast, with the boats available to each team. All the rescue teams are equipped with line-throwing apparatus.

Location	Boats Available
Akranes	Rigid hull inflatable, 7m; inflatable
Akureyri	
Arskogssandur	Inflatable
Bildudalur	Inflatable
Blonduos	Inflatable
Bolungarvik	Rigid hull inflatable, 8m; inflatables
Borgarfjordhur	Rigid hull inflatable, 6m
Borgarnes	
Breidhdalsvik	Inflatable
Budhir	Rigid hull inflatable, 8m
Faskrudhsfjordhur	
Dalvik	Inflatable
Djupivogur	Inflatable
Drangsnes	Inflatable
Egilsstadhir	
Eskifjordhur	Rigid hull inflatable, 6m; inflatable
Eyrarbakki	Inflatables
Flateyri	Inflatables
Gardhur	Inflatable
Grenivik	Inflatable
Grindavik	Glass reinforced plastic (GRP) boat, 9m
Grundarfjordhur	Inflatables
Hafnarfjordhur	Rigid hull inflatable, 8m; inflatable
Hafnir	
Hellisandur	Aluminum boat, 13m
Hnifsdalur	
Hofn, Hornafjordhur	Steel boat, 15m; inflatable
Hofn, Bakkafjordhur	Inflatable
Hofsos	
Hrisey	Rigid hull inflatable, inflatable
Husavik	Rigid hull inflatable, 6m; inflatables
Hvammstangi	Inflatable
Isafjordhur	Aluminun boat, 13m; inflatables
Kelduhverfi	lnflatable
Kirkjubejarklaustri	
Kjalarnes	Inflatable
Kopasker	
Kopavogur	Rigid hull inflatable, 6m; inflatable
Mosfell	
Neskaupstadhur	Rigid hull inflatable, 6m; inflatable
Olafsfjordhur	Inflatables
Olafsvik	
Patreksfjordhur	Rigid hull inflatable, 8m; inflatables
Raufarhafnarhofdhi	Inflatable
Reydharfjordhur	
Reykjavik	Steel boat, 20m; rigid hull inflatable, 8m
Sandgerdhi	Steel boat, 24m; inflatable
Sandvik, Grimsey	
Saudharkrokur	Rigid hull inflatable, 6m; inflatable
Selfoss	
Seltjarnarnes	Rigid hull inflatable, inflatable
Seydhisfjordhur	Rigid hull inflatable, 6m
Siglufjordhur	Rigid hull inflatable, 6m
Hofdhakaupstadhur	Rigid hull inflatable, 6m; inflatable
Stodhvarfjordhur	Inflatable
Stokkseyri	Inflatables
Stykkisho1mur	Rigid hull inflatable, 6m; inflatable
Sudhavik	
Sudhureyri	
Svalbardhseyri	
Talknafjordhur	Inflatables
Thingeyri	Rigid hull inflatable, 6m; inflatable
Thorlakshofn	Rigid hull inflatable, 8m; inflatable
Thorshofn	Inflatable
Vogar	Inflatable
Vopnafjordhur	Inflatable

Coastal refuge huts, now erected and maintained by the NLSI, first came into practice after a German trawler stranded on Skeidhararsan during January 1903; the crew got safely ashore, only to suffer great privations, from which three men died before finally reaching a farm house after 11 days. As a result, the German Consul at Reykjavik, at his own expense,

caused a hut to be built and provisioned at Kalfafellsmelar. This facilitated to a second German trawler that stranded, and the crew were rescued by the local farmers.

Since the foundation of the NLSI, many more shelters have been built, first on the S coast, and later in Vestfirdhir and on the N coast. Shelters are not designed to meet any particular type of structure. On the sands of the S coast they are built on stilts, approximately 1m above ground level, so as to allow sand to be blown under them instead of piling up against their sides.

Shelters on the N sides of Vestfirdhir are similarly raised, to prevent them from being snowed under.

All shelters are identifiable by the NLSI sign, and are painted in international orange color. They are stocked with all the necessary survival equipment such as warm clothing, food, first aid kit, heating apparatus, lights, and useful information. Radiotelephones (RT), installed in many shelters, receive and transmit on the 2182 kHz emergency frequency, at 20 watts, powered by eight 6-volt dry batteries. In addition, some sets have a manually-operated generator.

The following table gives the location of the coastal refuge huts around the Icelandic coast. All the huts are equipped with a VHF radio, unless stated otherwise.

Location	Position	Remarks
Almenningsnof	66˚08.9'N,19˚03.2'W	Telephone only
Alvidhruhamrar	63˚26.3'N,18˚27.1'W	
Austurfjorutangi	64˚14.3'N,15˚10.0'W	Telephone only
Bardhsvik	66˚20.1'N,22˚13.9'W	
Brunavik	65˚32.0'N,13˚42.0'W	No radio equipment
Dritvik	64˚45.8'N,23˚55.0'W	No radio equipment
Faxasker	63˚27.7'N,20˚14.4'W	No radio equipment
Fjallaskagi	66˚00.5'N,23˚48.0'W	
Flatey	66˚09.6'N,17˚50.8'W	
Flotavik	66˚26.8'N,22˚55.6'W	
Fossfjara	63˚44.2'N,17˚36.5'W	
Furufjordhur	66˚16.5'N,22˚13.9'W	
Glettinganes	65˚31.0'N,13˚37.0'W	No radio equipment
Hedhinsfjordhur	66˚07.8'N,18˚47.4'W	Citizens band radio only
Hjorleifshofdhi	63˚25.1'N,18˚46.1'W	No radio equipment
Hlodhuvik	66˚25.3'N,22˚38.8'W	
Hornvik	66˚25.3'N,22˚29.5'W	
Hrafnsfjordhur	66˚16.0'N,22˚21.8'W	
Hvalsneskridhur	64˚27.6'N,14˚30.7'W	No radio equipment
Hvanndalir	66˚09.3'N,18˚39.8'W	No radio equipment
Ingolfshofdhi	63˚48.2'N,16˚38.4'W	No radio equipment
Keflavik, Briedhafjordhur	65˚30.5'N,24˚14.5'W	
Keflavik, Gjogurta	66˚10.0'N,18˚15.0'W	
Kopanes	65˚47.7'N,24˚06.5'W	No radio equipment
Krossadalur	67˚42.0'N,24˚03.5'W	No radio equipment
Lageymanareyjar	66˚17.8'N,17˚07.2'W	No radio equipment
Latrar	66˚07.0'N,18˚19.0'W	
Latravik, Adhalvik	66˚24.0'N,23˚01.0'W	
Manes	65˚32.0'N,22˚25.0'W	No radio equipment
Myrnatangi	63˚27.1'N,18˚19.8'W	
Naustavik	66˚01.0'N,17˚40.0'W	No radio equipment
Nyios	63˚45.2'N,17˚30.0'W	
Sandeyri	66˚09.0'N,22˚50.8'W	
Sandvik, Gerpir	65˚05.4'N,13˚33.1'W	
Saebol, Adhalvik	66˚20.5'N,23˚05.5'W	
Seley	64˚59.0'N,13˚31.0'W	
Skaftaros	63˚39.0'N,17˚49.6'W	
Skalar	66˚19.8'N,14˚46.2'W	
Skalavik	66˚11.0'N,23˚28.0'W	
Skeidhararsandur	63˚46.6'N,17˚15.1'W	
Sletta Ytri Hafnir	66˚17.8'N,22˚59.2'W	
Stigi	66˚11.5'N,23˚24.0'W	
Surtsey	63˚18.2'N,20˚35.6'W	No radio equipment
Svalvogaviti	65˚54.5'N,23˚51.0'W	
Thorgeirsfjordur	66˚09.1'N,18˚07.5'W	

Tides

The tides are mainly semi-diurnal. In Iceland, the time of the tide progresses clockwise round the island. The ranges vary between 3 to 4m at the W end and about 1.5m at the E end.

Time Zone

The Time Zone description is ZULU (UTC). Daylight Savings Time is not observed.

U.S. Embassy

The U.S. Embassy is situated at Laufasvegur 21, Reykjavik. The mailing addresses are, as follows:

1. Iceland address—
   Laufasvegur 21
   101 Reykjavik
2. U. S. address—
   PSC 1003, Box 40
   FPO AE 09728-0340

U. S. Embassy Iceland Home Page
http://www.usa.is

NORWAY



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General

Norway (Norge) is located in the W and N parts of the Scandinavian peninsula in NW Europe. It is bordered on the E by Sweden, Finland, and Russia; on the N by the Arctic Ocean; on the W by the North Sea; and on the S by the Skagerrak.

The climate along the S coast of Norway, because of the influence of the North Atlantic Current, has very mild weather for such high latitudes and the harbors are ice free.

The terrain is glaciated in character, being of mostly high plateaus and rugged mountains over fertile valleys. The coastline is deeply indented by fjords.

Buoyage System

The IALA Buoyage System (Region A) is in effect. See Chart No. 1 for further IALA Buoyage System information.

Mariners are cautioned that few buoys in Norwegian waters carry the topmark as prescribed for the IALA Buoyage System (Region A).

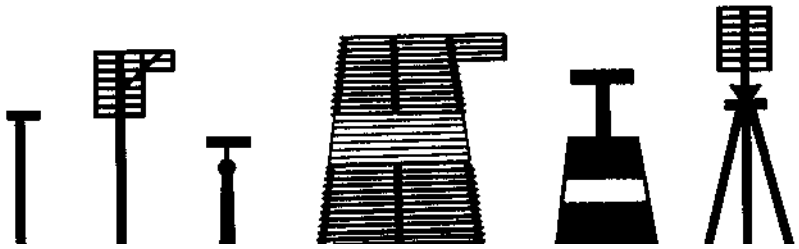
Fixed marks placed on the coast close to the fairway consist of beacons, perches, iron pillars, and wood or stone structures. They are usually fitted with arms indicating the fairway, or when a vessel may pass on either side, with two arms, one on each side.

Iron perches and posts may, for the sake of increased visibility, be furnished with topmarks. Marks exposed to the sea carry neither arms nor topmarks.

Due to the large number of fixed marks, mariners are warned that at any one time some of them will be damaged. In particular, iron beacons may become twisted and their arms point in the wrong direction. Defects, or any need for inspection which may be observed when passing, should be reported.

In channels where ice is expected, topmarks are removed in autumn and replaced in the spring. Buoyage is removed for the winter in channels prone to freezing.

Waverider lighted buoys (special/spherical) may be encountered within the vicinity of Svalbard and should be given a wide berth.



Examples of Norwegian Fixed Marks

Oceanographic instruments may be moored off the coast of Norway and are usually marked, although they may not be charted. Mariners are requested to give floating aids as wide a berth as possible.

Floating marks are removed for the winter in channels where seasonal freeze always takes place. Mariners are advised to give a wide berth to these floating aids (buoys and spars) due to continued damage caused by vessels and ice conditions, and any irregularity discovered relating to the lights and buoyage system should be reported to the National Coordinator of Navigational Aids, as follows:

Telephone: 22-422331
Telex: 76550 NAVCO N (24 hours)
Telefax: 22-410491 (24 hours)

Bridge Markings.—Many bridges may be lighted in accordance with the IALA markings for fixed bridges over navigational waters. The prescribed navigational markings are, as follows:

1. Red and green lights mark the lateral limits of the bridge.
2. White lights indicate the center of the bridge span.
3. Floodlights illuminate the bridge pillars in or adjacent to the channel.
4. A racon indicates the best transit under the bridge.

Cautions

Navigation off the Norwegian coast is difficult and requires great caution. The outlying islands and harbors are also difficult to access; yet, there are nearly always deep-water channels between the rocks. These channels are often very intricate, but they are often well marked by buoys and beacons and pilots are usually available. Generally, depth soundings are of little use in making the coast of Norway.

The movement of swell over this area is mainly from the SW, moderate, with periods of heavier swell in winter. In summer, the dominant swell is light or moderate from NW or N. Waves may be unusually long over the N sector during W winds. Prolonged N or NE gales between Norway and the Shetland Isles cause stormy seas and heavy swell. Similar conditions prevail off SW Norway when a deep “low” develops in Skagerrak. Hazardous conditions, with confused sea and swell, are liable to develop near the centers of vigorous depressions. The approaches to the numerous fjords at the more exposed points are particularly disturbed in stormy weather, and sudden changes of wind may increase the hazards.

The sea breaks in heavy gales over ground with depths of up to 37m; especially if the swell comes from the direction of greater depth. A danger may often be detected by noticing a number of sea-birds, particularly gulls, near the surface as they gather over shoals to catch small fish.

During the summer months, navigation is facilitated by the long hours of daylight. In winter, the nights are proportionately long, cloudy, and the landmarks are often obscured by snowstorms and are indistinguishable by their uniform covering of snow which often renders hazardous and dangerous situations along the coast.

In conjunction with the establishment of GMDSS (Global Maritime Distress and Safety System), numerous medium frequency radiobeacons situated around the coast of Norway have been discontinued.

Currency

The official currency of Norway is the krone, consisting of 100 ore.

Firing Areas

Five permanent firing practice areas have been established, in the SW approaches to Bergen, in the following areas:

1. In the SW and W approaches to Selbjornsfjorden.
2. In the SW approaches to Korfsfjorden.

These five areas are contiguous to each other and have been designated, as follows:

1. **END202—**An area bounded by lines joining the following positions:
   a. 60˚09'58"N, 4˚04'54"E.
   b. 60˚09'58"N, 4˚34'54"E.
   c. 59˚54'58"N, 4˚34'54"E.
   d. 59˚54'58"N, 4˚04'54"E.
   e. 60˚09'58"N, 4˚04'54"E.
2. **END203—**An area bounded by lines joining the following positions:
   a. 60˚09'58"N, 4˚34'54"E.
   b. 60˚09'58"N, 4˚56'54"E.
   c. 59˚54'58"N, 4˚56'54"E.
   d. 59˚54'58"N, 4˚34'54"E.
   e. 60˚54'58"N, 4˚34'54"E.
3. **END204—**An area bounded by lines joining the following positions:
   a. 59˚52'58"N, 4˚26'54"E.

b. 59˚52'58"N, 4˚56'54"E.
c. 59˚39'58"N, 4˚56'54"E.
d. 59˚39'58"N, 4˚26'54"E.
e. 59˚52'58"N, 4˚26'54"E.

4. **END259—**An area bounded by lines joining the following positions:
a. 59˚54'58"N, 4˚26'54"E.
b. 59˚54'58"N, 5˚04'54"E.
c. 59˚50'58"N, 5˚04'54"E.
d. 59˚48'58"N, 4˚56'54"E.
e. 59˚52'58"N, 4˚56'54"E.
f. 59˚52'58"N, 4˚26'54"E.
g. 59˚54'58"N, 4˚26'54"E.

5. **Stolmen—**An area bounded by lines joining the following positions:
a. 60˚01.3'N, 5˚01.3'E.
b. 60˚02.9'N, 5˚01.3'E.
c. 60˚05.0'N, 4˚57.0'E.
d. 59˚59.0'N, 4˚57.0'E.

Fishing Areas

Fisheries

Fishing is throughout the year with seasonal concentrations in various localities. A considerable part of fishing occurs in coastal and fjord waters, but in the 1960s a greater part extended seaward. Seasonal concentrations are most marked in coastal waters where large gatherings of vessels are seen with much fishing gear. Other vessels should pass through these areas with care and avoid congested fishing harbors. Fishing grounds on the edge of the continental shelf are mentioned below in the accompanying tables.

Winter herring fishery, known as the “large and spring herring fishery, takes place by day and at night from January to March along the coast from Kristiansund to the N.

Purse nets, also known as ring nets, are marked by floats and are laid from the starboard side. The vessel then circles and usually occupies a considerable area; there may be a workboat with a towline up to 90m long. A purse-net vessel exhibits, in addition to the lights prescribed by COLREGS 72, two yellow lights disposed vertically and flashing alternately. The “fat and small herring fishery” is carried on throughout the year, mostly by purse net as already described.

Mackerel fishery may be encountered along the coast from the end of April until late summer, by drift net, purse net, or trolling. Drift nets, as long as 2 miles, are set at sundown and hauled early in the morning. They are marked by floats, and the end of the net lengths are marked by buoys with flags and lights. Drift net vessels often illuminate the net lengths with a searchlight.

Banks and Fishing Grounds N of Storegga

Name	Position	Remarks
Nordegga	63˚27'N, 5˚40'E	Depth of 270m; fine sand
Perjohanneset	63˚35'N, 5˚38'E	Depths of 600 to 800m; sand and clay
Nyegga	63˚15'N, 5˚53'E	Depths 250m; sand
Storneset	63˚45'N, 5˚35'E	Depths of 400 to 600m; sand and clay

Deeps and Banks on the Continental Shelf

Name	Position	Remarks
Stadhavet	62˚12'N, 4˚40'E	Depths of 100 to 200m.
Sildestobotnen	62˚17'N, 5˚05'E	Depths of 40 to 100m.
Nylandsbotnen	62˚21'N, 5˚05'E	Depths of 100 to 200m.
Breidsunddjupet	62˚32'N, 5˚24'E	Depths of 200 to 300m.
Mebotnen	62˚38'N, 5˚30'E	Depths of 70 to 100m.
Stordjupet	62˚38'N, 5˚40'E	Depth of 215m.
Langgrunnssoyla	62˚44'N, 5˚07'E	Depths of 110 to 140m.
Langgrynna	62˚52'N, 5˚25'E	Depths of 90 to 100m.
Fjortoftgrynna	62˚53'N, 5˚57'E	Depths of 100 to 150m.
Onadjupet	63˚04'N, 6˚07'E	Depths of 100 to 180m.
Onaskallen	63˚10'N, 6˚07'E	Depths of 100 to 150m.
Onagrunnen	63˚14'N, 6˚04'E	Depths of 100 to 150m.

Deeps and Banks on the Continental Shelf		
Name	**Position**	**Remarks**
Buagrunnen	63˚07'N, 6˚32'E	Depths of 50 to 100m.
Froyabanken	63˚47'N, 7˚25'E	Depths of 160 to 200m.
Haltenbanken	64˚44'N, 8˚50'E	Depths of 100 to 200m.
Caution.—The depths on Froyabanken and Haltenbanken are considered to give limited warning of approach to the coast.		

Banks and Fishing Grounds SW of Egga (66˚00'N, 6˚00'E)		
Name	**Position**	**Remarks**
Aktivneset	62˚30'N, 3˚40'E	Uniform depths of 185m; sand and stones.
Korallneset	62˚45'N, 4˚10'E	Depths of 320 to 450m; irregular bottom, with coral, avoided by fishermen.
Svatangane	62˚50'N., 5˚00'E	Seldom used for fishing.
Gnausen	62˚44'N., 4˚54'E	Seldom used.

Banks on Storegga (62˚50'N, 4˚30'E)		
Name	**Position**	**Remarks**
Sormannseset	63˚03'N, 5˚10'E	On the line with Hildrehesten (62˚34'N., 6˚24'E.) touching the W edge of Hararnsoy, bearing 130˚; fishing is in depths of 170 to 470m; uneven bottom partly rock.
Brattegga	63˚05'N, 5˚17'E	On a line with Hildrehesten open N of Mannen, bearing 135˚; sand and shingle; fishing is in depths of 170 to 470m.
Fjortoftneset	63˚07'N, 5˚18'E	About 3 miles NW of Remma on a line with Bjorlagstinden, touching the SW edge of Bergsnakken, bearing 135˚; sand and stones, with clay in the deeper parts; fishing is in depths of 170 to 470m.
Kalvhola	63˚08'N, 5˚25'E	The S part of Bukta, on a line with Bjorlagstinden, touching Bergsnakken, bearing 138˚.
Skallen	63˚12'N, 5˚18'E	Depth of 320m; sand.
Skateneset	63˚14'N, 5˚24'E	The N part of Bukta, on the line with Bjorlagstinden touching the N edge of Skulen, bearing 142˚; sand and stones; fishing is in depths of 185 to 560m.
Steinmaren	63˚18'N, 5˚30'E	Fishing is in depths of 185 to 560m.

Banks on Storegga (62˚50'N, 4˚30'E)		
Name	**Position**	**Remarks**
Kalvhola	63˚23'N, 5˚41'E	On the line with Hildrehesten, touching the W edge of Skulen, bearing 158˚; fishing is in depths of 185 to 560m.

Coal-fish and tunny fisheries take place off the coast from May until autumn. Purse nets are used and may extend up to 150m. Cod fishery takes place off the coast from Stattlandet to Nordkapp in the N of Norway. The main area is near the Lofoten Islands, but concentrations of vessels may be met in other areas, such as Borgundfjorden or off Vikna.

