

Contents

Part I The Northern Sea Route in Global Shipping and History

1 Introduction	3
1.1 Purpose and Scope of the Book	4
1.2 Sea Route and Its Specifics	9
1.3 Shipping Routes of the World	12
1.4 Shipping Routes of the Russian Arctic	14
1.5 Specificity of the Northern Sea Route as a Shipping Lane	19
References	24
2 A Brief History of Navigation on the Northern Sea Route	27
2.1 The Beginnings of Cargo Shipping on the Northern Sea Route	28
2.2 The Period of the Second World War	29
2.3 Shipping on the Northern Sea Route After the Second World War	30
2.4 Creation of Legal Amenities for International Traffic on the Northern Sea Route	32
2.5 The Use of the Northern Sea Route for International Traffic	34
References	36

Part II Environmental Conditions—Bathymetry, Climate and Hydrology

3 Environmental Conditions Affecting the Use of the Northern Sea Route as a Shipping Lane	41
3.1 Bathymetric Conditions of the Russian Arctic Seas	42
3.2 Climatic Conditions of the Russian Arctic Seas and Their Implications for Navigation on the Northern Sea Route	44
3.2.1 Air Temperature	45
3.2.2 Wind	48

3.2.3	Fog and Horizontal Visibility	53
3.2.4	Vessel Icing	55
3.3	Hydrological Conditions of the Russian Arctic Seas and Their Implications for Navigation on the Northern Sea Route.	58
3.3.1	Sea Water Temperature	59
3.3.2	Salinity and Density of Sea Water.	62
3.3.3	Waves	63
3.3.4	Fluctuations of Water Levels and Tides	64
3.3.5	Marine Currents	67
	References	68
4	Sea Ice Occurring on the Seas of the Russian Arctic and Its Impact on Navigating the Northern Sea Route	71
4.1	Sea Ice Characteristics Affecting the Safety and Navigation of Vessels on the Northern Sea Route	72
4.1.1	Concentration and Thickness of the Ice	72
4.1.2	Horizontal Dimensions of Ice Floes.	73
4.1.3	Ice Under Pressure, Ridged Ice and Hummocked Ice.	73
4.1.4	A Vessel's Ability to Overcome Ice	74
4.2	Mean Ice Conditions on the Seas of the Russian Arctic	76
4.2.1	Changes in Ice Cover	76
4.2.2	Drift of Ice.	79
4.2.3	Changes in Ice Cover Concentration	81
4.2.4	Ice Massifs.	82
4.2.5	Ice Cover Thickness	83
4.2.6	Thickness of Snow on Ice	84
4.2.7	Ice Decay.	85
4.3	Long-Term Variability of Ice Cover on Seas of the Russian Arctic	85
4.3.1	The Barents Sea	86
4.3.2	The Kara Sea	86
4.3.3	The Laptev Sea.	88
4.3.4	The East Siberian Sea	89
4.3.5	The Chukchi Sea	91
4.3.6	The Bering Sea.	92
4.3.7	Length of Ice-Free Season	92
4.4	Long-Term Variability of the Ice-Free Season on the Seas of the Russian Arctic	95
	References	98

Part III Technical Conditions—Vessels, Infrastructure, Routes and Nodal Points

5 Technical Conditions Affecting the Use of the Northern Sea Route as a Shipping Lane	103
5.1 Technical Requirements Placed on Vessels	
Using the Northern Sea Route.	104
5.1.1 Ice Class and Polar Class Vessels	105
5.1.2 Propulsion Power and Fuel Consumption	106
5.1.3 Vessel Speed in Ice.	111
5.2 Transport and Navigation Infrastructure on the Northern Sea Route.	112
5.2.1 Location of Ports	112
5.2.2 Fuel Provisions and Ship Repairs	121
5.2.3 Emergency Preparedness and Rescue.	122
5.2.4 Navigation Infrastructure Along the Route	123
5.2.5 Availability of Charts, Nautical Publications and Information on Current Ice and Hydrometeorological Conditions	125
References	128
6 Variants of the Northern Sea Route	131
6.1 Route Location	134
6.1.1 Transit Routes	135
6.1.2 Route Recommendations for Particular Seas	136
6.2 Narrow Passages—Nodal Points of the Northern Sea Route	146
References	150

Part IV Current and Future Accessibility of the Northern Sea Route—Expectations and Reality

7 Route Selection on the Northern Sea Route Under Continuously Changing Ice Conditions	155
7.1 Principles of Route Selection During the Navigation Season.	156
7.2 Routing of a Vessel on the Northern Sea Route in Real Ice Conditions	161
7.2.1 Selection of Bathymetric Maps and Ice Maps for the Simulation	161
7.2.2 Parameters of the Vessel Selected for the Simulation.	164
7.2.3 Voyage Cost.	166
7.2.4 Simulation Procedure for Voyage Planning and Plan Implementation Monitoring	168
7.3 Inception of Regular Shipping on the Northern Sea Route	177
References	178

8 The Possibility of Using the Northern Sea Route in the Light of Climate Change Scenarios	181
References	192
9 Summary and Conclusions.	195
Appendix A	201
Appendix B	207
Appendix C	211
Index—English	215
Index—Russian	219

<http://www.springer.com/978-3-319-41832-2>

The Northern Sea Route as a Shipping Lane
Expectations and Reality

Pastusiak, T.

2016, XXXIX, 219 p. 58 illus., 46 illus. in color.,
Hardcover

ISBN: 978-3-319-41832-2