



CONTENTS

About the authors	9
Foreword by Robert Christopherson	11
Acknowledgements	13
1. Introduction: The lure of the icy seascapes	17
2. The Arctic's geography in a nutshell	23
An ocean surrounded by land	23
Where are the Arctic's boundaries?	25
The meaning of the Arctic Circle	26
How big is the Arctic area?	27
3. The Arctic climate	31
Less solar radiation, more reflection	31
The radiation balance and the supply of heat	32
The more northerly, the colder and dryer	33
Where do we find the lowest temperatures?	35
4. Climate change in the Arctic	39
Why is the increase in temperature more evident in the Arctic?	39
Climate change and the Arctic people	42
The influence of changes in the Arctic on the climate at lower latitudes	43
Is what is happening in the Arctic really that bad?	45

5. The sea ice	49
About water	50
How sea water freezes	50
From ice crystal to first-year pack ice	52
Multi-year pack ice	53
Movements of sea ice in space and time	57
Temperature gradient and salt concentrations in the ice	58
Open water amid sea ice: the polynya	60
Freshwater mountains in the sea: icebergs	61
6. Algae and grazers in the sea ice ecosystem	65
A piece of ice alive with all kinds of beings	65
Single-celled life as the basis of the sea ice ecosystem	66
The growth and production of algae in the sea ice	68
Sea ice algae also need nutrients	69
The ice algae bloom and their release from the melting ice	69
Sea algae play a role in atmospheric processes	70
The grazers of the sea ice algae	70
Two separate algae blooms fuel the grazing animals	71
Zooplankton as a link between algae and higher trophic levels	71
<i>Calanus</i> copepods as bulk food for fish, birds, whales	72
Copepods as food for the Little Auk	75
A small fish with a great influence: the Polar Cod	76
A companion to warming: the acidification of the ocean	79
7. How do birds and mammals cope with the cold?	83
Stay or go	83
Heat production and brown fat	84
The difficult balance between heat loss and production	86
Thermal bridges and insulation	86
Sea mammals need a thick fat layer	87
A heat exchanger	87
Body volumes and surfaces	88
The meanings of colours	89
Hibernation?	89

8. Sea ice loss and Arctic seabirds	93
Arctic ice-associated seabirds	93
The Spectacled Eider	94
Least Auklet	94
Crested Auklet	95
The Black Guillemots of Cooper Island	96
Brünnich's Guillemots	100
The elusive Ivory Gull	101
Ross's Gull: the mystery of the Arctic	104
9. Impacts of declining sea ice on Arctic marine mammals	109
Walrus: the tooth walker	109
Lack of sea ice	111
Ringed seals	113
Bearded seals	115
Harp seals	117
Moving north?	119
Whales of the Arctic sea ice	119
Bowhead Whale	120
Beluga or White Whale	121
The Narwhal: unicorn of the ice	122
Reduced sea ice: more assaults	122
10. Apex predator: the Polar Bear	127
Taxonomy	128
The early years	129
Speciation is underway	131
The 'ice bear' cometh	132
Fossil record, classification and taxonomy	133
Surviving the earlier warmer periods	137
11. Population ups, downs & whereabouts	147
Where do Polar Bears live in this seasonal landscape?	149
The subpopulation regions: the bears' home ranges	151
Roaming the regions	153
Svalbard Archipelago in the Barents Sea	154

Bears of the Greenland pack ice	158
Hudson Bay: the best-studied Polar Bears in the Arctic	159
The Beaufort sea and the Chukchi Sea Polar Bears	166
12. Reproduction, denning & cub rearing	173
The mating season	174
Pregnant bears move ashore and make dens	178
Declining and unstable pack ice	180
Birthing and external pregnancy	184
Leaving the den and the hunt for food	186
Mother bear as teacher	189
13. Hunting strategies and food	197
Top of the menu: seals	197
Hunting methods on the ice	198
The still hunt	199
Stalking on the ice	201
Aquatic stalking	203
Sense of smell	206
Hunt timing issues	206
Alternative food sources	209
Potential food trapped in the ice	211
Bears stranded on land where living is not easy	213
Food at a dead end	218
14. Additional assaults on the Polar Bear	223
Contamination	223
Why is a threatened species still harvested?	227
The Future Polar Bear: a reflection	231
References	234