Trawling occurs mainly to a distance of 12 miles offshore, but shrimp and float trawlers may be met nearer the coast. When working in pairs at night, each trawler uses a searchlight trained in the direction of the other vessel.

The area or location of the larger fishing fleets are announced every day over the national radio network, immediately after the news transmittal at 1230.

Shark and cod fishing takes place on Spitsbergen Bank (75˚00'N., 20˚00'E.).

Norwegian fishery protection vessels, when on duty, exhibit a fixed blue light from the highest masthead.

Drift Net Fishing

Drift net fishing takes place from May to September. The fish are concentrated in the area from W of Maloy to SW of Utsira (59˚18'N., 4˚53'E.) and from NW of Egersund (58˚27'N., 6˚00'E.) to Oslo Fjord.

Mackerel fishing usually takes place from 7 to 30 miles offshore. The mackerel nets usually run parallel to the coast and stretch from 1 to 3 miles.

Salmon fishing area marks from the baseline out to 4 to 5 miles offshore, and the nets are usually placed at right angles to the coast stretching from 0.5 to 1 mile long.

The nets are marked by lighted buoys with flag and radar reflector at each end. Mariners can normally make radio contact with fishing fleets.

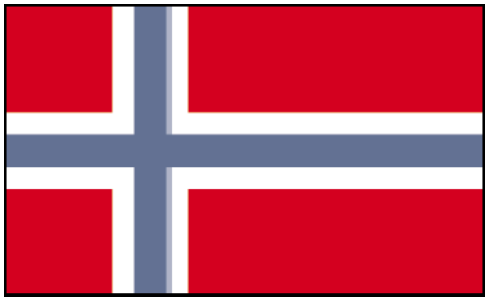
Government

The Kingdom of Norway is a constitutional monarchy. The country is divided into 19 counties and two terr1tories.

Norway is ruled by a King, in conjunction with a Prime Minister and the cabinet, who are appointed by the King with the approval of the Storting. The unicameral Storting consists of 165 members, directly elected according to a system of proportional representation, for 4-year terms.

The legal system is based on a mixture of customary law, civil law, and common law traditions.

The capital is Oslo.



Flag of Norway

Holidays

The following holidays are observed:

January 1	New Year's Day
Palm Sunday	Variable
Holy Thursday	Variable
Good Friday	Variable
Easter Sunday	Variable
Easter Monday	Variable
May 1	Norwegian Labor Day
May 17	Norwegian Constitution Day
Ascension Day	Variable
Whitsunday	Variable
Whitmonday	Variable
December 24	Christmas Eve (half day)
December 25	Christmas Day
December 26	Second Christmas Day
December 31	New Year's Eve (half day)

Ice

The Norwegian Ice Service is administered by the Norwegian Coastal Administration, whose main task is to inform vessels about the prevailing ice situation. This service covers the fairways, harbors, and coastal routes along the coast from the Swedish border to Kristiansand, including Oslofjord.

Ice reports are available on the Internet between December 1 and March 31, as follows:

Norwegian Ice Service Ice Reports
http://www.kystverket.no

The Norwegian Ice Service can also be contacted by e-mail, as follows:

ismelding@kystverket.no

The Norwegian Ice Service does not provide icebreaker assistance to and from Norwegian ports. Certain harbors provide their own ice-breaking service; the harbor authorities should be contacted for details of relevant information.

Industries

Norway is mostly barren and mountainous. Arable soil is found in narrow strips in deep valleys and around fjords and lakes. Of the total area, 80 per cent is unproductive, 18 per cent is productive forest, and only 2 per cent is cultivated.

The major natural sources of wealth are forestry, fisheries, minerals, and offshore oil and gas. The most important sea fisheries in order of value were cod, mackerel, coal-fish (saithe), deep-water prawn, haddock, herring, and dogfish. The principal mineral products are iron ore, aluminum, and copper.

Industry is based mainly on raw materials produced within the country (wood, fish, oil, etc.) and is aided by great resources of hydroelectric power. The most important manufactures in order of value are food canning, transport equipment, pulp and paper, machinery and equipment, wood, metal products, petroleum (crude and refined), printing, and publishing.

Languages

Norwegian is the official language. There are small areas of Lapp and Finnish-speaking minorities.

Navigational Information

The maritime territorial claims of Norway are, as follows:

Territorial Sea	12 miles.
Contiguous Zone	12 miles.
Fisheries or Economic Zone	200 miles.
Continental Shelf	200 miles or the Continental Margin.

Offshore Islands

Jan Mayen

Jan Mayen is a bleak, desolate, and mountainous island lying 300 miles NNE of Iceland. It is formed of volcanic origin and is partly covered by glaciers. The total area of the island is 380 sq. km. Beerenberg, its tallest peak, attains a height of 2,277m.

Volcanic activity had been dormant, but reactivated in September 1970. The island was possibly discovered in 1608. It was rediscovered time and again and renamed. Its present name derives from the Dutch whaling captain Jan Jacobszoon May, who indisputably discovered the island in 1614. It was uninhabited, but occasionally visited by seal hunters and trappers until 1921, when Norway established a radio and meteorological station.

On 8 May 1929, Jan Mayen was officially proclaimed and was incorporated in the Kingdom of Norway. Its relation to Norway was finally settled by law on 27 February 1930.



Jan Mayen

Svalbard

Svalbard is an archipelago located between 10˚ and 35˚E and between 74˚ and 81˚N. The main islands are Spitsbergen, Nordaustlandet, Edgeoya, Barentsoya, Prins Karls Forland, Bjornoya, Hopen, Kong Karls Land, and Kvitoya. The Arctic climate is tempered by mild winds from the Atlantic. The archipelago was probably discovered by Norsemen in 1194 and rediscovered by the Dutch navigator Barents in 1596. In the 17th century, whale-hunting gave rise to rival Dutch, British, and Danish-Norwegian claims to sovereignty. In the 18th century the whale-hunting ended, and the issue of the sovereignty of Svalbard lost its significance, but was again raised in the 20th century with the discovery and exploitation of coal fields.



Svalbard

A treaty was signed on 9 February 1920 in Paris recognizing Norway's sovereignty over the archipelago. On 14 August 1925, the archipelago was officially incorporated in Norway. There are two Norwegian and two Russian mining camps. There are research and radio stations, and an airport near Longyearbyen (Svalbard Lufthavn).

Spitsbergen Bank, with Bjornoya located near its S end, has depths of less than 200m extending from 30 miles S of the island for 225 miles to the NNE; fishing vessels are engaged on the bank, fishing for cod and shark.

Except in the vicinity of Bjornoya, the bank has not been completely surveyed. At a distance of 50 miles NE and 43 miles N of the island, depths of 22 and 18m have been recorded. Depths of less than 37m lie in the area between and around those two soundings.

Pilotage

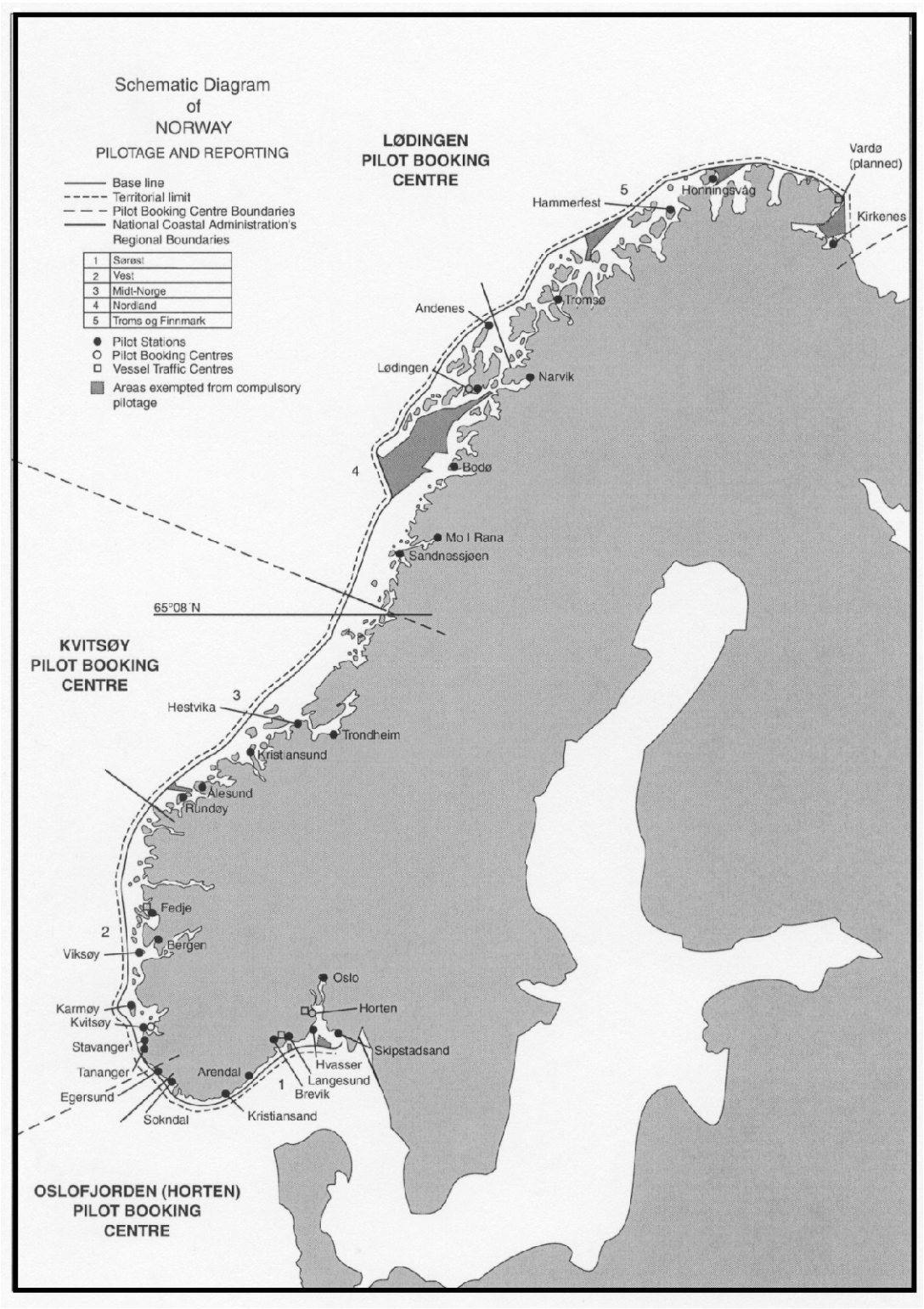
Pilotage regulations apply, with minor exemptions, to all coastal waters within the baseline The baseline consists of a straight line drawn from one outermost point to the next along the entire Norwegian coast.

State Pilotage is controlled by the Ministry of Fisheries. Although pilotage is a function of State Pilots (Statslos), certain vessels are allowed to use company employed "line" pilots (rutelos).

Pilotage procedures are, as follows:

1. Pilotage is compulsory for the following:
   a. Vessels over 500 gross tons, as stated in the vessel's international certificate of registered tonnage pursuant to the 1969 International Convention on Tonnage Measurement.
   b. Vessels pushing or towing one or more objects exceeding a total length of 50m.
   c. Vessels, irrespective of size, carrying particularly hazardous and/or polluting bulk cargo.
   d. Vessels over 100 gross tons, with a single bottom, and vessels exceeding 300 gross tons, with a double bottom, that are carrying hazardous and/or polluting cargo.
   e. Nuclear-powered vessels.
   f. Vessels with a maximum length of 24m or more, not holding a valid international certificate of registered tonnage pursuant to the 1969 Convention on Tonnage Measurement.

2. Vessels should send requests for pilots 24 hours prior to arrival to the appropriate Pilot Booking Center, all of which operate 24 hours, as described in the accompanying table. Requests should include:
   a. Vessel name.
   b. Call sign.
   c. Nationality.
   d. LOA, beam, and grt.
   e. Draft.
   f. Nature of cargo.
   g. Destination.
   h. Purpose of call.
   i. ETA at pilot boarding area, or ETD from harbor.
   j. Whether one or two pilots are required.
   k. Vessel's IMO number (if any).
   l. Crew and passengers (Master's name and nationality, size of crew, etc.).
   m. Cargo and bunker fuel (UN number and quantity of hazardous or polluting cargo, type and quantity of bunker fuel, etc.).
   n. Details of passage (last port of call, next port of call, etc.).
   o. Details related to pilotage requests and pilotage exemption certificates (PECs).
   p. Agent or Operator (the Norwegian contact).
   q. Shipping company (name and address).
3. Duty pilots are located at all pilot offices and undertake outward pilotage, through (transit) pilotage, and coastal pilotage.
4. Inquiries about compulsory pilotage, pilotage exemption certificates (PEC), pilotage service dues, and transitional arrangements should be sent to the appropriate Pilot Booking Center.
5. Indreleia (Coastal Fairways).—Pilotage is compulsory. Vessels should send requests for pilots 24 hours in advance to the appropriate Pilot Booking Center stating the following:
   a. ETA.
   b. Draft.
   c. GRT.
   d. Destination.
   e. How far pilotage is required.
6. Pilots may be contacted on VHF channel 16.
7. Between June 15 and August 20, a pleasure craft escort service is available and can be arranged through the Lifeboat



Norway—Pilotage and Reporting

Service by telephone or VHF. Emergency situations and assistance to distressed vessels can affect the lifeboats ability to meet its escort service commitments. Thick fog and bad weather can also be a hindrance. For information on the escort service, weather conditions, requests for assistance, contact the Lifeboat Service on VHF channel 16.

Norway—Pilot Booking Centers

Center	Area	Telephone	Facsimile	E-mail	VHF channel
Lodingen	West coast of Norway N of 65˚08'N to the Finnish border	+47-76-986810	+47-76-986820	losformidl.nordland@kystverket.no	13
Kvitsoy	West coast of Norway S of 65˚08'N to W of Egersund	+47-51-735397 +47-51-735398	+47-51-735391	losformidling.rogaland@kystverket.no	13
Oslofjorden (Horten)	South coast of Norway from W of Egersund to the Swedish border	+47-33-034970	+47-33-034999	losformidl.oslofjord@kystverket.no	13

Pollution

Vessels navigating in Norwegian coastal waters are requested to send pollution reports to Stavenger Area Control Center through any Norwegian coast radio station. Stavenger Area Control Center may also be contacted directly, as follows:

1. Surface mail: SFT
P.O. Box 125
N-3191
Horten, Norway
2. Fax: +47-33-034949
3. E-mail otto-martin.froyvedt@sft.telemax.no

Regulations

Entry Regulations

See Appendix I, Appendix II, and Appendix III for details of regulations concerning the entry into and passage through Norwegian Territorial Waters in peacetime of foreign non-military vessels. Vessels should contact the appropriate naval operations center for permission to enter Norwegian waters and when passing specified reporting points in the fairway. All notifications in connection with entry and sailing in Norwegian Territorial Waters are to be routed through a Norwegian Coast Radio Station who will distribute the information to the appropriate Norwegian authorities.

Regulations for Norwegian Internal Waters

The following regulations apply to internal Norwegian waters and differ from the rules in the International Regulations for Preventing Collisions at Sea (1972):

1. A vessel towing floating timber, oil containers, plastic hoses, etc. carries a white lantern with an additional white lantern for every 100m of tow, or, by day, a black flag or rectangular black shape.

2. **Marking of Objects Other Than Vessels.—**Dracons, herring and fish locknets, etc., lying wholly or partly submerged and under tow shall have a raft or float in tow. To mark the after end of the tow, the raft or the float shall exhibit an all around white light or a diamond shape.

Power cables and similar constructions being kept afloat by means of floats, etc., and which while being extended across waters, may result in blocking or restrictions of the general traffic, shall be marked by lights prescribed in Rule 24(g). The floats shall be light reflective.

3. Dredges show the lights and shapes prescribed by the International Regulations except that only one shape is displayed by day. In fog, the sound signal for a vessel at anchor is followed by:

a. At least six single strokes of the bell if the dredge is to be passed as if it were a red spar buoy.

b. At least six double strokes of the bell if the dredge is to be passed as if it were a green spar buoy.

4. **Patrol Vessels—Channel Closure.—**A vessel patrolling for the purpose of warning approaching shipping of the temporary closure or restriction of a channel will show:

a. By day—International flag U.

b. By night—one green light above two red lights disposed vertically.

c. The vessel may transmit the letter U (..-) in the Morse code by light or signal.

5. **Bend in Channel.—**A power-driven vessel approaching a bend in the channel must sound a 10 second blast when 0.5 mile short of the bend. On hearing this signal a meeting vessel must wait.

6. **Narrow Passage.—**A power driven-vessel approaching a passage so narrow that meeting vessels cannot pass must sound at least 5 short blasts. On hearing this signal a meeting vessel must wait.

7. **Speed Limits.—**Speed is limited to 5 knots when less than 100m from the shore, boat harbors, anchored boats, etc.

and within 50m of bathing places. Public bathing places are marked by buoys (orange with orange spherical topmark) and passing inside these is prohibited.

8. Cable ferries or chain ferries carry a ball and three red lights, disposed in a triangle apex up.

Lights for Large Vessels at Anchor

Vessels 92m in length and above when at anchor in Norwegian inland waters, shall in addition to the anchor lights show one white light screened to show from right ahead to right astern, on each side of the vessel midway between the forward and after anchor lights, at such a height that all three lights are in a straight line, decreasing in height toward the stern.

Lifeboat Drills

Lifeboat drills involving the lowering of boats is not permitted when vessels are underway in Norwegian territorial waters. Harbor drills are allowed with local police permission.

Seaplane Harbors

The following information has been extracted from the regulations:

1. The alighting and taking-off of aircraft must in no way be impeded or endangered.
2. No vessel shall pass within 50m of any moored or stationary aircraft, and must pass at such reduced speed that no damage may be caused by wash.
3. All vessels in the vicinity of alighting or taking-off areas shall keep a sharp lookout for a patrol boat and promptly obey any order received from such boat.
4. When seaplanes are operating, a black and yellow checkered flag or ball will be displayed ashore at the administrative buildings, and a patrol boat will be on duty; this signal indicates that the flying area is closed to shipping. During this period, vessels and small craft should not approach the patrol boat within a distance of 200m, even if they are outside the operating area.

The patrol boat is easily recognizable by its black and yellow checkered hull; it displays a flag or ball with similar colors and may call the attention of a vessel by siren or green and red visual signals and, at night, by flares.

Light signals shown by the patrol boat are, as follows:

Signal	Meaning
Fixed red	Stop immediately and wait.
Flashing red	You are in a prohibited area; proceed clear on reverse course, or in the direction indicated by visual signals.
Fixed green	All clear, continue on your course.
Flashing green	The area is clear and open to shipping.

During the part of the year when flying operations take place, a number of notice boards are established within the seaplane harbors, in such a position as to be easily visible to all craft underway within the limits of the operating area.

The notice boards warn vessels to reduce speed and to follow the instructions of the patrol boat and are inscribed.

Dangerous and Polluting Cargo

Regulations are in force requiring vessels carrying dangerous or polluting cargo to submit departure and arrival reports and to complete a checklist. Departure reports are made prior to leaving port. Arrival reports are made by vessels arriving from countries other than Iceland or countries in the EEC.

The regulations, forms, and checklists are available from the Norwegian Coast Directorate, as follows:

1. Via the Internet at http://www.kystdir.no
2. Via surface mail from:
   Kystverket/HAZMAT
   Moleveien 7
   3187 Horten
   Norway
3. Via facsimile at 47-33-034680

Local Speed Restrictions

When a vessel carrying a red ball in the rigging is lying moored at any of the lighted structures, or is loading or discharging gas containers at any piers or jetties, powered vessels passing must not proceed at a greater speed than 5 knots for a distance of 100m on either side of the moored vessel.

Routes

Jan Mayen

The choice of selecting a preferred route results from examination of the charts and of the surface temperature of Greenland and Norwegian Seas. Sea ice usually affects the island from mid-November to mid-April, but in severe seasons from late October to early August, if not continuously. It is generally best to approach Jan Mayen from the SE.

From the North Sea a course may be shaped N, or a little W of N, so as to keep in temperate waters for as long as possible. When Beerenberg (71˚06'N., 8˚10'W.) bears NW, steer for it.

From Iceland, steer E until out of the East Greenland Current, then turn, keeping in waters of a temperature of over 4˚C.

From the coast of Norway, a direct course may be set without passing N of 71˚N.

Spitsbergen

If a vessel is bound for Bellsund (77˚35'N., 1˚00'E.) or Isfjorden, 30 miles farther N, shape course for the S extremity of Prins Karls Forland, passing about 40 miles W of Bjornoya (74˚27'N., 19˚00'E.).

When vessels are bound for Kongsfjorden, the ice will usually be cleared by passing outside Prins Karls Forland, except from December to May. In early summer the drift ice may be encountered near the latitude of Bjornoya; always alter course W to clear it. Keep W of the ice, a careful lookout from the aloft for ice-blink may save time, as wide and deep bights in the ice leading towards the land often afford no access to it. Bellsund or Isfjorden may be approached from abreast their entrances, but allow for a N current of about 2 knots. If the

entrances are obstructed by ice it may be possible, in calm weather, to enter by a lane but great caution is required. A sudden wind may arise, close the lane, and nip the vessel. Many vessels have been beset or have damaged their propellers under these conditions.

Search and Rescue

The Norwegian Rescue Services for sea, air, and land are regarded as one organization under the common heading of life-saving service. The sea rescue service combines a number of public and private institutions, coordinated through the police, who have general responsibility and authority for the saving of lives. Among these institutions are the pilotage, light, and harbor authorities; civil defense and fishery organizations; and the Norwegian Lifeboat Society (Norwegian Society for Rescue of Shipwrecked Mariners). The Norwegian Naval Defense Force has vessels in readiness for distress calls at all times.

The Norwegian Lifeboat Society operates a fleet of over 30 rescue vessels of various sizes and a chain of rescue stations along the coast. The vessels have an operational radius of 400 to 5,000 miles and are fitted with VHF, SSB, and mobile telephone communications. The vessels have white hulls, with a wide red band along the deck, and a red Maltese cross in a blue ring on the bow. About 20 of the rescue stations are operated year round, with the remaining stations operating during the fishing and pleasure-boating season.

Norwegian Chart Q6356 shows the location of coastguard stations, lifeboat stations, coast radio stations, and other details of the search and rescue organization in British and North European waters.

A fleet of about 50 vessels is run by the pilotage authority; many of these vessels operate within a radius of 175 to 360 miles. Vessels are equipped for rescue missions. Many shore pilot stations maintain a listening watch on VHF channel 16.

Other vessels, such as those used for harbor works and buoy maintenance, as well as fishing vessels and merchant vessels, can be called upon for rescue service.

The Norwegian Air Force has ten Sea King helicopters, with an operating radius of 220 miles, available for search and rescue duty. The helicopters are based at Stavanger (Sola), Vigra, Orlandet, Bodo, and Banak. Long-range transport and maritime aircraft can be called on for more extensive searches and for the dropping of rescue equipment.

A civilian helicopter, with a range of 150 miles, is based at Svalbard.

The Joint Rescue Coordination Centers (JRCC) are located, as follows:

1. SSR South Norway (Stavanger)—South of 65˚N.
2. SSR North Norway (Bodo)—North of 65˚N.

These centers receive all distress calls and assign the appropriate local rescue center to each incident. The JRCCs can be contacted by e-mail, as follows:

1. JRCC Stavanger: post@jrcc-stavanger.no
2. JRCC Bodo: mailto@jrcc-bodoe.no

Submarine Operating Areas

Norwegian submarines may be met underway on the surface, at night, in channels within the skerries. At night, they show an amber quick flashing light showing about 90 flashes every minute.

Submarines which are entirely submerged or showing only their periscopes are required to keep clear of all surface vessels. Surface vessels must keep a sharp lookout and exercise caution.

Tides

At Jan Mayen and Bjornoya, the tidal range is about 1.1m. In Svalbard, the tidal range varies between l and 1.5m.

Time Zone

The Time Zone description, including Jan Mayen and Svalbard, is ALFA (-1). Daylight Savings Time (BRAVO (-2)) is maintained from the last Sunday in March until the Saturday before the last Sunday in October.

U.S. Embassy

The U.S. Embassy is situated at Drammensveien 18, Oslo. The mailing addresses are, as follows:

1. Norway address—
   Drammensveien 18
   0244 Oslo
2. U. S. address—
   PSC 69, Box 1000
   APO AE 09707

U. S. Embassy Norway Home Page
http://www.usa.no

Vessel Traffic Service

Oil Fields and Installations Surveillance Service

Statoil Traffic Control performs a radar surveillance service for the oil fields and installations listed in the table below. All vessels passing within 3 miles or less of these installations must contact Statoil Traffic Control at least 1 hour prior to doing so, using the VHF channel listed in the table below.

Vessels must state their name and call sign. In order to take into account maritime operations and safe navigation, vessels may be asked to alter course.

Oil field/ installation	Position	VHF channel
Heidrun	65˚19.5'N, 7˚19.0'E	9
Asgard A	65˚03.5'N, 6˚43.4'E	6
Asgard B	65˚06.6'N, 6˚47.4'E	6
Asgard C	65˚07.8'N, 6˚51.9'E	6
Visund	61˚22.2'N, 2˚27.4'E	10
Snorre B	61˚31.5'N, 2˚12.5'E	10
Statfjord A	61˚15.3'N, 1˚51.1'E	9
Statfjord B	61˚12.4'N, 1˚49.8'E	9
Statfjord C	61˚17.8'N, 1˚54.0'E	9

Oil field/ installation	Position	VHF channel
OLS A	61˚15.3'N, 1˚51.1'E	9
OLS B	61˚13.4'N, 1˚50.1'E	9
SPMC	61˚16.8'N, 1˚52.9'E	9
Gullfaks A	61˚10.6'N, 2˚11.3'E	9
Gullfaks B	61˚12.2'N, 2˚12.1'E	9
Gullfaks C	61˚12.9'N, 2˚16.3'E	9
SPM 1	61˚11.5'N, 2˚09.1'E	9
SPM 2	61˚10.0'N, 2˚13.7'E	9
Kvitebjorn	61˚04.8'N, 2˚30.1'E	9
Huldra	61˚51.3'N, 2˚39.1'E	71
Veslefrikk A/B	60˚47.0'N, 2˚54.0'E	71
Troll A	60˚38.7'N, 3˚43.7'E	68
Troll B	60˚46.0'N, 3˚30.0'E	10
Troll C	60˚53.0'N, 3˚36.0'E	10
Oseberg East	60˚42.0'N, 2˚56.1'E	10
Oseberg C	60˚36.0'N, 2˚46.0'E	10
Oseberg Feltsenter	60˚29.0'N, 2˚49.0'E	10
Oseberg South	60˚23.5'N, 2˚47.7'E	10
Brage	60˚32.0'N, 3˚03.0'E	10
Grane	59˚09.9'N, 2˚29.1'E	15
Sleipner A	58˚22.0'N, 1˚54.3'E	14
Sleipner B	58˚25.0'N, 1˚42.9'E	14
Draupner	58˚11.0'N, 2˚28.0'E	17

This service may also be contacted via e-mail, as follows:

smarin@ statoil.com

Traffic Reporting—Entry into or passage through Norwegian Territorial Waters (NTW)

The following definitions apply to this section:

1. Baseline—Straight lines joining the outermost points of the entire coast of Norway.
2. Norwegian Internal Waters (NIW)—All waters inside the baseline.
3. Norwegian Territorial Waters (NTW)—All waters within the territorial limits of Norway extending 4 miles seaward from the baseline.

All foreign non-military vessels are to keep Norwegian Authorities informed when sailing in Norwegian Territorial Waters (NTW). This is to be done by sending an Arrival Notification and a Reporting Point Notification through the nearest Norwegian Coast Radio Station (CRS), or directly to the Norwegian Authorities, as follows:

1. For vessels in positions N of 65˚N:
   Regional Headquarters North
   Surveillance Center
   N-8002 Bodo
   Norway
   Telephone: +47-75-536886
   Fax: +47-75-536354
   E-mail: Idkncos@comnon.mil.no
2. For vessels in positions S of 65˚N:
   National Joint Headquarters
   Naval Operations Center
   N-4068 Stavanger
   Norway
   Telephone: +47-51-343815
   Fax: +47-51-343819
   E-mail: south@coss.mil.no

Arrival Notification.—The Arrival Notification should be sent at least 24 hours in advance of entering Norwegian Internal Waters (NIW). In need for dispensation to enter NIW earlier than 24 hours, vessels should contact the Norwegian Authorities through a CRS or by telephone at the above numbers. Messages without a valid AAIC will not be accepted by a CRS.

The Arrival Notification shall contain the following:

1. Vessel name.
2. Call sign.
3. AAIC (Accounting Authority Identification Code).
4. IMO identity.
5. MMSI number.
6. Flag (nationality).
7. Type of vessel.
8. Type, quantity, and UN number of cargo.
9. LOA (feet or meters), beam (feet or meters), draft (feet or meters), and tonnage (gross tons).
10. Last port/place before entering NTW.
11. Next port after leaving NTW.
12. Date, time (UTC), and position on entering Norwegian baseline.
13. Date, time (UTC), and position on leaving Norwegian baseline.
14. Port (name, ETA, ETD, and purpose).
15. Norwegian agent's name, address, and telephone.
16. Vessel's communication numbers (INMARSAT or telephone).
17. Master's name and nationality.

Vessels calling at more than one port of call within Norwegian Territorial Waters should repeat the above details of 14 and 15 for the additional ports.

If changes of more than 4 hours to the ETA/ETD given in the original Advance Notification occur, an updated Arrival Notification shall be sent to the Norwegian authorities as soon as possible.

Reporting Point Notification.—This should be sent when crossing the Norwegian baseline upon entering and leaving NIW, and when passing the Reporting Points, listed below. Reporting Point Notifications without a valid AAIC will not be accepted by a CRS.

The Reporting Point Notification shall contain the following:

1. Vessel name.
2. Call sign.
3. AAIC (Accounting Authority Identification Code).
4. IMO identity.
5. MMSI number.

6. Flag (nationality).
7. Current position (latitude/longitude).
8. Destination.
9. Master's name and nationality.

Reporting Points		
No.	**Name**	**Reporting Line**
1	Kvitsoy	Latitude 59˚05'N
2	Stad	Latitude 62˚10'N
3	Rorvik	Latitude 64˚52'N
4	Landegode	Latitude 67˚27'N
5	Tromso	Latitude 69˚41'N
6	Honningsvag	Longitude 26˚00'E

Reporting Points		
No.	**Name**	**Reporting Line**
	Passing the baseline	When entering or leaving NTW

Stopping or anchoring.—Stopping or anchoring by vessels passing through NTW is only permitted, as follows:

1. Actions incidental to ordinary navigation.
2. Force majeure.
3. Distress.
4. Assisting persons, ships, or aircraft in danger or distress.

If a vessel makes a temporary stop or remains stationary, the Norwegian Authorities must be notified.

Appendix I

LAWS AND REGULATIONS APPERTAINING TO NAVIGATION

Regulations concerning foreign non-military vessels entering and making passage through Norwegian territorial waters in peacetime.—Laid down by Royal Decree and put forward by Ministry of Defense.

Introductory Provisions

Section 1.—These regulations only apply when Norway and the State whose flag the vessel is entitled to fly are at peace, or until contingency measures have been implemented.

Section 2.—The regulations do not apply to Norwegian territorial waters off Svalbard, Jan Mayen or dependencies unless otherwise prescribed by statute.

Section 3.—For the purpose of these regulations, foreign, non-military vessel means any foreign vessel, or Norwegian vessel the master of which is a foreign national, to which current Norwegian regulations concerning the admission of foreign warships and military aircraft to Norwegian territorial waters in peacetime do not apply.

In these regulations, foreign, non-military vessel also means equipment belonging to the vessel (lifeboats, landing craft, aircraft, etc.).

Section 4.—Nuclear-powered vessels are subject to special licensing pursuant to section 4 of Act No. 28 of 12 May 1972. Vessels carrying nuclear substances are required to hold a permit pursuant to section 5 of the said Act.

Section 5.—Sections 13, 15 and 16 of these regulations apply subject to any restrictions established by agreements with foreign States.

Section 6.—Pleasure craft carrying foreign nationals who are required to hold a visa shall be subject to the regulations concerning the admission of foreigners to the Kingdom and their stay there pursuant to sections 83 and 111 of the Crown Prince Regent's Decree of 21 December 1990.

Pleasure craft over 24m in length or 50 grt shall use prescribed sea lanes and are required to give notification pursuant to section 17 and may be ordered to report pursuant to section 19.

Pleasure craft are otherwise exempted from the restrictions set out in sections 16, 17, 18, and 19.

Section 7.—Norwegian territorial waters and sea limits:

(a) For the purpose of these regulations, baselines means straight lines drawn between the base points.

(b) For the purpose of these regulations, Norwegian territorial waters means all waters within the territorial limit.

(c) For the purpose of these regulations, internal waters means all waters that lie within the baselines.

(d) For the purpose of these regulations, the territorial sea means the waters between the baselines and the territorial limit.

Section 8.—Responsibility of the shipmaster.—Masters of all foreign, non-military vessels are required to familiarize themselves with the substance of these regulations before entering Norwegian territorial waters.

Section 9.—Norwegian authorities.—For the purpose of these regulations, the Norwegian authorities means the Ministry of Defense or whosoever the Ministry so authorizes. All inquiries, notifications, reports, applications for clearance etc, to the Norwegian authorities shall be directed to Headquarters Defense Command North Norway (Hq DEFCOMNON) for vessels in positions north of 65˚N and to Headquarters Defense Command South Norway (Hq DEFCOMSONOR) for vessels in positions south of 65˚N and shall be submitted in Norwegian, Danish, Swedish or English.

Section 10.—Innocent passage through the territorial sea.—Innocent passage through the territorial sea is permitted for foreign, non-military vessels. Innocent passage means navigation through the territorial sea, either in transit or for the purpose of proceeding to or from Norwegian internal waters or ports. Stopping or anchoring while passing through the territorial sea is only permitted when such action is incidental to ordinary navigation or is rendered necessary by force majeure or distress or for the purpose of rendering assistance to persons, ships or aircraft which are in danger of distress.

Section 11.—Any vessel in innocent passage through the territorial sea which for reasons set forth in section 10, second paragraph, must make a temporary stop or remain stationary or enter Norwegian internal waters or call at a Norwegian port facility, shall notify the Norwegian authorities without undue delay.

Section 12.—Admission of foreign, non-military vessels to Norwegian internal waters.—Foreign, non-military vessels to which the list in section 13 does not apply may, subject to the restrictions set out in section 16, enter Norwegian internal waters without obtaining written permission in advance. Foreign, non-military vessels maybe refused admission to Norwegian internal waters when special grounds make this necessary. Such special grounds exist when inter alia fishing vessels plan to enter these waters in connection with fishing or bringing ashore a catch as set out in section 8, first paragraph, of Act No. 19 of 17 June 1966.

Section 13.—Admission to Norwegian internal waters is permitted for the following foreign, non-military vessels only when written permission has been granted in advance by the Norwegian authorities:

(a) Research vessels.
(b) Seismic vessels and other vessels carrying equipment used for surveying and charting the sea bed.
(c) Factory ships, repair ships and expedition vessels.
(d) Vessels for special purposes, including floating and mobile oil platforms, tugboats, dredges, icebreakers and floating cranes, unless entry into Norwegian internal waters is necessary due to a binding agreement with a Norwegian company which requires the vessel to call at a Norwegian port facility.
(e) Non-military government ships and stand-by and support vessels for naval units.
(f) Vessels specified in section 4 of these regulations.
(g) Vessels carrying aircraft.

In cases of doubt, the Norwegian authorities will decide whether a foreign, non-military vessel is subject to this provision.

Section 14.—The vessels specified in section 13 b, c, d and g may be granted admission into Norwegian internal waters without a prior written application in order to be repaired or laid up in a Norwegian port provided a binding agreement with a Norwegian company exists. In such cases, deviations may be made from the deadlines referred to in section 15. The Norwegian authorities shall be notified of such admission as soon as possible. Foreign, non-military vessels which are obliged to seek a port of refuge for the reasons specified in section 10, second paragraph, may enter Norwegian internal waters without a prior written application.

Section 15.—A written application for permission to enter Norwegian internal waters under section 13 a, b, c, d, e and g shall have reached the Norwegian authorities at the latest 7 days before entry is expected to take place. Applications under section 13 f shall have reached the Norwegian authorities at the latest 14 days before entry is expected to take place. All applications shall contain the information specified in section 17 and any other information deemed to be of importance in connection with the planned entry. Not withstanding these regulations, the Norwegian authorities may require information from foreign, non-military vessels which is considered to be of relevance to the planned entry, including information about catches carried on board and, if the catch is to be delivered in Norway, fishing activities within Norwegian fishery jurisdiction in which the vessel has been engaged.

Section 16.—Entry, passage and notification requirement when navigating through Norwegian internal waters.—For foreign, non-military vessels, entry into and passage through Norwegian internal waters is restricted to the following activities:

(a) Navigation to and from Norwegian ports in connection with loading, unloading, restocking, bunkering, carrying out necessary repairs or carrying out binding agreements with Norwegian interests. Laytime in a Norwegian port shall be limited to the necessary length of time as dictated by the purpose of the call at the port.
(b) Navigation in transit via specified sea lanes when the vessel's mission makes this necessary.
(c) Navigation in order to seek a port of refuge. Stopping or anchoring while passing through internal waters is only permitted when such action is incidental to ordinary navigation or is rendered necessary by force majeure or distress or for the purpose of rendering assistance to persons, ships or aircraft which are in danger or distress. If the vessel makes a temporary stop or remains stationary, the Norwegian authorities shall be notified without undue delay.

Section 17.—Masters of all foreign, non-military vessels over 24 meters in length or 50 gross tons who intend to navigate their vessel into Norwegian internal waters are required to give notification of such entry and shall notify the Norwegian authorities at the latest 24 hours in advance. Such notification may be made in written or oral form and shall contain:
(a) Vessel's IMO identification number, if any.
(b) Vessel's nationality, name, international radio call sign (distinctive letters) and any mobile or satellite telephone numbers.
(c) Type of vessel, cargo, draft and size in gross tons.
(d) Purpose of the entry including any information about the entry as specified in section 14 of these regulations.
(e) Specification in latitude and longitude of the point where the vessel intends to cross the Norwegian baseline when entering and leaving.
(f) Intended ports of-call with specification of times of arrival and departure.
(g) Norwegian contact (agent, operator, ship owner, etc).
(h) The Norwegian authorities shall be informed without delay of any changes in the submitted plan of navigation.

Passenger and car ferries in regular service to and from Norwegian ports are excepted from the notification requirement provided an approved navigation plan has been forwarded to the Norwegian authorities at the latest 14 days before the service is put into operation. The Norwegian authorities are to be informed if the navigation plan is withdrawn or if major changes are introduced.

The vessels specified in section 13 are required to give notification as described above irrespective of their length or size.

Section 18.—Sea Lanes and Reporting Points in Norwegian internal waters.—When navigating through Norwegian internal waters, foreign non-military vessels shall only use those sea lanes prescribed by the Ministry of Defense.

Section 19.—Foreign, non-military vessels shall report to the Norwegian authorities when entering and leaving Norwegian internal waters and when passing specified geographical positions in the sea lane. Such reports shall include the vessel's name, call-sign, destination and estimated time of passing the next report point or of arrival at the vessel's next port of call. The report points are determined by the Ministry of Defense.

Section 20.—Foreign, non-military vessels which are obliged to enter Norwegian internal waters due to force majeure or distress or to provide assistance to persons, ships or aircraft that are in danger are excepted from the above provisions concerning the requirement to report and the use of sea lanes. Such vessels shall nevertheless and by the fastest possible means contact the Norwegian authorities for specific instructions regarding anchoring or continued navigation.

Section 21.—Vessels lying in Norwegian territorial waters.—No registrations or measurements other than those necessary for safe navigation are permitted without special permission from the Norwegian authorities.

Section 22.—It is prohibited for all persons on board foreign, non-military vessels to make maps or sketched maps of ports, waters, airfields or seaplane ports of the Kingdom. It is also prohibited to make maps, sketches of maps, take photographs or record descriptions of Norwegian military facilities or equipment.

Section 23.—Foreign, non-military vessels shall fly their national flag at all times while navigation through Norwegian territorial waters. When the vessel is at anchor or moored, the flag shall be hoisted during the day.

Section 24.—Officers on Norwegian warships or guard ships and other officers in the Norwegian Armed Forces may inspect any foreign, non-military vessel, including its documents, cargo, equipment and any persons on board. The master of the vessel under inspection shall provide any assistance necessary to facilitate the inspection, including placing the vessel's communications equipment at the disposal of the inspecting officers free of charge. The master shall provide on request any information which is of interest to the Norwegian authorities. He/she is under obligation to comply with instructions regarding the remainder of the voyage.

Section 25.—The master and crew of a foreign, non-military vessel shall comply with current Norwegian legislation including regulations concerning the environment, health, customs, use of pilot, traffic, ports, foreign nationals and rules of conduct. Norwegian regulations governing the use of communications equipment shall be complied with.

Section 26.—Should the master or crew of a foreign, non-military vessel fail to comply with the laws and regulations laid down for the presence and navigation of vessels in Norwegian territorial waters, the Norwegian authorities may order the vessel to leave Norwegian territorial waters immediately or within a specified, reasonable period of time. The vessel may also be brought to the nearest police authority to be charged and prosecuted.

Section 27.—Unless otherwise prescribed by statute, infringement of these regulations is punishable by fines or by imprisonment for a term not exceeding three months pursuant to section 418, subsection 2, of Act No. 10 of 22nd May 1902.

Section 28.—Concluding provisions.—The Ministry of Defense or whosoever the Ministry so authorizes may grant exemption from these regulations and may issue further provisions for the supplementation and implementation of these regulations.

Section 29.—These regulations enter into force on 1st May 1995.

Appendix II

REGULATIONS ON PRESCRIBED CHANNELS FOR FOREIGN NON-MILITARY VESSELS IN NORWEGIAN TERRITORIAL WATERS

Decreed by the Ministry of Defense 4 May 1995 in accordance with Royal Resolution of 23 December 1994 No. 1130 on foreign non-military vessels calling at and traveling in Norwegian territorial waters during peacetime

Prescribed Channels

1. Foreign non-military vessels shall follow prescribed channels which are summarized in the Coast Directorate's fairway system.

2. Foreign non-military vessels wishing to call at places which are not directly connected to the prescribed channels, shall follow prescribed channels as far as possible and then take the shortest safe channel in or out. Where a prescribed channel cannot be followed as in the previous sentence, a vessel shall cross the baseline at a point which allows the shortest safe channel in or out between the baseline and the port of call, and the vessel shall follow that channel.

3. Foreign non-military vessels which, after entering Norwegian internal waters, have a need to follow channels other than those described in paragraphs 1 and 2 above, can obtain special permission from the Norwegian authorities (i.e. Headquarters Defense Command North Norway/South Norway) to follow these channels as long as there is a state pilot on board. In areas regulated by traffic centers, the appropriate pilot master at the traffic center can give dispensation as necessary.

Reporting Points

4. When passing in or out of the Norwegian internal waters and when passing defined geographical points in channels, foreign non-military vessels shall report to the Norwegian authorities. The report shall contain the vessel's name, call sign, and the time for passing the next reporting point in a channel or the next harbor.

5. The reporting points are defined, as follows:

Headquarters Defense Command	
North Norway	Kvitsoy (Rogaland)
	Statt (More and Romsdal)
	Rorvik (Nord Trondelag)
South Norway	Landego (Nordland)
	Tromso (Troms)
	Honningsvag (Finnmark)

Appendix III

Norway—Economic Exploitation Zone

By act No. 91 of 17 December 1976 and Royal Decree of 17 December 1976, of which the following are extracts, the Norwegian authorities established, from 1 January 1977, an Economic Exploitation Zone, the outer limits of which are set at a distance of 200 nautical miles from the appropriate baselines but not so as to extend beyond the Continental Shelf Boundaries of other States.

The establishment of the Zone does not affect the rights of navigation through or flight over the waters in question.

Except as provided in agreements with other States and in regulations concerning fisheries, aliens may not engage in fishing or hunting within the Zone.

Regulations concerning the protection of the environment, scientific research, artificial installations and port facilities, cables and pipelines, and the exploitation of the Zone for any economic purpose, may be issued.

RUSSIA



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General

Russia is located in Northern Asia and borders the Arctic Ocean between Europe and the North Pacific Ocean.

The climate varies from steppes in the S to humid continental in much of the European part. The polar North has tundra and Siberia is subarctic. Winters are cool along the Black Sea to frigid in Siberia. The S shores of the Arctic Ocean are fringed by a belt of barren country, sometimes steep, rocky, and descending in more or less abrupt cliffs to the sea, but more often sloping down gently in mud banks and sand hills; this belt is known as the tundra.

The Ural Mountains extend approximately along the meridian of 60˚ E from the Arctic Ocean nearly to the Caspian Sea and roughly separate Russia in Europe from Siberia.

The Obdorsk or Northern Urals, which begin within a few miles of the head of Karskaya Guba (69˚18'N., 64˚59'E.) and extend SW as far as the 64th parallel, form a distinct range, stony and craggy, sloping steeply SE and gently towards the marshes of European Russia.

The major rivers flowing into the Arctic Ocean are the Ob, the Yenisey, the Pyasina, the Lena, the Yana, the Indigirka, and the Kolyma.

Passage along the rivers forms the principal access from the Arctic coast to the hinterland during the navigational season.

Buoyage System

IALA Maritime Buoyage System (Region A) is in effect. See Chart No. 1 for further IALA Buoyage System information.

Temporary markings indicating areas prohibited for navigation, anchoring and fishing, and naval exercise areas, will be broadcast by marine radio and published in the weekly notice.

Cautions

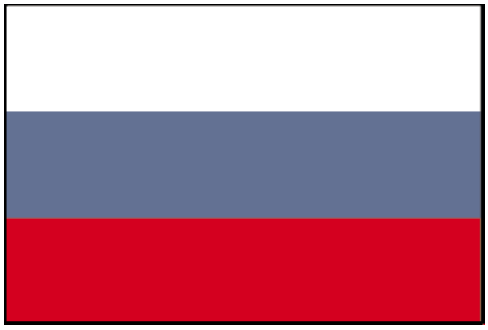
Protection zones have been established extending 100m on each side of all pipelines in Russian waters. Anchoring, trailing an anchor, trawling, dredging, or any operation which could endanger a pipeline is prohibited within these zones. The same restrictions apply within 0.25 mile on each side of the seabed cables.

Because of insufficient information, it is not possible to ensure that NGA charts and publications, covering the coasts of Russia and adjacent waters, are up to date concerning new dangers or changes to navigational aids or warnings and mariners are therefore cautioned to exercise additional care when navigating these waters.

Currency

The official currency is the ruble, consisting of 100 kopeks.

Government



Flag of Russia

Russia is a federation. The country is divided into 89 various administrative entities.

Russia is governed by a directly-elected President serving a maximum of two consecutive 4-year terms. The bicameral Federal Assembly is composed of the 178-member appointed Council of the Federation (upper chamber), serving 4-year terms, and the 450-member State Duma (lower chamber), of which 225 members are directly elected and 225 members are elected on the basis of proportional representation, serving 4-year terms.

The legal system is based on civil law.

The capital is Moscow.

Holidays

The following holidays are observed:

January 1	New Year's Day
January 7	Russian Orthodox Christmas
February 24	Defenders' Day
March 8	International Women's Day
May 1 and 2	Spring and Labor Holiday
May 9	Victory Day
June 12	Independence Day
August 22	Day of the Russian Federation State Flag
November 7	Day of Accord and Conciliation
December 12	Constitution Day

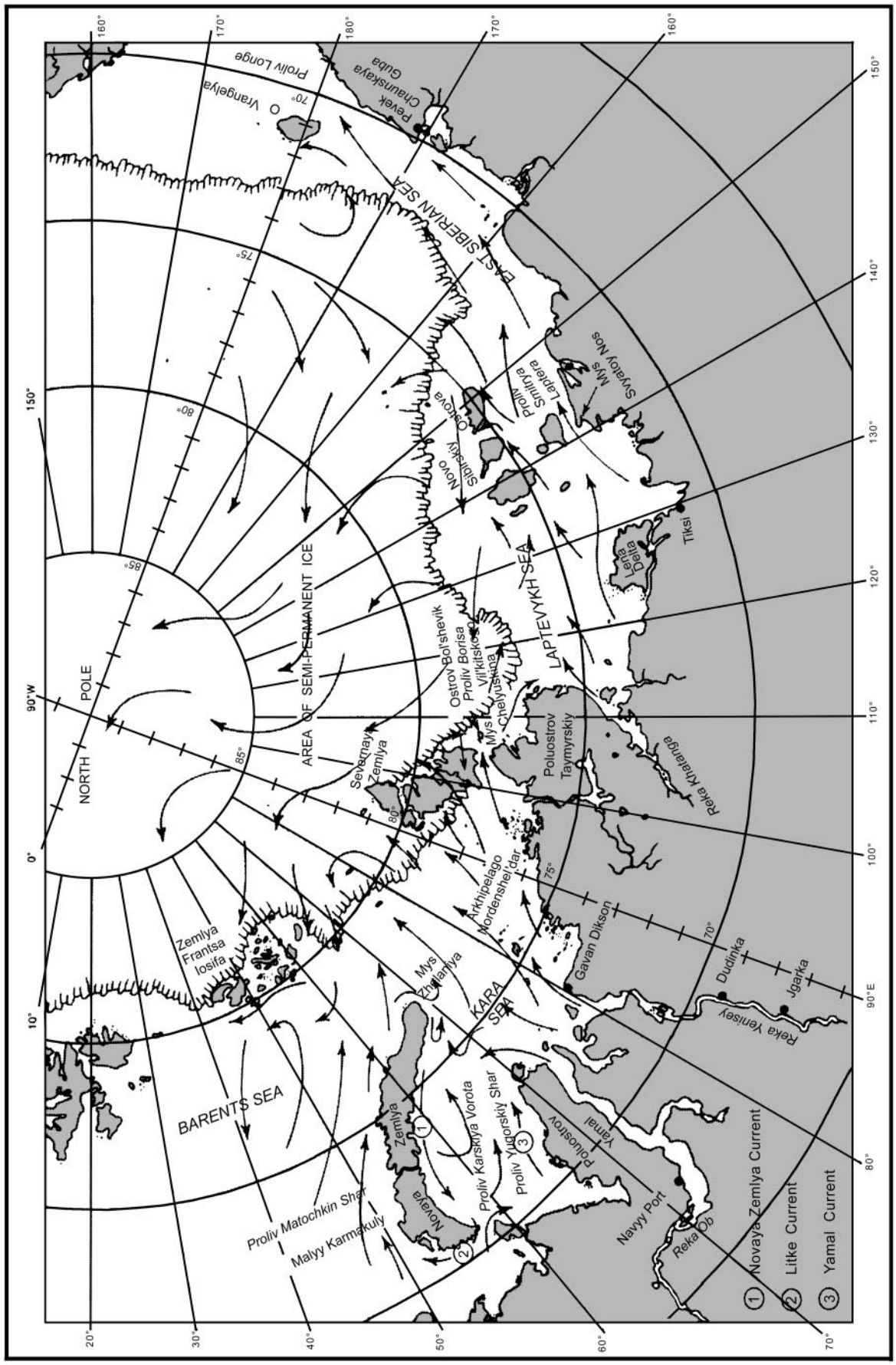
Ice

Icebreakers

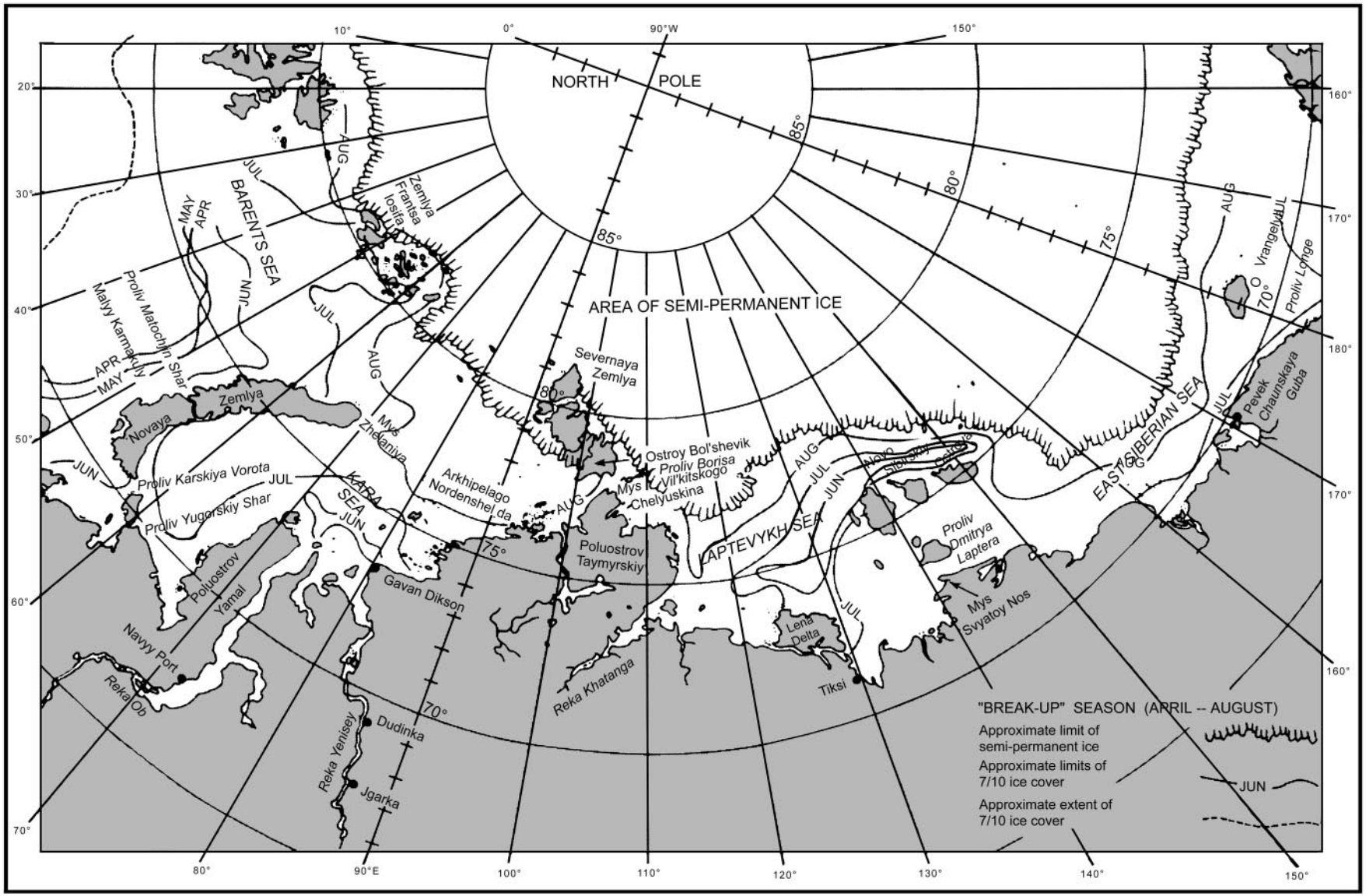
Russian icebreakers are maintained to assist vessels in the navigation of territorial waters during the ice season. The movements and positions of the icebreakers are reported daily by radio.

The following are extracts from Russian regulations concerning assistance from icebreakers:

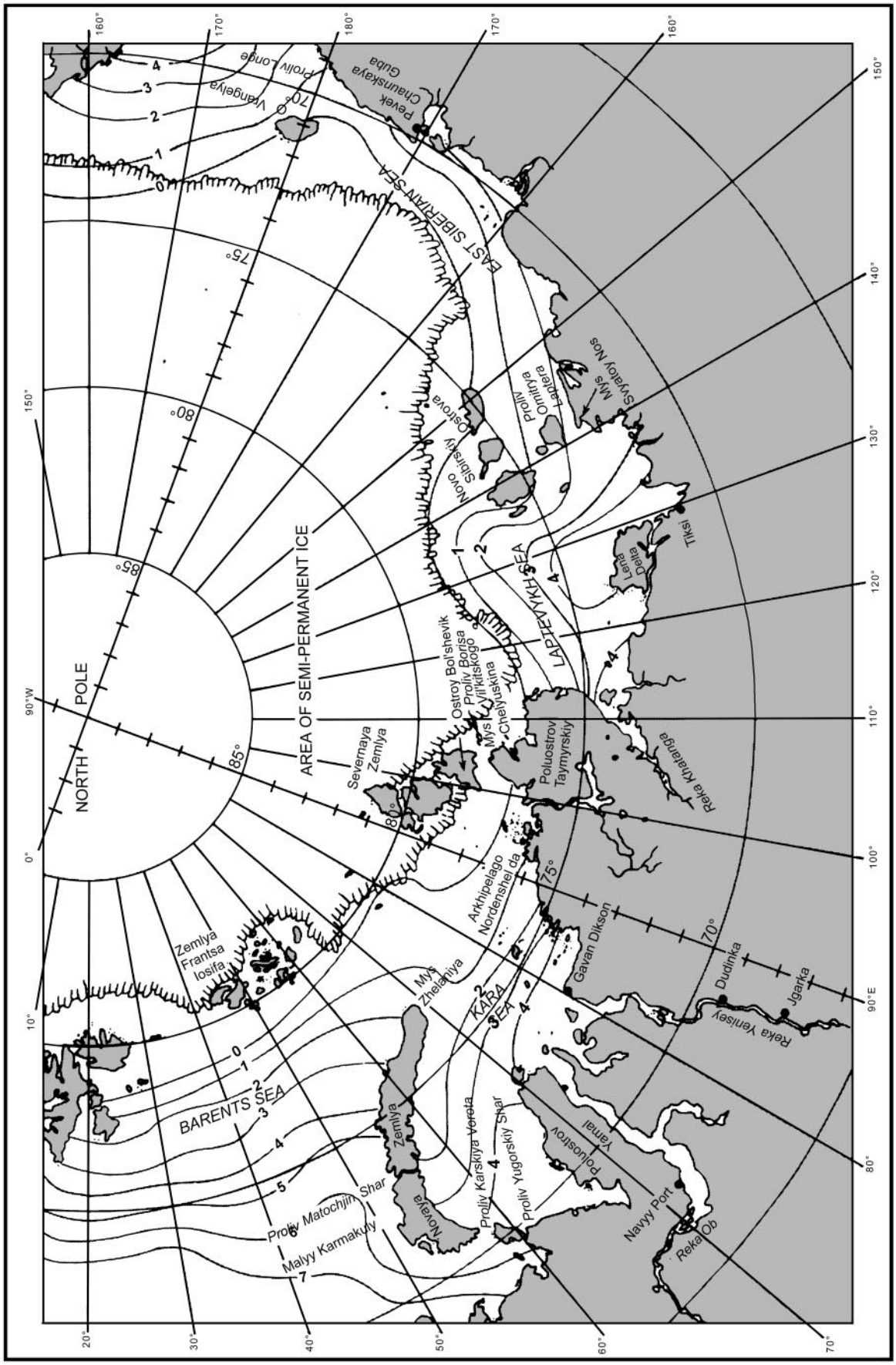
1. Requests for icebreakers to conduct vessels through ice must be made, in harbor, to the port director, and at sea to the master of the icebreaker.
2. Every vessel to be conducted must have on board sufficient fuel and provisions, timber, quick-setting cement, plaster, mats etc.; the ship's pumps and radio must also be in working order. If these conditions are not met and also if the vessel does not have valid certificates of seaworthiness, the port director or, if at sea, the master of the icebreaker, has the right to decline to assist the vessel.
3. Every vessel requiring the assistance of an icebreaker must await the arrival of the latter before entering the ice. The time, number and order of vessels following through the ice, or the time if only one vessel is going, is determined by the port director, or if at sea, by the master of the icebreaker.
4. Masters of vessels following an icebreaker through ice must act in accordance with the orders of the master of the icebreaker, with respect of their movements, to ensure the quickest and safest passage through the ice.
5. Vessels following an icebreaker may not overtake one another. The distance between ships must be maintained as accurately as possible.
6. Vessels following an icebreaker must be ready to go full speed astern immediately. When a vessel gathers sternway, the rudder must be set amidships.
7. Vessels being towed through ice must not use their engines for going ahead without a definite order from the master of the icebreaker. They must at all times be ready to cast off the tow on instructions from the master of the icebreaker, and also to go full speed astern.
8. The order of vessels to follow the icebreaker usually is warship, mail and/or passenger ships, cargo vessels with priority freight, and then the remaining vessels depending on their time of arrival at the ice edge, or readiness to leave harbor.
9. If a vessel in ice sustains damage or begins to leak, the master must immediately take measures to deal with the damage and, at the same time, radio the captain of the icebreaker.
10. In the event of damage to a vessel following an icebreaker, the damaged vessel must make the distress signals prescribed by the International Code of Signals.
11. Vessels following an icebreaker must be guided by the signals contained in the International Code of Signals, which may be made by RT, visually, by whistle or on the siren. Except for the signals "Be ready to take (or cast off) tow line," they must be repeated by each ship in turn, beginning



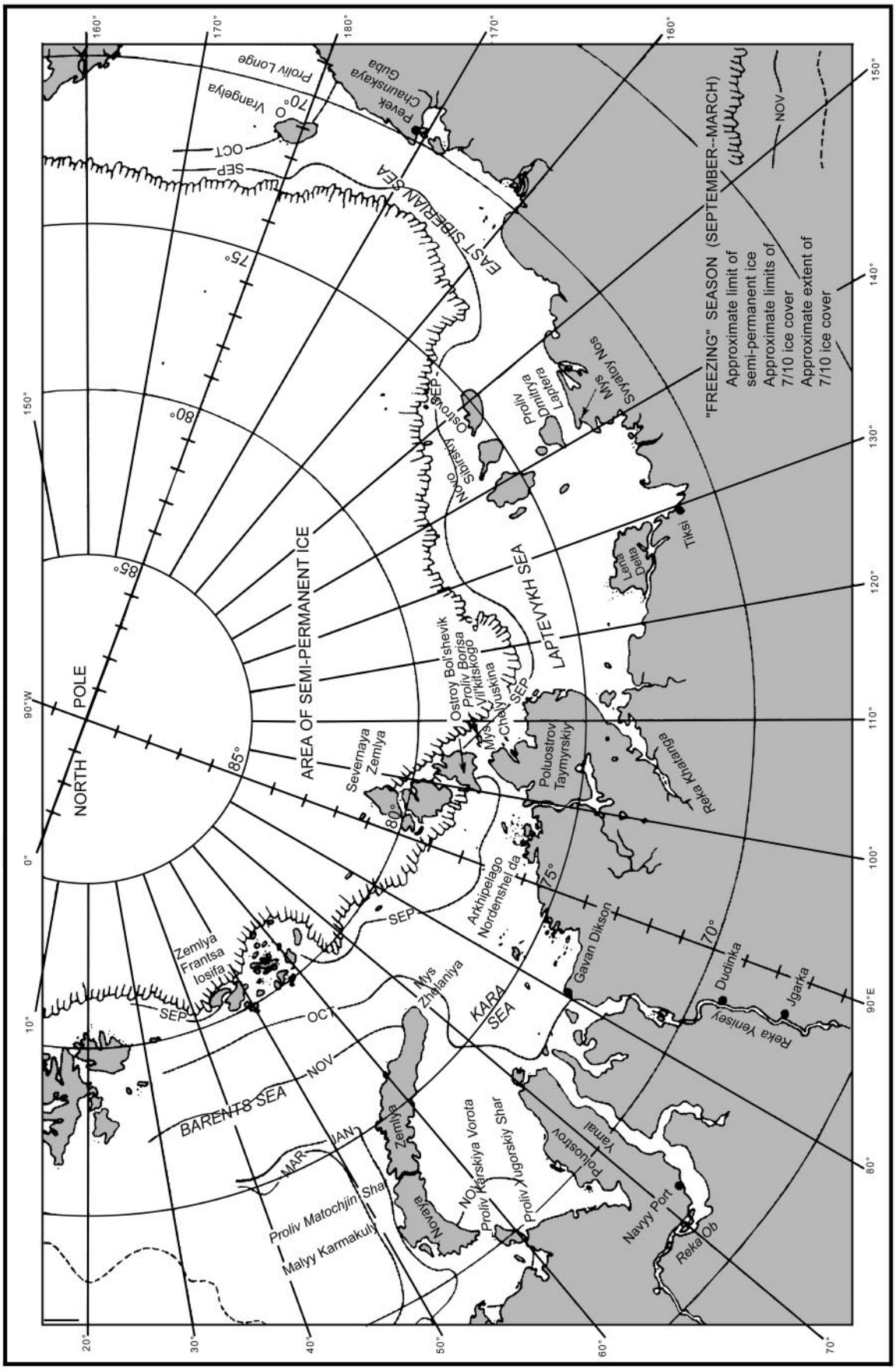
General Surface Current Circulation



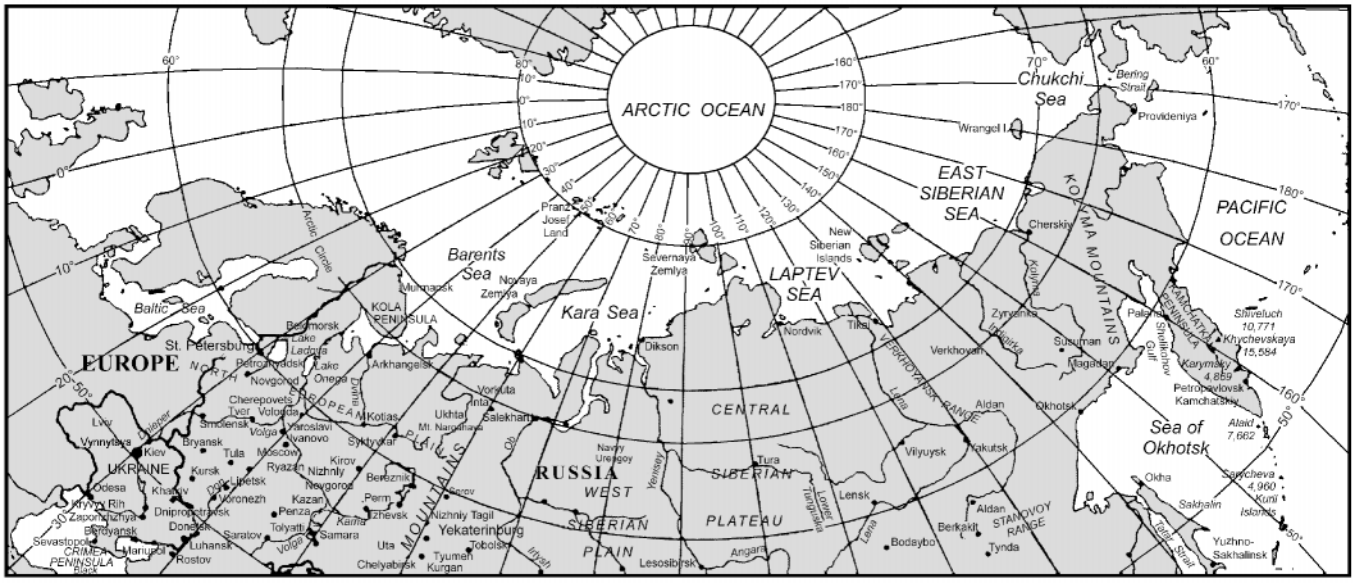
Ice Conditions—April to August



Mean Sea Surface Temperature (°C)—August



Ice Conditions—September to March



Arctic Coast of Northern Russia

with the one nearest the icebreaker or vessel making the signal.

12. When it is necessary to make an emergency alteration of course of the convoy, orders by radio must be repeated by the appropriate sound signals.

13. The instructions of the icebreaker, given by these signals, must be obeyed immediately by the vessels addressed. If the orders of the master of the icebreaker are not carried out by the master of a vessel under escort, the master of the icebreaker has the right to refuse to escort the latter vessel any farther until his instructions have been executed.

14. Neither the icebreaker, nor the owner of the icebreaker, nor the charterer, is responsible for damage or loss liable to be caused to the vessel conducted, while being escorted through the ice.

15. Merchant vessels of all flags can use the services of the icebreakers without charges from the port authorities for:

(i) Escort from the edge of the ice into port.

(ii) From the port to sea.

(iii) Within the limits of the port.

(iv) The towrope when its use is deemed necessary by the master of the icebreaker.

The service offered for mooring of ships for loading and unloading operations, bunkering, docking, etc, is done for payment.

16. The master of every vessel which requires the assistance of an icebreaker for passing through ice must declare his readiness to comply with these regulations. The master of the vessel following an icebreaker must at all times be certain of his own position.

Ice-worthiness

Russian ship classification rules in force in 1977 distinguished six classes of ice-worthiness. In ascending order, they were:

L4, L3, L2, Ll—cleared for navigation astern of an icebreaker in various conditions in the Black Sea, the Arctic Ocean, and the White Sea.

UL—cleared for navigation astern of an icebreaker as well as independent navigation in ice cakes in Arctic seas, or in other regions with similar ice conditions during the navigational period.

ULA—cleared for navigation astern of an icebreaker, as well as independent navigation in small floes in Arctic and Antarctic seas during the whole navigational period in continuous ice up to 0.5m thick.

Apart from icebreakers, which have their own classification, only ships in the classes UL and ULA are cleared for the Northern Sea Route.

Industries

Natural resources include agricultural land, fishery, and forests. Within the Russian Federation mineral resources include iron ore, oil and gas, gold, platinum, copper, zinc, lead, and tin.

Industries include iron and steel, electrical power, manufacture of vehicles, timber, agriculture and fisheries, cement, clothing, radio and television, paper, foodstuffs, petroleum refinery, aluminum, and forest products.

Exports include oil and gas, iron ore, paper, vehicles, machinery, and steel.

Languages

Russian is the official language.

Magnetic Field

Magnetic Variation

Due to high latitudes, the horizontal component of the earth's magnetic field is very small throughout this area. The effects of both local magnetic anomalies and of magnetic storms therefore create a much greater deflection of the compass needle compared to lower latitudes.

Additionally, the area lies in or near the region of maximum auroral frequency where there is a high level of magnetic disturbance. During a severe magnetic storm, the resultant deflection of the compass may amount to several tens of degrees.

In the Kara sea the average number of days per month on which the range of the deflection of the compass needle due to magnetic storms may reach a value of 4˚ may amount to ten. In the Laptev Sea, severe magnetic storms occur on not more than 4 or 5 days per month, but deflections of as much as 4˚ may occur on as many as 10 days per month. In the East Siberian Sea, deflections of up to about 4˚ may occur on about 10 to 12 days per month.

The magnetic variation in these regions also undergoes a diurnal fluctuation reaching its maximum about 0600 and 1800, and its minimum about 1100 and 2300. Under normal magnetic conditions the range of these fluctuations is about 11' at Proliv Matochkin Shar, 16' at Ostrov Dikson, 70' on a line between Mys Chelyuskina and Mys Anisiy, Ostrov Kotel'nyy, and 20' off the Lena delta. A report of larger fluctuations was observed at Bukhta Ledyanaya.

It should be noted that the value of the magnetic variation changes rapidly from E to W, and that, as far as can be ascertained from the incomplete observations so far obtained, this change is by no means uniform in many places.

Magnetic observatories have been established at Proliv Matochkin Shar, Ostrov Dikson, and Mys Chelyuskina, and these will supply information regarding alterations in the earth's magnetic field on demand by radio.

During the navigational season, the Dikson radio station broadcasts information regarding the state of the earth's magnetic field; these broadcasts are primarily intended for the use of vessels bound between Proliv Yugorskiy Shar or Proliv Matochkin Shar and Ostrov Dikson, but they will give an indication of the occurrence of magnetic storms.

Mined Areas

Mines laid during World War II (1939-45) have not been swept in some areas. It is now considered that there is no risk involved to surface navigation from the mines; however, the risk of danger still exists to ships anchoring, trawling, or conducting seabed operations. Uncharted wrecks and shoals may also be present in these waters. For details of the mined areas, see Appendix II.

Navigational Information

Maritime Territorial Claims

The maritime territorial claims of Russia are, as follows:

Territorial Sea	12 miles.
Fisheries or Economic Zone	200 miles.
Continental Shelf	Depth of 200m or the Limit of Exploitation.

Navigable Season (Russian Arctic)

Since large clearings in the ice are usually not found in June, the W part of the Kara Sea is navigable towards the end of June with an icebreaker assisting. In July, navigation through ice is possible without icebreaker s in the S part of the Kara Sea. The sea becomes accessible for navigation on the average period between the beginning of August to the end of September. During a mild weather year this period may last a few weeks longer. In most favorable years the sea is navigable from the end of July to the middle of October. On the other hand, prevailing NW winds can keep the E part of the Kara Sea ice-bound in June, July, and August.

During winters, vessels assisted by icebreakers have reached the oil and gas installation on Poluostrov Yamal on the E shore of the Kara Sea. Year-round operation, through the Kara Sea to Dudinka on Reka Yenisey, has been possible.

Pilotage

Pilotage is compulsory for entry to and departure from all Russian ports and for mooring and casting off. Pilots should be ordered through their agent 12 hours in advance and confirmed 4 hours prior to arrival, unless otherwise stated by individual ports.

Vessels should send their ETA via their agent 12 days, 96 hours, and 12 hours in advance. Oil, gas, and chemical tankers should however, confirm their ETA 14 days, 72 hours, and 12 hours before arrival.

In addition, masters must indicate that the vessel has certification guaranteeing civil responsibility for damage from oil pollution.

The following information is required by the Port Authority:

1. Name and flag of vessel.
2. Port of departure (last port of call).
3. Vessel's draft at bow and stern.
4. Cargo capacity of vessel, volume of hold, measurements.
5. Name and quantity of cargo and its distribution by hold (for tankers, in addition, indicate type and disposition of ballast).
6. Requirements from port services.

Information concerning a vessel's sanitation state must be reported in accordance with current sanitation, veterinary, and quarantine regulations.

A vessel's arrival in port must be registered directly with the Port Authority or with a representative of the Transport Fleet Maintenance Service, within the first 6 hours in port for

completing sanitation, quarantine, customs, and border formalities.

On sailing, the Port Authority must be informed of intended departure at least 6 hours in advance; during a short term anchorage (less than 6 hours) at least 2 hours notice is required.

Pilotage requirements are uniform for all foreign flag vessels but come under the purview of local pilotage laws. Pilotage requirements may therefore vary from port to port. In the majority of ports, entry and departure of vessels take place around the clock. In some ports, pilotage is carried out with the aid of tugs. In others, shore radar and radio direction-finding stations are used.

Pollution

Russian regulations prohibit the discharge of oil, oil products, and any other substance or refuse hazardous to human health or to the living resources of the sea. Severe penalties are imposed upon the violators within the territorial and internal waters of Russia.

Failure to inform the nearest Russian authority of accidental or emergency discharge of such substances within the territorial and internal waters of Russia and failure to note the occurrence in the ship's log carry severe penalties.

Russian merchant vessels and civil aircraft are instructed to inform Russian authorities of witnessed infringements of the Russian regulations and of the international regulations.

Within the territorial and internal waters of Russia, vessels suspected of infringing the regulations are liable to be stopped, boarded, and inspected. If an infringement has taken place within those waters, the vessel is liable to be detained.

Regulations

Access to Russian ports by any foreign vessel is subject to compliance with applicable laws and regulations of the government of Russia and local municipal and port authorities in the areas wherein they have their jurisdiction.

Economic Zone

Russia claims an economic zone extending 200 miles seaward from the limits of its territorial sea.

Within the economic zone, the Government of Russia issues regulations in connection with and for the control of:

1. Exploitation and conservation of resources found on or below the sea bed and in the waters above it, including anadromous fish. Fishing of anadromous types of fish is permitted only as a result of inter-governmental agreement.
2. Marine scientific research.
3. Pollution of the marine environment.

Freedom of passage for ships and aircraft through the economic zone is assured.

Regulations exist for the inspection of vessels suspected of causing pollution and penalties for infringement exist.

Foreign Naval Vessels

Foreign naval vessels intending to enter waters of Russian or visit Russian ports should obtain a copy of "Regulations for Foreign Naval Vessels Navigating and Remaining in the Territorial or Internal Waters of Russia or Visiting Russian Ports." These regulations are published as a Russian Annual Notice to Mariners.

Proposals to visit Russian ports should be forwarded through the Russian Ministry of Foreign Affairs not less than 30 days prior to the suggested visit. This rule does not apply to warships on which heads of governments or heads of state are embarked, nor to ships accompanying them.

Ships whose approach is necessitated by foul weather or engine failure which threatens the safety of the ship must inform the nearest port of the reason for entry, and, if possible, go to a recognized port open to foreign merchant vessels, or to a point indicated by the vessel sent to aid or meet it.

All foreign vessels when within territorial waters or internal waters of Russia, must observe radio communication, navigational, port, customs, sanitary and other regulations.

In the event of an emergency entry into territorial waters, or emergency non-observance of rules for navigation and stay in these waters, foreign vessels must immediately notify the nearest Russian port authority.

Foreign Merchant Vessels

Foreign non-military vessels enjoy the right of innocent passage through Russian territorial waters in accordance with Russian laws and international treaties; innocent passage is effected by crossing them without entering Russian internal waters, or by passing through them en route to or from Russian ports open to foreign vessels.

While effecting innocent passage, vessels must follow the customary navigational course or course recommended through sea corridors or in accordance with traffic separation schemes.

The master of a foreign non-military vessel which has violated the rules of innocent passage is accountable under Russian legislation.

All foreign vessels when within territorial waters or internal waters of Russia, must observe radio communication, navigational, port, customs, sanitary and other regulations.

In the event of an emergency entry into territorial waters, or emergency non-observance of rules for navigation and stay in these waters, foreign vessels must immediately notify the nearest Russian port authority.

Territorial Waters

Waterways off the Arctic coast of Russia lie within the following lines:

1. From the North Pole, S along 40˚E to 72˚N;
2. Then E to 72˚N, 45˚E;
3. Then SE to 70˚N, 50˚E;
4. Then ESE to a position on the coast close S of Mys Belyy Nos (69˚35'N., 60˚12'E.);
5. Then E along the Arctic coast of Russia to 178˚E;
6. Then N along 178˚E to the North Pole.

Restricted Areas

Regulated or Prohibited Areas

Regulated areas include areas where navigation is prohibited or restricted and fishing or anchoring are prohibited. These areas are usually charted.

Regulated areas also include where navigation is periodically prohibited, and periodically declared dangerous areas to navigate.

Radio warnings are given for the areas where navigation is periodically prohibited; for further details, see Appendix I.

Radio warning are also given for areas periodically declared dangerous for navigation, which may include various firing, danger, and exercise areas. Danger areas may lie partly or wholly outside the Russian territorial waters. If the danger area lies close or adjacent to its territorial waters, a warning is announced giving the date on which it becomes dangerous for navigation. Similar warnings may be broadcast concerning other areas previously not designated as areas where navigation is periodically prohibited. For details, see Appendix I.

The limits of regulated areas are shown on Russian Federation Charts and the areas are listed in the handbooks for those vessels visiting Russian Federation ports. This handbook is issued by the Russian Federation Ministry of Defence, Central Department of Navigation and Oceanography. Changes to the regulated areas are announced by NAVIM or NAVIP. The Russian Federation authorities place responsibility on the ship's master for any violation of the limits of a regulated area.

Fortified Zones

When control of navigation in a specific area is established, it is named a "Fortified Zone" by the Russian Federation authorities. Request must be made to enter or leave fortified or controlled areas, and pilotage is mandatory through these zones.

Pilots must board vessels immediately on request, and masters must take all safety precautions for embarking them. Special regulations are in force in these zones, and the pilot's instructions concerning the special regulations must be followed. In fog, navigation is usually prohibited through these zones. In bad weather, when the pilot cannot board a vessel, the pilot boat may lead the vessel to a position where embarkation can take place, but only if agreed by both the master and the pilot. In such cases, continuous communication must be maintained between the vessel and the pilot boat.

Masters must allow the pilots to use the ship's radio transmitter in order to communicate with the nearest shore station or the pilot vessel. In addition, pilots must be allowed to use the ship's electronic navigation equipment when under adverse weather conditions.

The pilot will provide a copy of the Obligatory Regulations for the port to the person in command of a vessel visiting the port for the first time. Pilots are forbidden to disembark before the vessel is safely moored, anchored, has reached the open sea or he has been relieved by another pilot. However, the pilot's presence on board ship does not relieve the master from the responsibility of vessel's safety and of navigation. When a master leaves the bridge he must inform the pilot of the officer who will be responsible for navigation of the vessel during his absence. The person in command must inform the pilot of the precise draft and other particulars necessary for safe pilotage of the vessel.

Incorrect declaration of draft, length, breadth, or tonnage to the pilot will incur a fine of double the pilotage fee.

Routes

Northern Sea Route

In May and June of 1978, the Russian icebreaker Sibir escorted the merchant ship Kapitan Myshevskiy from Murmansk (69˚N., 33˚E.) to Magadan (59˚30'N., 150˚30'E.). The route passed N of Novaya Zemlya, Severnaya Zemlya, and Novo Sibirskiye Ostrov, and S of Ostrov Vrangelya.

The Northern Sea Route runs, in its full extent, from Murmansk and Arkhangelsk in the W to Vladivostok, on the Japan Sea, in the E. The route passes from the W limit of the Barents Sea, through the Kara Sea, through the Laptevykh Sea, to 178˚E in the East Siberian Sea.

It is reported (1995) that the Russian Federation has issued more than 180 charts covering the Northern Sea Route. These charts are for use by the international shipping community. A Guide to Navigation along the Northern Sea Route was also published in Russian, with an English version to follow.

Navigational Season

The Northern Sea Route is normally open to navigation from the end of July to the end of October; the dates varying each year with the prevailing ice conditions.

Except for a period of up to 6 weeks, during May and June, when the river ice drifts out, continuous navigation has been made possible, since 1979, with icebreakers along the W part of the route, up to Dudinka (69˚24'N., 86˚10'E.) on Reka Yenisey.

Icebreaker pilotage is available, on request, for the whole of the Northern Sea Route.

Vessels are required to be ice-strengthened.

Vessels have passed from the Bering Strait to Arkhangel'sk and Murmansk, along the N Siberian coast, from early July to mid-September, but in some years the ice conditions make this passage impossible. The navigational season varies, in length and date, along this route; thus, the season is usually longer in each part of the route than in the route as a whole.

The Barents Sea is navigable up to 75˚N and as far E as 50˚E by the middle of June. Towards the end of June the W coast of Novaya Zemlya, between Gusinaya Zemlya (71˚30'N., 51˚40'E) and Poluostrov Admiralteystva (220 miles NNE), begins to clear of ice. The entire W coast of Novaya Zemlya is ice-free in early July, when the whole Barents Sea S of 77˚N is navigable.

In some years the ice is so open that vessels may reach Zemlya Frantsa Iosifa, where the sea may be quite free of ice in August, while in other years the islands are quite inaccessible due to ice. Zemlya Frantsa Iosifa was reached in June 1905, a rare occurrence, July and August usually being most convenient for navigation, but navigation is not possible every year.

On an average, every other year a vessel goes through or the vessel has been free of ice reaching the island. Southward of that island, though much heavy pack-ice was about, and young ice rapidly formed in calm weather, which was very rare, it quickly broke up with the first fresh gale, and fast-ice six miles wide did not form before March. Many of the narrower channels and fjords among the islands are perpetually ice-bound, but the larger ones are generally free, at some point, every season. In some channels and harbors the lack of recent information and the scale of the chart make local knowledge

essential. The requirement for local knowledge is often stated in the appropriate text and to apply in some measure to all the channels and harbors mentioned, whether stated or not.

Search and Rescue

The Maritime Rescue Coordination Center (MRCC) Moskva is responsible for coordinating search and rescue operations and working with search and rescue services of neighboring countries.

A network of coast radio stations maintains a continuous listening watch on international distress frequencies for distress traffic.

The MRCCs and the Maritime Rescue Coordination Subcenters (MRSC) can be contacted by e-mail, as follows:

MRCC Moskva:	smrcc@morflot.ru
MRCC Murmansk:	rcc@mapm.ru
MRSC Archangelsk:	rcc@mapa.ru

Signals

Anchor Signals

Vessels using a kedge anchor show, by day, a red flag, or at night a white light on the anchor cable at half the height of the ship's side. These signals are additional to those prescribed by the International Regulations for Preventing Collisions at Sea.

Survey Vessels

Russian vessels, engaged in survey operations, display a blue pennant having on it a white disc bearing the figure of a lighthouse.

Fishing Vessels

Mariners are cautioned that, in certain waters of the Baltic Sea and Gulf of Finland, Russian fishing vessels may be encountered at night showing lights additional to those described in the International Rules of the Road.

These lights are white, red, green and blue, the brightest being a red light with a visibility of at least 1 mile; the remaining lights have a visibility of not less than 750m.

Mariners are advised on sighting these fishing vessels, to give them a berth of not less than 2 miles.

Lightships Not on Station

A lightship, not on station, that has broken loose from its anchor shall hoist the following signals:

1. By day—Two large black balls, one in the bow, the other in the stern.
2. At night—Two red lights, one in the bow, the other in the stern.

Red flags shall be displayed in place of the black balls if circumstances are such that the above daytime signals cannot be used, or if the signals are the distinguishing signals for the particular lightship.

The lightship that has broken loose from its anchor shall, in addition to the above, take the following precautions:

1. By day—Hoist the signal "LO" of the International Code, meaning "I am not in my charted position."
2. At night—Burn red and white pyrotechnic lights simultaneously at least once every 15 minutes.

If circumstances are such that pyrotechnics cannot be used, the red and white pyrotechnics shall be replaced by simultaneously showing a red and a white light.

Special Warning Signals

It may at times be necessary to prohibit entry of shipping into certain Russian territorial waters and under these conditions a special warning service consisting of special warships, guardships, examination vessels, or coast guard stations will be established. Mariners are cautioned on approaching such waters to maintain a good lookout for these vessels which will show the following signals:

1. By day—A blue triangular flag.
2. By night—Three blue lights, vertically disposed.

Should any vessel approach an area where entry to or navigation within is prohibited, the patrol vessel, guardship, or coastguard station shall in addition to the above signals, show the following signals:

1. By day—Three red balls, vertically disposed.
2. By night—Three red lights, vertically disposed.

The above information is not to be construed to mean every restricted area will be guarded, and vessels proceeding into these waters should have on board the latest available information pertaining to navigation off the coastal areas of Russian.

Vessels of the Russian Police Department wishing to stop vessels will exhibit:

1. By day—International Code flag L from the mast.
2. By night—Two green lights, vertically disposed.

Ships that have been given either of these signals must stop and remain stopped until permission to proceed is received from the guardship.

Should entry or navigation into a given area be unrestricted and no special signal or instruction regarding further movements have been made or given by the guardship or coastguard station, an incoming vessel is free to proceed to its destination, but must observe such regulations as may already have been promulgated.

Should Russian naval vessels be present in any restricted area, and should no special regulations concerning navigation with it have been issued, then approaching vessels must not pass between such naval vessels.

Submarine Warning Signals

Foreign naval vessels intending to enter waters of Russia or visit Russian ports should obtain a copy of "Regulations for Foreign Naval Vessels Navigating and Remaining in the Territorial or Internal Waters of Russia or Visiting Russian Ports." These regulations are published as a Russian Annual Notice to Mariners.

The following signal is used to warn foreign submarines which are submerged:

1. A series of three explosions at 1 minute intervals, followed after an interval of 3 minutes by a second series of

three explosions; you have entered territorial waters. Come to the surface immediately. If you do not surface you will be fired upon.

2. An acoustic signal by sonar may be given simultaneously, with the same meaning as above. The signal will consist of five dashes, each dash 3 seconds long, with the interval between dashes being 3 seconds.

Tidal Signals

Signals are displayed to indicate the height of the water level above chart datum, in units of 20 cm, as follows:

Day Signal	Night Signal	Meaning
Black cone, point down	White light over green light	Falling water level
Black cone, point up	Green light over white light	Rising water level
Black cone, point down	Green light	Height of water level—1 unit
Black cylinder	Red light	Height of water level—5 units
Black ball	White light	Height of water level—25 units
White cylinder	Red light	Height of water level—0.5 unit

Traffic Signals

Signals regulating entry to and departure from the Russian Federation ports are, as follows:

Day Signal	Night Signal	Meaning
Three balls	Three red lights	Entry forbidden due to obstruction
Cone, apex up, between two balls	White light between two red lights	Entry temporarily prohibited-Normal opera-tions
Cone, apex down, above cone, apex up, over ball	Green light above white light over red light	Entry and exit temporarily prohibited-Normal operations
Cone, apex down, above cone, apex up, over cone, apex down	White light between two green lights	Exit temporarily prohibited-Normal operations
Ball between two cylinders	Red light between two white lights	Movement of small warships, launches, boats prohibited in harbor and roads

All signals are disposed vertically; all the day signal shapes are black.

Towing Signals

The following sound signals are used by the vessel being towed:

Signal	Meaning
One long blast	Tow straight ahead or astern (as appropriate)
Two long blasts	Stop engines
One long blast, one short blast	Reduce speed
One short blast, one long blast	Increase speed
One long blast, one short blast, one long blast	Let go or take up tow
One short blast	Tow to starboard
Two short blasts	Tow to port
Three short blasts	Go full speed astern
Three long blasts, one short blast	Tug required
Five or more short blasts	Stop moving immediately

When two tugs are employed, one will be directed by the ship's whistle and the other by oral whistle signals. Signals given by the towed ship must be repeated by the tug.

Submarine Operating Areas

Warships of the Navy of Russia escorting submarines will, for purposes of warning vessels of the presence of submarines in a particular sea area, hoist the flag signal "NE 2" of the International Code of Signals, meaning "You should proceed with particular caution because submarine exercises are in progress in this area."

Warships of Russia shall, if possible, also transmit the fact by radio in plain language on the established international frequency, 500 kHz.

During darkness, specially assigned warships shall warn approaching vessels of the presence of submarines by using for the purpose, all communication means available to them.

Approaching vessels shall set their courses so as not to interfere with the movements of the warships displaying the signals indicated, and shall ensure that warships have adequate room in which to maneuver.

If, for whatever reason, a vessel is unable to meet these requirements, such vessel should reduce speed to as slow as possible until such time as the danger area has been transmitted to it, or until such time as instructions as to a safe course are received.

The vessel shall, at the same time, keep a sharp lookout for submarines, the presence of which can be detected only if they are at a depth where the periscope, snorkel, parabolic radar antenna, or DF loop is visible.

All these devices can be mistaken for the brooms used as topmarks, logs, and other floating objects, because of their external appearance. However, if they are in fact extendible devices of a submarine they usually will leave a wake.

A submarine, moreover, sometimes can be detected because of air bubbles coming to the surface, or because of a red and white float or buoy, towed astern and visible on the surface.

A surfaced submarine can be detected at night by its running lights, and by the fixed white lights of emergency signal buoys which can be lighted by the submarine, in good time, while it still is submerged. In some cases the presence of a submarine in the area can be made known by its submerged firing of signal cartridges which form a colored smoke in the daytime, and by a similarly colored flare at night.

A vessel observing the extendible devices of a submarine, a towed float or buoy, the fact of running lights showing as well as the fixed white lights of emergency signal buoys, or the firing of signal cartridges shall sheer off immediately so as to leave them astern, or back down or stop its engine, so as to pass clear of the submarine at a safe distance.

Mariners should, however, be aware of the fact that surface warships do not always escort submarines engaged in exercises or making passage.

Sunken Submarines

When a Russian submarine is in distress and cannot surface it can indicate its position by releasing, to the surface, an emergency signal buoy, fuel or lubricating oil, or air bubbles.

Submarines of the Navy of Russia are fitted with two emergency signal buoys; one in the bow, the other in the stern.

The emergency signal buoys are shaped like a truncated cone with a flat bottom and a spherical upper part (the buoy can, in some cases, is shaped like an oblate spheroid). Buoy diameter is about 0.9 to 1.25m; height about 0.4 to 0.7m.

The body of the buoy rises about 0.4 to 0.6m above the surface. The buoy is red, with the upper part having three red sectors alternating with three white sectors. One of the white sectors carries a black H or a black K.

The letter H signifies that the buoy is the bow buoy, the letter K that the buoy is the stern buoy. The buoys are visible for about 2 miles.

A quick flashing white light (70 flashes per minute) visible for 5 miles, is shown from the center of the upper part of the buoy.

A mariner sighting evidence on the surface that a submarine is in distress shall, with the maximum accuracy, fix the position of an oil slick or of the appearance of air bubbles, and report this to the nearest Russian port authorities.

If an emergency signal buoy is spotted, the fact shall be reported immediately to the nearest Russian port, such report shall include the exact position of the buoy and time spotted, and communications shall be established with the submarine over the emergency signal buoy telephone.

To establish communications with the submarine, open the cover on the well in the buoy (by removing the wing nuts, or by backing off the nuts with a wrench), secure it, remove the handset from the rubber case, and call by pressing the button on the end of the rubber bulb.

Upon receiving a response, release the button and begin to talk. Now further action on the part of the mariner will depend entirely on the situation in which the submarine may be in and on the status of its crew.

Vessels, cutters, or boats should not tie up to an emergency signal buoy, nor lift it on board.

Russian Submarine Lights

The design features of submarines prevent them from fully complying with the provisions of Rules of the Road with respect to ships' lights.

The low position of the running lights, the small vertical spacing, and the closeness together of the masthead and side lights all work to give an incorrect idea of the length of the submarine, its exact course, and even more to the point, of changes in course. This is why submarine lights can be mistaken for those of a small vessel, or a cutter, moving at slow speed.

Mariners should always be aware of the special features of the placement of submarine lights, and take all precautionary measures necessary when passing submarines, particularly in fairways, in narrow waters, and in the entrances (exits) of bays and gulfs.

Submarines may carry one or two special identification lights for timely recognition when in restricted waters, and in areas in which traffic is heavy.

These are quick flashing (100 flashes per minute) orange lights visible all around the horizon, located in the submarines fore and aft plane.

One light is installed on top and in the middle of the conning tower, at least 1.5m above the masthead light. The other is on the stern of the submarine, or on a stabilizer.

All ships, upon seeing these lights, shall take immediate, decisive measures to pass the submarine at a safe distance.

Time Zone

Russia has several time zones. The boundaries between the zones are irregular; the principal towns in each zone are listed in Appendix III. Daylight Savings Time is observed from the last Sunday in March until the Saturday before the last Sunday in October.

Traffic Separation Schemes

Traffic Separation Schemes (TSS) in the Arctic Ocean of the N coast of Russia are listed below. The schemes are not IMO-adopted.

1. **The White Sea (Beloye More)**
   a. Off Mys Zimnegorskiy (Government of Russia).
   b. Off Ostrov Sosnovets (Government of Russia).
   c. Off Ostrova Ponoyskiye Ludki (Government of Russia).
   d. Off Tersko-Orlovskiy (Government of Russia).
   e. Off Svyatonosskiy Poluostrov (Government of Russia).
2. **The Barents Sea**
   a. Entrance to Kol'skiy Zaliv (Government of Russia).
   b. Proliv Karskiye Vorota (Government of Russia).

U.S. Embassy

The U.S. Embassy is situated at Bolshoy Devyatinskiy Pereulok No. 8, 121099 Moscow.

The mailing address is APO AE 09721.

U. S. Embassy Russia Home Page
http://moscow.usembassy.gov

Appendix I

RUSSIAN FEDERATION REGULATED AREAS

The numbers given to the areas and their limits are those promulgated in Russian Federation Notices to Mariners and the positions are referred to the Russian Federation chart datums.

Areas Prohibited for Navigation

Area No. 3.—North coast of Poluostrov Rybachiy.—Lies within an area enclosed by the shore and lines joining:
a. 69˚53.0'N, 32˚20.0'E.
b. 69˚54.4'N, 32˚24.9'E.
c. 69˚50.0'N, 32˚48.0'E.
d. 69˚47.0'N, 32˚45.0'E.

Area No. 7.—North coast of Poluostrov Rybachiy.—Lies within an area bounded by lines joining:
a. 69˚41.5'N, 33˚06.5'E.
b. 69˚39.3'N, 33˚19.3'E.
c. 69˚33.2'N, 33˚17.3'E.
d. 69˚35.0'N, 32˚57.5'E.

Area No. 9.—South of Mys Gorodetskiy.—Lies within an area bounded by lines joining:
a. 69˚29.9'N, 32˚42.0'E.
b. 69˚30.9'N, 32˚43.0'E.
c. 69˚30.9'N, 32˚45.5'E.
d. 69˚29.8'N, 32˚53.9'E.
e. 69˚28.6'N, 32˚52.6'E.

Area No. 130.—Motovskiy Zaliv.—Lies within an area bounded by lines joining:
a. 69˚35.0'N, 32˚33.0'E.
b. 69˚35.2'N, 32˚54.6'E.
c. 69˚30.6'N, 32˚53.0'E.
d. 69˚33.6'N, 32˚31.4'E.

Area No. 11.—Guba Zapadnaya Litsa.—Lies within an area S of lines joining:
a. 69˚30.4'N, 32˚29.8'E.
b. 69˚30.2'N, 32˚33.2'E.
c. 69˚29.1'N, 32˚33.3'E.

Area No. 12.—Guba Zapadnaya Litsa.—Lies within an area S of lines joining:
a. 69˚27.8'N, 32˚54.2'E.
b. 69˚27.6'N, 32˚56.1'E.
c. 69˚27.6'N, 32˚56.6'E.
d. 69˚27.1'N, 32˚58.0'E.

Area No. 13.—Guba Zapadnaya Litsa.—South of a line joining Mys Vyyev Navolok (W arm) and W of 33˚04.5'E (E arm).

Area No. 131.—Guba Zelenetskaya Zapadnaya.—Lies within an area S of a line joining:
a. 69˚16.9'N, 33˚42.7'E
b. 69˚16.9'N, 33˚43.4'E

Area No. 27.—Guba Dolgaa Zapadnaya—Along the line joining Mys Chernyy (69˚18.6'N., 33˚49.7'E.) and Mys Dolgiy (69˚17.9'N., 33˚48.2'E.).

Area No. 125.—West of Ostrov Kil'din—Lies within an area bounded by lines joining:
a. 69˚20.7'N, 33˚46.0'E.
b. 69˚21.6'N, 33˚46.0'E.
c. 69˚24.0'N, 33˚53.5'E.
d. 69˚20.7'N, 33˚53.5'E.

Area No. 16.—Proliv Kuvshinskaya Salma (69˚18.0'N., 33˚24.6'E.)

Area No. 18.—West of line joining Ostrov Sedlovatyy (69˚15.4'N., 33˚28.8'E.) and Bolshoy Oleniy (69˚13.8'N., 33˚29.3'E.)

Area No. 19.—Yekaterininskaya Gavan (69˚12.3'N., 33˚29.3'E.)

Area No. 20.—East of Mys Shurinov—Lies within an area enclosed by the shore and lines joining:
a. 69˚10.8'N, 33˚28.8'E.
b. 69˚10.8'N, 33˚31.4'E
c. 69˚10.1'N, 33˚31.4'E.
d. 69˚09.4'N, 33˚29.9'E.
e. 69˚09.4'N, 33˚29.0'E.

Area No. 21.—Guba Vayenga—Lies within an area enclosed by the shore and lines joining:
a. 69˚07.0'N, 33˚27.4'E.
b. 69˚06.4'N, 33˚25.0'E.
c. 69˚05.4'N, 33˚22.1'E.
d. 69˚04.8'N, 33˚21.4'E.

Area No. 23.—Guba Chalmpushka (69˚03.7'N., 33˚14.3'E.) and Guba Roslyakova (69˚03.5'N., 33˚12.3'E.)

Area No. 25.—Southwest of Mys Pinagoriy—Lies within an area enclosed by the shore and lines joining:
a. 69˚02.5'N, 33˚04.4'E.
b. 69˚02.5'N, 33˚04.0'E.
c. 69˚03.7'N, 33˚04.3'E.
d. 69˚03.2'N, 33˚05.4'E.
e. 69˚03.1'N, 33˚05.5'E.

Area No. 31.—Approaches to Lumbovskiy Zaliv—Lies within an area enclosed by the shore and lines joining:
a. 67˚54.7'N, 40˚15.5'E.
b. 68˚00.0'N, 40˚27.6'E.
c. 67˚48.7'N, 41˚02.7'E.
d. 67˚43.0'N, 40˚50.0'E.

Area No. 128.—Guba Savikha—Lies within an area bounded by lines joining:
a. 68˚19.7'N, 39˚06.3'E.
b. 68˚21.0'N, 39˚08.3'E.
c. 68˚18.3'N, 39˚17.5'E.
d. 68˚17.1'N, 39˚14.9'E.

Area No. 126.—Svyatonosskiy Zaliv—Lies within an area bounded by lines joining:
a. 68˚05.4'N, 39˚25.3'E.
b. 68˚05.8'N, 39˚26.3'E.
c. 68˚04.0'N, 39˚31.6'E.
d. 68˚17.1'N, 39˚30.6'E.

Area No. 129.—South of Ostrov Salnyy—Lies within an area bounded by lines joining:
a. 68˚03.8'N, 39˚32.9'E.
b. 68˚03.6'N, 39˚33.5'E.
c. 68˚03.5'N, 39˚33.2'E.
d. 68˚03.7'N, 39˚32.6'E.

Area No. 38.—Dvinsky Zaliv—Lies within an area enclosed by the shore and lines joining:
a. 65˚06.3'N, 37˚22.0'E.
b. 65˚11.3'N, 37˚33.5'E.
c. 65˚05.0'N, 37˚49.5'E.
d. 65˚01.5'N, 37˚41.4'E.

Area No. 41.—Dvinsky Zaliv—Port Arkhangel'sk—Lies within an area enclosed by the shore and lines joining:
a. 64˚31.1'N, 40˚33.4'E.
b. 64˚31.2'N, 40˚33.6'E.
c. 64˚31.1'N, 40˚33.8'E.
d. 64˚31.1'N, 40˚34.0'E.

Area No. 184.—North of Ostrov Zhizhginshy—Lies within an area bounded by lines joining:
a. 65˚50'N, 36˚54'E.
b. 65˚45'N, 36˚44'E.
c. 65˚48'N, 36˚29'E.
d. 65˚54'N, 36˚40'E.

Area No. 186.—Dvinsky Zaliv—Lies within an area enclosed by the shore and lines joining:
a. 64˚38.1'N, 39˚48.1'E.
b. 64˚40.1'N, 39˚34.4'E.
c. 64˚32.7'N, 39˚34.4'E.

Area No. 32.—Kandalakshskiy Zaliv—Lies within an area enclosed by the shore and lines joining:
a. 66˚32.4'N, 34˚32.1'E.
b. 66˚29.1'N, 34˚27.2'E.
c. 66˚33.8'N, 34˚04.4'E.
d. 66˚36.4'N, 34˚08.3'E.
e. 66˚37.8'N, 34˚22.8'E.

Area No. 33.—Lies within an area bounded by lines joining:
a. 66˚30.1'N, 33˚45.8'E.
b. 66˚33.7'N, 33˚49.8'E.
c. 66˚26.0'N, 34˚35.4'E.
d. 66˚22.4'N, 34˚31.8'E.

Area No. 34.—Lies within an area boundd by lines joining:
a. 66˚35.0'N, 33˚59.0'E.
b. 66˚38.4'N, 34˚04.0'E.
c. 66˚38.7'N, 33˚51.8'E.
d. 66˚37.7'N, 33˚50.4'E.

Area No. 42.—Barents Sea—Ostrov Novaya Zemlya—Zaliv Mollera—Lies within an area enclosed by the shore and lines joining:
a. 71˚38'N, 51˚34'E.
b. 71˚35'N, 51˚00'E.
c. 72˚05'N, 51˚00'E.
d. 72˚44'N, 51˚45'E.
e. 72˚43'N, 52˚25'E.

Area No. 43.—Barents Sea—Ostrov Novaya Zemlya—Guba Belushya—Lies within an area enclosed by the shore and lines joining:
On the W:
a. 73˚21.4'N, 54˚04.3'E. (Mys Serebryanyy)
b. 73˚17.6'N, 53˚56.3'E. (Mys Atolbovoy)
On the E:
a. 73˚14.1'N, 56˚44.9'E. (Mys Vykhpdnoy)
b. 73˚09.3'N, 56˚34.0'E. (Mys Rok)

Kara Sea—Reka Yenisey—Northwest of Port Dudinka—Lies within an area bounded by lines joining:
a. 69˚25.4'N, 86˚07.9'E.
b. 69˚25.6'N, 86˚07.7'E.
c. 69˚25.7'N, 86˚08.2'E.
d. 69˚25.5'N, 86˚08.4'E.

Areas Prohibited for Anchoring, Fishing, Dredging, Underwater Explosions, and Navigating with Trailing Anchor

Area No. 44.—Entering Guba Pechenga—Lies within an area enclosed by the shore and lines joining:
a. 69˚41.7'N, 31˚26.2'E.
b. 69˚41.8'N, 31˚26.4'E.
c. 69˚41.3'N, 31˚29.8'E.
d. 69˚40.8'N, 31˚27.8'E.
e. 69˚41.1'N, 31˚26.8'E.

Area No. 45.—Guba Pechenga—Lies within an area enclosed by the shore and lines joining:
a. 69˚43.3'N, 31˚33.5'E.
b. 69˚41.6'N, 31˚33.5'E.
c. 69˚41.5'N, 31˚26.7'E.
d. 69˚43.3'N, 31˚26.7'E.

Area No. 46.—Guba Malaya Volokovaya—Lies within an area enclosed by the shore and lines joining:
a. 69˚40.7'N, 31˚38.0'E.
b. 69˚41.1'N, 31˚38.0'E.
c. 69˚40.6'N, 31˚40.6'E.
d. 69˚40.8'N, 31˚42.2'E.
e. 69˚39.4'N, 31˚49.1'E.

Area No. 47.—Guba Malaya Volokovaya—Lies within an area enclosed by the shore and lines joining:
a. 69˚41.1'N, 31˚38.0'E.
b. 69˚41.3'N, 31˚29.8'E.
c. 69˚46.0'N, 31˚42.0'E.
d. 69˚44.7'N, 31˚42.5'E.
e. 69˚40.8'N, 31˚33.5'E.
f. 69˚41.1'N, 31˚31.3'E.

Area No. 48.—Entering Guba Bolshaya Volokovaya—Lies within an area bounded by lines joining:
a. 69˚50.4'N, 31˚47.3'E.
b. 69˚50.2'N, 31˚44.6'E.
c. 69˚54.0'N, 31˚48.8'E.
d. 69˚53.7'N, 31˚51.0'E.

Area No. 49.—North of Poluostrov Rybachiy—Lies within an area enclosed by the shore and lines joining:
a. 69˚55.3'N, 31˚54.4'E.
b. 69˚55.3'N, 31˚42.7'E.
c. 70˚01.2'N, 31˚42.7'E.
d. 70˚01.2'N, 32˚03.5'E.
e. 69˚50.1'N, 33˚00.0'E.
f. 69˚45.2'N, 33˚00.0'E.

Area No. 50.—Guba Skorbeyevskiy—Lies within an area bounded by lines joining:
a. 69˚54.1'N, 32˚18.0'E.
b. 69˚54.4'N, 32˚20.4'E.
c. 69˚53.8'N, 32˚22.7'E.
d. 69˚53.3'N, 32˚21.2'E.

Area No. 54.—Guba Laush—Lies within an area enclosed by the shore and lines joining:
a. 69˚45.2'N, 33˚00.0'E.
b. 69˚46.1'N, 33˚01.5'E.
c. 69˚45.2'N, 33˚03.5'E.
d. 69˚44.3'N, 33˚02.9'E.
e. 69˚44.4'N, 33˚02.2'E.

Area No. 56.—East of Poluostrov Rybachiy—Lies within an area bounded by lines joining:
a. 69˚41.5'N, 33˚10.9'E.
b. 69˚42.0'N, 33˚08.6'E.
c. 69˚42.9'N, 33˚07.1'E.
d. 69˚42.7'N, 33˚09.0'E.

Area No. 59.—Southwest of Guba Eyna—Lies within an area enclosed by the shore and lines joining:
a. 69˚37.0'N, 32˚23.3'E.
b. 69˚35.5'N, 32˚27.5'E.
c. 69˚34.4'N, 32˚26.4'E.
d. 69˚36.5'N, 32˚09.0'E.
e. 69˚38.2'N, 32˚10.5'E.

Area No. 60.—Entering Guba Titovka—Lies within an area bounded by lines joining:
a. 69˚35.6'N, 32˚07.3'E.
b. 69˚35.8'N, 32˚04.8'E.
c. 69˚35.4'N, 32˚02.8'E.
d. 69˚36.7'N, 32˚03.4'E.
e. 69˚36.2'N, 32˚05.1'E.
f. 69˚36.0'N, 32˚07.6'E.

Area No. 61.—Southeast of Mys Piksuyev—Lies within an area enclosed by the shore and lines joining:
a. 69˚33.3'N, 32˚26.4'E.
b. 69˚32.0'N, 32˚33.0'E.
c. 69˚30.2'N, 32˚33.2'E.
d. 69˚30.4'N, 32˚29.8'E.

Area No. 64.—Entering Guba Ara—Lies within an area enclosed by the shore and lines joining:
a. 69˚27.1'N, 32˚58.0'E.
b. 69˚27.6'N, 32˚56.6'E.
c. 69˚27.6'N, 32˚56.1'E.
d. 69˚27.8'N, 32˚54.2'E.
e. 69˚28.6'N, 32˚55.3'E.
f. 69˚32.2'N, 32˚40.7'E.
g. 69˚30.6'N, 32˚53.0'E.
h. 69˚31.3'N, 32˚53.7'E.
i. 69˚29.4'N, 33˚02.5'E.
j. 69˚27.2'N, 33˚01.4'E.

Area No. 65.—Northeast of Mys Vyyev Navolok—Lies within an area enclosed by the shore and lines joining:
a. 69˚27.4'N, 33˚03.8'E.
b. 69˚28.5'N, 33˚06.0'E.
c. 69˚28.1'N, 33˚09.4'E.
d. 69˚26.8'N, 33˚06.8'E.
e. 69˚26.8'N, 33˚04.7'E.

Area No. 66.—West arm of Guba Ura—Lies within an area enclosed by the shore and lines joining:
a. 69˚23.4'N, 32˚59.3'E.
b. 69˚23.4'N, 32˚57.4'E.
c. 69˚23.9'N, 32˚58.8'E.
d. 69˚23.9'N, 32˚00.6'E.

Area No. 67.—Entrance to Kol'skiy Zaliv—Lies within an area bounded by the shore and lines joining:
a. 69˚18.1'N, 33˚38.6'E.
b. 69˚18.3'N, 33˚35.5'E.
c. 69˚17.8'N, 33˚33.3'E.
d. 69˚18.6'N, 33˚29.7'E.
e. 69˚23.0'N, 33˚29.7'E.
f. 69˚20.2'N, 33˚49.2'E.
g. 69˚18.1'N, 33˚42.4'E.

Area No. 81.—Kol'skiy Zaliv—Northeast of Ostrov Toros—Lies within an area bounded by the circle, with a radius of 0.3 mile, centered on position 69˚18.9'N, 33˚29.4'E.

Area No. 82.—Southeast of Ostrov Toros—Lies within an area bounded by lines joining:
a. 69˚17.0'N, 33˚30.0'E.
b. 69˚17.0'N, 33˚28.8'E.
c. 69˚17.6'N, 33˚28.8'E.
d. 69˚17.7'N, 33˚30.0'E.

Area No. 113.—Entrance to Guba Tyuva—Lies within an area enclosed by lines joining:
a. 69˚12.1'N, 33˚33.6'E.
b. 69˚12.1'N, 33˚34.6'E.
c. 69˚11.7'N, 33˚34.7'E.
d. 69˚11.7'N, 33˚33.7'E.

Area No. 85.—Between Ostrov Sal'nyy and Ostrov Shurinov—Lies within an area bounded by lines joining:
a. 69˚06.7'N, 33˚27.0'E.
b. 69˚07.3'N, 33˚25.0'E.
c. 69˚09.6'N, 33˚29.6'E.
d. 69˚09.6'N, 33˚33.2'E.
e. 69˚07.9'N, 33˚29.8'E.
f. 69˚07.7'N, 33˚30.3'E.

Area No. 114.—South of Mys Retinskiy—Lies within an area enclosed by lines joining:
a. 69˚06.9'N, 33˚24.0'E.
b. 69˚06.8'N, 33˚24.7'E.
c. 69˚06.5'N, 33˚24.2'E.
d. 69˚06.6'N, 33˚23.5'E.

Area No. 84.—South of Mys Karbas—Lies within an area enclosed by lines joining:
a. 69˚05.0'N, 33˚27.0'E.
b. 69˚05.8'N, 33˚25.9'E.
c. 69˚06.3'N, 33˚25.6'E.
d. 69˚06.4'N, 33˚26.5'E.
e. 69˚05.9'N, 33˚26.7'E.
f. 69˚05.1'N, 33˚26.8'E.

Area No. 86.—Southeast of Mys Mishukov—Lies within an area bounded by lines joining points with the following range/bearing combinations from Mishukov Lighthouse (69˚02.6'N., 33˚02.8'E.):

345.0˚	74m
079.0˚	407m
129.0˚	463m
187.0˚	296m
227.0˚	130m

Area No. 87.—Southeast of Mys Abram—Lies within an area bounded by lines joining points with the following range/bearing combinations from Commercial Port Primary Cargo Area No. 1 Lighted Beacon (68˚58.5'N., 33˚03.7'E.):

201.5˚	1,051m
203.25˚	960m
196.5˚	923m
195.0˚	1,015m

Area No. 88.—West entrance to Kildinskiy Proliv—Lies within an area bounded by lines joining:
69˚18.9'N, 33˚53.6'E
69˚20.5'N, 33˚56.4'E
69˚19.7'N, 34˚01.1'E

Area No. 89.—Entering Kaldinskiy Proliv from E—Lies within an area enclosed by lines joining:
a. 69˚16.3'N, 34˚26.7'E.
b. 69˚21.2'N, 34˚24.7'E.
c. 69˚19.9'N, 34˚28.5'E.
d. 69˚20.1'N, 34˚28.6'E.

Area No. 178.—Kaldinskiy Proliv—Lies within an area bounded by lines joining:
a. 69˚20.3'N, 34˚02.3'E.
b. 69˚20.0'N, 34˚01.3'E.
c. 69˚19.7'N, 34˚02.1'E.
d. 69˚20.1'N, 34˚03.2'E.

Area No. 91.—West of Ostrov Malyy Oleniy—Lies within an area bounded by lines joining:
a. 69˚15.8'N, 34˚32.7'E.
b. 69˚16.2'N, 34˚33.0'E.
c. 69˚16.5'N, 34˚41.6'E.
d. 69˚15.8'N, 34˚39.2'E.

Area No. 92.—Guba Teriberskaya—Lies within an area bounded by lines joining:
a. 69˚10.2'N, 35˚08.7'E.
b. 69˚12.2'N, 35˚08.7'E.
c. 69˚12.7'N, 35˚06.7'E.
d. 69˚15.6'N, 35˚06.7'E.
e. 69˚15.6'N, 35˚09.0'E.
f. 69˚15.5'N, 35˚08.9'E.
g. 69˚14.2'N, 35˚09.8'E.
h. 69˚11.2'N, 35˚10.3'E. continuing along the coast to
i. 69˚10.8'N, 35˚10.3'E.
j. 69˚10.2'N, 35˚10.5'E.

Area No. 93.—Entering Guba Voronya—Lies within an area bounded by lines joining:
a. 69˚12.6'N, 35˚40.6'E.
b. 69˚13.6'N, 35˚40.8'E.
c. 69˚13.3'N, 35˚49.2'E.
d. 69˚12.3'N, 35˚49.0'E.

Area No. 94.—Entering Guba Yarnyshnaya—Lies within an area bounded by lines joining:
a. 69˚07.4'N, 36˚03.1'E.
b. 69˚07.4'N, 36˚02.7'E.
c. 69˚08.2'N, 36˚02.0'E.
d. 69˚08.8'N, 36˚00.7'E.
e. 69˚08.6'N, 36˚04.0'E.
f. 69˚08.2'N, 36˚04.0'E.

Area No. 95.—Proliv Bolshoy Oleniy—Lies within an area bounded by lines joining:
a. 69˚05.1'N, 36˚18.6'E.
b. 69˚04.5'N, 36˚20.3'E. continuing along the coast to
c. 69˚03.8'N, 36˚21.7'E.
d. 69˚03.7'N, 36˚21.0'E.
e. 69˚04.3'N, 36˚19.4'E.
f. 69˚04.4'N, 36˚18.2'E.
g. 69˚04.5'N, 36˚18.2'E. continuing along the coast to
h. 69˚05.1'N, 36˚18.6'E.

Area No. 96.—Proliv Bolshoy Oleniy—Lies within an area bounded by lines joining:
a. 69˚03.7'N, 36˚22.2'E.
b. 69˚03.4'N, 36˚23.2'E.
c. 69˚03.2'N, 36˚25.7'E.
d. 69˚03.5'N, 36˚25.4'E.

Area No. 97.—South of Mys Karbas—Lies within an area bounded by lines joining:
a. 68˚57.5'N, 36˚22.2'E.
b. 68˚58.2'N, 36˚48.5'E.
c. 68˚53.6'N, 37˚04.6'E.
d. 68˚52.9'N, 37˚03.0'E.

Area No. 98.—Ostrov Kharlov—Lies within an area bounded by lines joining:
a. 68˚47.7'N, 37˚18.7'E.
b. 68˚50.0'N, 37˚13.3'E.
c. 68˚49.6'N, 37˚17.8'E.
d. 68˚48.7'N, 37˚17.8'E.
e. 68˚47.9'N, 37˚19.7'E.

Area No. 99.—Mys Chernyy—Lies within an area bounded by lines joining:
a. 68˚23.2'N, 38˚35.0'E.
b. 68˚23.1'N, 38˚39.9'E.
c. 68˚22.5'N, 38˚39.9'E.

Area No. 100.—Guba Savikha—Lies within an area bounded by lines joining:
a. 68˚14.5'N, 39˚02.9'E.
b. 68˚15.3'N, 39˚05.1'E.
c. 68˚12.9'N, 39˚11.0'E.
d. 68˚12.1'N, 39˚08.8'E.

Area No. 101.—Svyatonosskiy Zaliv—Lies within an area bounded by lines joining:
a. 68˚06.3'N, 39˚27.0'E.
b. 68˚06.7'N, 39˚30.0'E.
c. 68˚04.8'N, 39˚38.5'E.
d. 68˚05.5'N, 39˚40.3'E.
e. 68˚05.3'N, 39˚42.2'E.
f. 68˚07.5'N, 39˚46.1'E.
g. 68˚06.3'N, 39˚47.5'E.
h. 68˚03.2'N, 39˚41.3'E.

Area No. 182.—Kandalakshskly Zaliv—Lies within an area bounded by the shore and lines joining:
a. 66˚36.0'N, 34˚48.2'E.
b. 66˚29.3'N, 34˚41.8'E.
c. 66˚26.2'N, 34˚53.0'E.
d. 66˚28.6'N, 34˚57.0'E.
e. 66˚35.7'N, 34˚52.3'E.

Area No. 133.—Lies within an area bounded by the shore and lines joining:
a. 66˚32.6'N, 34˚15.7'E.
b. 66˚35.0'N, 34˚20.0'E.
c. 66˚35.0'N, 34˚23.7'E.
d. 66˚33.2'N, 34˚27.1'E.
e. 66˚30.7'N, 34˚22.8'E.

Area No. 132.—Lies within an area bounded by the shore and lines joining:
a. 66˚39.4'N, 34˚20.0'E.
b. 66˚39.0'N, 34˚18.0'E.
c. 66˚38.0'N, 34˚08.0'E.
d. 66˚33.0'N, 33˚56.0'E.
e. 66˚30.2'N, 34˚00.0'E.
f. 66˚28.5'N, 34˚07.2'E.
g. 66˚37.0'N, 34˚19.4'E.
h. 66˚39.4'N, 34˚21.0'E.

Area No. 167.—Dvinskiy Zaliv; Port Arkhangel'sk—Lies within an area boundd by lines joining points with the following range/bearing combinations from Chizhovskiye Rear Range Lighted Beacon (64˚41.7'N., 40˚32.3'E.):

026.0˚	722m
020.0˚	945m
031.0˚	1,130m
040.0˚	833m

Area No. 168.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Sredne-Krivyakskiye No. 8 Rear Range Lighted Beacon (64˚41.4'N., 40˚29.1'E.):

013.0˚	1,018m
353.0˚	1,204m
001.0˚	1,389m
017.0˚	1,204m

Area No. 169.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Povrakul Skiye No. 4 Rear Range Lighted Beacon (64˚39.6'N., 40˚31.9'E.):

223.5˚	648m
240.0˚	537m
225.0˚	259m
191.5˚	518m

Area No. 170.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Birzhevoy Lighted Beacon (64˚37.8'N., 40˚31.1'E.):

010.0˚	648m
003.5˚	1,018m
020.0˚	1,185m
031.0˚	833m

Area No. 171.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Amosovskiye Rear Range Lighted Beacon (64˚37.1'N., 40˚29.6'E.):

348.0˚	685m
343.0˚	888m
358.5˚	945m
005.0˚	778m

Area No. 172.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Amosovskiye Rear Range Lighted Beacon (64˚37.1'N., 40˚29.6'E.):

274.75˚	296m
274.0˚	611m
307.0˚	778m
321.5˚	574m

Area No. 109.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Khabarovskiye Rear Range Lighted Beacon (64˚34.8'N., 40˚28.7'E.):

034.5˚	407m
092.0˚	926m
094.5˚	1,148m
123.5˚	1,463m
136.5˚	963m
151.0˚	630m
202.0˚	333m

Area No. 110.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Khecheminskiye Rear Range Lighted Beacon (64˚30.8'N., 40˚30.9'E.):

320.0˚	1.63 miles
332.0˚	1.51 miles
354.5˚	1.48 miles
356.5˚	1.36 miles
333.0˚	1.31 miles
312.0˚	1.54 miles
312.5˚	1.62 miles

Area No. 174.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Khecheminskiye Rear Range Lighted Beacon (64˚30.8'N., 40˚30.9'E.):

284.0˚	3.38 miles
286.0˚	3.80 miles
293.5˚	3.53 miles
290.5˚	3.18 miles

Area No. 175.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Khecheminskiye Rear Range Lighted Beacon (64˚30.8'N., 40˚30.9'E.):

069.0˚	1.01 miles
053.5˚	1.28 miles
069.0˚	1.87 miles
089.5˚	1.62 miles

Area No. 176.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Obratnyye Tralbazovskiye Podkhodnyye Rear Range Lighted Beacon (64˚29.9'N., 40˚38.6'E.):

355.0˚	796m
341.0˚	1,185m
001.0˚	1,482m
022.0˚	1,408m

Area No. 177.—Lies within an area bounded by lines joining points with the following range/bearing combinations from Obratnyye Tralbazovskiye Podkhodnyye Rear Range Lighted Beacon (64˚29.9'N., 40˚38.6'E.):

274.5˚	1.08 miles
281.0˚	1.17 miles
295.0˚	1,537m
290.5˚	1,278m

Area No. 183.—East of Ostrov Zhizhginskiy—Lies within an area bounded by shore and lines joining:

a. 65˚10.0'N, 37˚00.0'E.
b. 65˚11.5'N, 37˚00.0'E.
c. 65˚13.0'N, 36˚53.2'E.
d. 65˚11.9'N, 36˚52.4'E.
e. 65˚12.0'N, 36˚49.9'E. continuing E and N along the coast of Ostrov Zhizhginskiy to
f. 65˚12.6'N, 36˚49.3'E.
g. 65˚18.9'N, 36˚49.3'E.
h. 65˚18.9'N, 37˚06.1'E.
i. 65˚15.9'N, 37˚06.9'E.
j. 65˚15.0'N, 37˚15.5'E.
k. 65˚11.0'N, 37˚32.7'E.
l. 65˚07.1'N, 37˚23.7'E.
m. 65˚10.4'N, 37˚06.6'E.
n. 65˚09.7'N, 37˚05.9'E.

Area No. 102.—Terskiy Bereg—Lies within an area bounded by the shore and lines joining:

a. 67˚43.7'N, 40˚54.8'E.
b. 67˚45.5'N, 40˚56.8'E.
c. 67˚44.6'N, 41˚00.6'E.
d. 67˚42.8'N, 40˚54.8'E.

Area No. 103.—Terskiy Bereg—Lies within an area bounded by lines joining:

a. 67˚24.0'N, 41˚08.6'E.
b. 67˚30.0'N, 41˚04.8'E.
c. 67˚30.0'N, 41˚07.6'E.
d. 67˚24.0'N, 41˚11.6'E.

Area No. 104.—Terskiy Bereg—Lies within an area bounded by lines joining:

a. 67˚08.8'N, 41˚26.1'E.
b. 67˚05.3'N, 41˚28.0'E.
c. 67˚04.7'N, 41˚26.4'E.
d. 67˚08.0'N, 41˚24.6'E.
e. 67˚08.0'N, 41˚23.8'E.
f. 67˚08.7'N, 41˚23.5'E.

Area No. 105.—Terskiy Bereg—Lies within an area bounded by lines joining:

a. 67˚00.6'N, 41˚24.2'E.
b. 66˚55.0'N, 41˚25.9'E.
c. 66˚55.0'N, 41˚23.7'E.
d. 66˚58.0'N, 41˚22.7'E.
e. 66˚58.4'N, 41˚20.5'E.

Area No. 106.—Terskiy Bereg—Lies within an area bounded by the shore and lines joining:
a. 66˚11.3'N, 39˚33.0'E.
b. 66˚09.0'N, 39˚44.3'E.
c. 66˚08.4'N, 39˚41.8'E.
d. 66˚10.8'N, 39˚31.5'E.

Area No. 107.—Terskiy Bereg—Lies within an area bounded by lines joining:
a. 66˚10.7'N, 39˚28.4'E.
b. 66˚10.7'N, 39˚30.5'E.
c. 66˚05.5'N, 39˚28.8'E.
d. 66˚05.5'N, 39˚26.6'E.

Area No. 108.—Ostrov Solovetskiy—Lies within an area bounded by lines joining:
a. 65˚01.0'N, 35˚29.3'E.
b. 65˚01.8'N, 35˚29.2'E.
c. 65˚01.6'N, 35˚38.4'E.
d. 65˚01.0'N, 35˚38.0'E.

Area No. 111.—Onezhskiy Zaliv—Lies within an area bounded by lines joining:
a. 64˚35.2'N, 35˚53.8'E.
b. 64˚35.2'N, 36˚09.5'E.
c. 64˚44.1'N, 36˚09.5'E.
d. 64˚44.1'N, 35˚43.5'E.
e. 64˚41.3'N, 35˚43.5'E.

Area No. 190.—Barents Sea—Northwest entrance to Proliv Kostin Shar—Lies within an area bounded by lines joining:
a. 71˚13.5'N, 52˚21.5'E. (shore)
b. 71˚20.0'N, 51˚35.0'E.
c. 71˚21.1'N, 51˚42.6'E.
d. 71˚27.7'N, 52˚27.6'E. (Mys Morozova)
e. 71˚28.1'N, 52˚37.0'E.
f. 71˚19.4'N, 52˚15.5'E. (Mys Shadrovskiy)

Kara Sea—Reka Yenisey—Northwest of Port Dudinka—Lies within an area bounded by the shore and lines joining:
On the NW:
a. 69˚29.5'N, 85˚55.8'E.
b. 69˚30.5'N, 85˚58.4'E.
On the SE:
a. 69˚28.6'N, 85˚59.1'E.
b. 69˚29.5'N, 86˚00.6'E.

Areas for Dumping Explosives—Anchoring, Trawling, and Operations with Explosives are Not Recommended in These Areas.

Area No. 120.—North of Ostrov Solovetskiy—Lies within an area bounded by lines joining:
a. 65˚45.5'N, 36˚00.0'E.
b. 65˚49.0'N, 36˚12.0'E.
c. 65˚45.5'N, 36˚12.0'E.

Area No. 121.—Northeast of Ostrov Solovetskty—Lies within an area bounded by lines joining:
a. 65˚20.0'N, 36˚30.0'E.
b. 65˚30.0'N, 36˚30.0'E.
c. 65˚30.0'N, 36˚50.0'E.
d. 65˚20.0'N, 36˚50.0'E.

Area No. 134.—Northwest of Ostrov Kolguyev—Lies within an area bounded by a circle, with a radius of 7 miles, centered on position 69˚34.2'N, 47˚56.5'E

Area No. 124.—Kara Sea—Northwest of Ostrov Novaya Zemlya—Lies within an area bounded by a circle, with a radius of 5 miles, centered on position 73˚29.0'N, 58˚18.0'E

Area No. 123.—Kara Sea—Northeast of Ostrov Novaya Zemlya—Lies within an area bounded by lines joining:
a. 77˚00.0'N, 68˚00.0'E.
b. 78˚00.0'N, 68˚00.0'E.
c. 78˚00.0'N, 71˚00.0'E.
d. 77˚00.0'N, 71˚00.0'E.

Appendix II

FORMER MINE AREAS

Prohibited Anchorage—Mined Areas open to surface navigation.—Mine areas previously published in NEMEDRI (withdrawn in 1974) documented lists of known areas where mines were laid during WWII. These areas are now generally known to be safe for surface navigation; however, all mine areas are still considered dangerous for anchoring, trawling, and dragging of anchor.

Area No. 8.—Between Reka Voryema and Guba Pechenga—Lies within an area bounded by lines joining:
a. 69˚47.2'N, 30˚51.1'E.
b. 69˚50.6'N, 30˚52.1'E.
c. 69˚50.6'N, 31˚09.6'E.
d. 69˚48.7'N, 31˚22.8'E.
e. 69˚44.0'N, 31˚36.5'E.
f. 69˚40.5'N, 31˚36.1'E.

Area No. 6.—When entering Guba Bolshaya Volokovaya—Lies within an area bounded by lines joining:
a. 69˚50.3'N, 31˚50.8'E.
b. 69˚53.7'N, 31˚50.8'E.
c. 69˚55.2'N, 31˚44.3'E.
d. 69˚50.3'N, 31˚44.3'E.

Area No. 4.—Along the N coast of Poluostrov Rybachiy—Lies within an area bounded by lines joining:
a. 69˚48.4'N, 32˚40.6'E.
b. 69˚49.2'N, 32˚45.1'E.
c. 69˚56.3'N, 32˚20.1'E.
d. 69˚59.0'N, 32˚03.3'E.
e. 69˚59.0'N, 31˚59.0'E.
f. 69˚57.7'N, 31˚57.4'E.
g. 69˚57.1'N, 32˚04.1'E.
h. 69˚53.2'N, 32˚20.9'E.

Area No. 5.—Northeast of Poluostrov Rybachiy—Lies within an area bounded by lines joining:
a. 70˚12.0'N, 33˚00.0'E.
b. 70˚12.0'N, 34˚00.0'E.
c. 69˚58.0'N, 34˚00.0'E.
d. 69˚58.0'N, 34˚40.0'E.
e. 69˚49.0'N, 34˚40.0'E.
f. 69˚39.0'N, 34˚50.0'E.
g. 69˚35.0'N, 34˚44.0'E.
h. 69˚45.0'N, 33˚35.0'E.
i. 69˚51.0'N, 33˚35.0'E.
j. 69˚54.0'N, 33˚00.0'E.

Area No. 1.—Northwest of Ostrov Kil'din—Lies within an area bounded by the shore, by the parallels of 69˚21'N and 69˚29'N, and by the meridians of 33˚30'E and 34˚10'E.

Area No. 78.—Northeast of Mys Ostraya Ludka—Lies within an area bounded by lines joining:
a. 67˚23.9'N, 41˚12.0'E.
b. 67˚23.9'N, 41˚35.0'E.
c. 67˚30.9'N, 41˚35.0'E.
d. 67˚30.9'N, 41˚12.0'E.

Area No. 79.—Northeast of Reka Pony—Lies within an area bounded by the shore and lines joining:
a. 67˚15.9'N, 41˚05.6'E.
b. 67˚15.9'N, 42˚00.0'E.
c. 67˚12.1'N, 42˚00.0'E.
d. 67˚11.7'N, 41˚48.0'E.
e. 66˚59.9'N, 41˚48.0'E.
f. 66˚59.9'N, 41˚45.0'E.
g. 66˚56.9'N, 41˚45.0'E.
h. 66˚56.9'N, 41˚29.6'E.
i. 66˚59.2'N, 41˚20.6'E.

Area No. 52.—Northwest of Ostrov Morzhovets—Lies within an area bounded by the shore and lines joining:
a. 66˚59.9'N, 41˚45.0'E.
b. 66˚59.9'N, 42˚19.9'E.
c. 66˚49.9'N, 42˚19.9'E.
d. 66˚49.9'N, 41˚45.0'E.

Area No. 51.—Kandalakshskiy Zaliv—Lies within an area bounded by lines joining:
a. 66˚34.0'N, 33˚34.5'E.
b. 66˚39.5'N, 33˚42.2'E.
c. 66˚41.5'N, 33˚33.7'E.
d. 66˚35.9'N, 33˚26.0'E.

Area No. 80.—West of Ostrov Mud'yugskiy—Lies within an area bounded by lines joining:
a. 64˚56.4'N, 40˚03.7'E.
b. 64˚57.1'N, 40˚07.5'E.
c. 64˚54.6'N, 40˚10.0'E.
d. 64˚54.0'N, 40˚06.1'E.

Area No. 80A.—South of Ostrov Mud'yugskiy—Lies within an area bounded by lines joining:
a. 64˚51.0'N, 40˚15.0'E.
b. 64˚50.0'N, 40˚17.1'E.
c. 64˚50.4'N, 40˚17.8'E.
d. 64˚51.2'N, 40˚15.6'E.

Area No. 55.—Mys Kanin Nos—Lies within an area bounded by the shore and lines joining:
a. 68˚40.1'N, 43˚23.9'E.
b. 68˚45.1'N, 43˚23.9'E.
c. 68˚45.1'N, 41˚59.9'E.
d. 68˚38.4'N, 41˚59.9'E.
e. 68˚25.1'N, 42˚41.9'E.
f. 68˚25.1'N, 43˚53.9'E.

Area No. 57.—Between Ostrov Kolguyev and Poluostrov Kanin—Lies within an area bounded by the shore and lines joining:
a. 68˚32.4'N, 45˚11.9'E.
b. 69˚01.9'N, 45˚11.9'E.
c. 69˚01.9'N, 48˚13.3'E.

d. 68˚42.5'N, 48˚29.4'E.
e. 68˚39.9'N, 48˚29.9'E.
f. 68˚39.9'N, 47˚05.9'E.
g. 68˚21.9'N, 47˚05.9'E.
h. 68˚21.9'N, 46˚03.9'E.

Area No. 68.—Northwest of Ostrov Kolguyev—Lies within an area bounded by the shore and lines joining:
a. 69˚16.0'N, 48˚20.1'E.
b. 69˚16.0'N, 47˚53.9'E.
c. 69˚56.0'N, 47˚53.9'E.
d. 69˚56.0'N, 49˚05.9'E.
e. 69˚44.0'N, 49˚08.5'E.
f. 69˚29.7'N, 49˚15.1'E.

Area No. 75.—North of Ostrov Sengeyskiy—Lies within an area bounded by the shore and lines joining
a. 68˚29.2'N, 51˚20.9'E.
b. 68˚42.1'N, 51˚20.9'E.
c. 68˚42.1'N, 50˚38.9'E.
d. 68˚28.1'N, 50˚38.9'E.
e. 68˚28.1'N, 51˚02.2'E.

Area No. 74A.—West of Poluostrov Russkiy Zavorot—Lies within an area bounded by the shore and lines joining:
a. 68˚55.7'N, 51˚58.7'E.
b. 68˚55.7'N, 53˚11.9'E.
c. 68˚50.6'N, 53˚11.9'E.
d. 68˚46.4'N, 52˚56.1'E.
e. 68˚46.4'N, 51˚58.7'E.

Area No. 74.—Lies within an area bounded by lines joining:
a. 68˚55.7'N, 51˚58.7'E.
b. 69˚05.7'N, 51˚58.7'E.
c. 69˚05.7'N, 53˚11.9'E.
d. 68˚55.7'N, 53˚11.9'E.

Area No. 76.—North of Poluostrov Russkiy Zavorot—Lies within an area bounded by lines joining:
a. 69˚04.4'N, 53˚58.4'E.
b. 69˚12.4'N, 53˚58.4'E.
c. 69˚12.4'N, 54˚36.4'E.
d. 69˚04.4'N, 54˚36.4'E.

Area No. 69.—North of Gulyayevskiye Koshki—Lies within an area bounded by lines joining:
a. 69˚09.4'N, 55˚27.1'E.
b. 69˚09.4'N, 55˚52.9'E.
c. 68˚53.4'N, 55˚52.9'E.
d. 68˚53.4'N, 55˚42.9'E.
e. 69˚01.7'N, 55˚27.1'E.

Area No. 77.—North of Ostrov Pesyakov—Lies within an area bounded by lines joining:
a. 68˚57.9'N, 57˚47.1'E.
b. 68˚52.1'N, 58˚00.1'E.
c. 68˚47.0'N, 57˚36.4'E.
d. 68˚50.9'N, 57˚27.1'E.
e. 68˚53.4'N, 57˚27.1'E.

Area No. 62.—West part of Proliv Yugorskiy Shar—Lies within an area bounded by the shore and lines joining:
a. 69˚39.2'N, 59˚59.2'E.
b. 69˚39.9'N, 60˚10.1'E.
c. 69˚33.1'N, 60˚10.1'E.
d. 69˚24.9'N, 59˚37.1'E.
e. 69˚24.9'N, 59˚10.1'E.
f. 69˚36.4'N, 59˚10.1'E.
g. 69˚43.1'N, 59˚27.1'E.
h. 69˚43.1'N, 59˚36.1'E.

Area No. 53.—Bolshaya Srednyaya Koshka—Lies within an area bounded by lines joining:
a. 66˚59.9'N, 41˚48.2'E.
b. 67˚02.9'N, 43˚29.4'E.
c. 67˚14.9'N, 43˚33.4'E.
d. 67˚12.1'N, 42˚00.0'E.

Area No. 70.—Bartents Sea—Ostrov Novaya Zemlya—Guba Belushya—Lies within an area bounded on the E and W by the coastline and by lines joining:
a. 71˚30.1'N, 52˚14.2'E.
b. 71˚31.0'N, 52˚13.8'E.
c. 71˚31.0'N, 52˚20.2'E.
d. 71˚28.8'N, 52˚23.8'E.
e. 71˚27.1'N, 52˚21.5'E.
f. 71˚26.7'N, 52˚19.3'E.
g. 71˚21.7'N, 52˚18.1'E.

Area No. 58.—Barents Sea—West part of Proliv Shar—Lies within an area bounded on the E by the meridian of 54˚16.9'E, by the coastline of the strait, and by lines joining:
a. 73˚16.9'N, 53˚47.6'E.
b. 73˚18.6'N, 53˚47.6'E.
c. 73˚21.6'N, 53˚55.8'E.
d. 73˚21.6'N, 54˚04.4'E.

Area No. 63.—Kara Sea—East part of Proliv Yugorskiy Shara—Lies within an area bounded by lines joining:
a. 69˚47.9'N, 60˚34.2'E.
b. 69˚47.9'N, 60˚39.6'E.
c. 69˚41.4'N, 60˚35.7'E.
d. 69˚41.4'N, 60˚34.1'E.
e. 69˚42.1'N, 60˚30.6'E.

Area No. 73.—Kara Sea—Approaches to Amderma Roadstead—Lies within an area bounded by lines joining:
a. 69˚51.6'N, 61˚06.6'E.
b. 69˚52.4'N, 61˚06.6'E.
c. 69˚52.4'N, 61˚51.1'E.
d. 69˚44.9'N, 61˚51.1'E. and continuing along the coastline to Mys Tonkiy, including Proliv Morozova.

Area No. 72.—Kara Sea—N part of Obskaya Guba—Lies within an area bounded by the shore and boundary lines, as follows:
1. North boundary—A line joining Mys Drovyanoy Obskiy, Mys Shuberta (Ostrov Belyy), and Ostrov Sholkalskiy (73˚01'N., 74˚07'E.).
2. East boundary—The coastline.
3. South boundary—The parallel of 72˚12'N.

4. West boundary—The coastline.

Area No. 65A.—Kara Sea—North of Ostrov Dikson—Lies within an area bounded by the coastline between the extremities of Mys Kregatnik and Mys Neonovvy and lines joining:

a. 73˚31.1'N, 80˚27.8'E.
b. 73˚30.9'N, 80˚31.0'E.
c. 73˚31.9'N, 80˚32.2'E.
d. 73˚34.2'N, 80˚25.2'E.
e. 73˚34.2'N, 80˚16.1'E.
f. 73˚32.1'N, 80˚16.1'E.

Area No. 65B.—Kara Sea—South of Ostrov Dikson—Lies within an area bounded by lines joining:

a. 73˚28.6'N, 80˚32.3'E.
b. 73˚28.6'N, 80˚13.5'E.
c. 73˚25.0'N, 80˚13.5'E.
d. 73˚25.0'N, 80˚39.5'E.

Area No. 71.—Kara Sea—Yeniseyskiy Zaliv—West of Ostrov Krestovskiy—Lies within an area bounded by lines joining:

a. 72˚22.5'N, 80˚22.7'E.
b. 72˚27.3'N, 80˚13.3'E.
c. 72˚29.6'N, 80˚13.3'E.
d. 72˚29.6'N, 80˚34.3'E.
e. 72˚23.7'N, 80˚45.3'E.
f. 72˚22.5'N, 80˚45.3'E.

Appendix III

Russia—Time Zones			
Zone	**City**	**Standard Time**	**Daylight Savings Time**
0	Kaliningrad	BRAVO (-2)	CHARLIE(-3)
1	Moscow, St. Petersburg, Arkhangelsk, Astrakhan	CHARLIE(-3)	DELTA (-4)
2	Samara, Izhevsk	DELTA (-4)	ECHO (-5)
3	Perm, Amderna, Novyy Port	ECHO (-5)	FOXTROT (-6)
4	Omsk, Novosibirsk	FOXTROT (-6)	GOLF (-7)
5	Norilsk, Kyzyl, Dikson	GOLF (-7)	HOTEL (-8)
6	Bratsk, Irkutsk, Ulan-Ude	HOTEL (-8)	INDIA (-9)
7	Yakutsk, Chita, Tiksi	INDIA (-9)	KILO (-10)
8	Vladivostok, Khabarovsk, Okhotsk	KILO (-10)	LIMA (-11)
9	Magadan, Yuzhno	LIMA (-11)	MIKE (-12)
10	Petropavlovsk, Pevek	MIKE (-12)	XRAY (-13)