

Contents

1	Introduction	1
	U. SOMMER, B. WORM	
1.1	The Intellectual Debate Until 1990	2
1.2	Progress During the Last Decade	3
1.3	Consequences for the Structure of the Book	4
	References	4
2	Competition in Well-Mixed Habitats: From Competitive Exclusion to Competitive Chaos	7
	J. PASSARGE, J. HUISMAN	
2.1	Introduction	7
2.2	Competition for a Single Abiotic Resource	9
2.2.1	Growth of a Single Species	9
2.2.2	Competitive Interactions	11
2.2.3	Competition for Light	13
2.3	Resource Storage	15
2.3.1	A Competition Model Based on Storage	15
2.3.2	Storage in a Constant Environment	16
2.3.3	Storage in a Variable Environment	17
2.4	Competition for a Single Biotic Resource	18
2.5	Competition for Two Resources	21
2.5.1	Essential vs. Substitutable Resources	21
2.5.2	Abiotic Resources	22
2.5.3	Biotic Resources	25
2.6	Competition for Three Resources	28
2.6.1	Competitive Oscillations	28
2.6.2	Competitive Chaos	30
2.7	Discussion	34
	References	38

3	Spatial Models of Competition	43
	C.A. KLAUSMEIER, D. TILMAN	
3.1	Introduction	43
3.2	Implicitly Spatial Models	45
3.2.1	Single Species Model	45
3.2.2	Two Species Models	46
3.2.3	Conclusions	56
3.3	Explicitly Spatial Models	57
3.3.1	Interacting Particle Systems	57
3.3.2	Point Process Models	59
3.3.3	Pair Approximation and Moment Methods	60
3.3.4	Reaction-Diffusion Models	61
3.4	Comparing and Connecting Methods	64
3.5	Underlying Spatial Heterogeneity	67
3.5.1	Reaction-Diffusion Models	67
3.5.2	Neighborhood Models	68
3.5.3	Patch Models	68
3.5.4	Conclusions	70
3.6	Competition and Coexistence	70
3.7	Future Directions	72
3.7.1	More Work on Environmental Heterogeneity	72
3.7.2	Combining Population and Ecosystem Perspectives	73
3.7.3	Competition for Light Among Terrestrial Plants	73
3.7.4	Evolution and Community Assembly	74
	References	75
 4	 Competition and Coexistence in Plankton Communities . .	 79
	U. SOMMER	
4.1	Introduction	79
4.1.1	What Makes Plankton Competition Special?	79
4.1.2	The Chemostat as an Experimental System	80
4.2	Competition Experiments in Laboratory Microcosms	84
4.2.1	Competition Experiments Under Constant Conditions	84
4.2.2	Competition Experiments Under Temporally Variable Conditions	89
4.3	Experiments in Field Mesocosms	94
4.4	Tests of the Intermediate Disturbance Hypothesis by Field Data	98
4.5	Herbivory and Diversity	101

4.6	The Role of Abundance and of Seasonality	102
4.7	Conclusions	104
	References	105
5	Competition and Coexistence in Mobile Animals	109
	M. RITCHIE	
5.1	Introduction	109
5.2	Competition Among Mobile Animals	111
5.3	Heterogeneity, Trade-Offs, and Competition	118
5.4	Scale and Heterogeneity	120
5.5	New Challenges	126
	References	128
6	Competition, Coexistence and Diversity on Rocky Shores	133
	B. WORM, R. KAREZ	
6.1	Introduction	133
6.1.1	What Distinguishes Rocky Shores from Other Communities?	133
6.1.2	Evolution of Competition Theory	136
6.2	Disruption of Competitive Exclusion: The Non-Equilibrium View	137
6.2.1	Keystone Predation and Herbivory	137
6.2.2	Strong vs. Weak Interactions	140
6.2.3	The Effects of Physical Disturbance	141
6.3	Coexistence Through Trade-Offs: The Equilibrium View	144
6.3.1	The Resource-Ratio Hypothesis	145
6.3.2	The Competitive Hierarchy Hypothesis	147
6.3.3	Intransitive Competitive Networks	149
6.4	Synthesis: Integrating the Effects of Competition, Consumption and Disturbance	152
6.4.1	Consumer vs. Resource Control of Species Diversity	152
6.4.2	An Integrated Competition Model	153
6.5	Conclusion	157
6.5.1	Unifying Competition Theory	157
6.5.2	Competition, Coexistence and the Human Impact	157
	References	158

7	Competition and Coexistence in Terrestrial Plants	165
	J. FARGIONE, D. TILMAN	
7.1	Introduction	165
7.2	Competition	166
7.2.1	Resource Competition	166
7.2.2	For Which Resources Do Species Compete?	173
7.2.3	Physiological and Morphological Mechanisms of Competition	175
7.2.4	Competition Summary	180
7.3	Coexistence	181
7.3.1	Neutral Theory of Biodiversity	181
7.3.2	Spatial Heterogeneity	183
7.3.3	Competition-Colonization Trade-Off	188
7.3.4	Temporal Variability	192
7.3.5	Additional Trophic Levels	194
7.3.6	Multiple Mechanisms of Coexistence and Limits to Diversity	196
7.3.7	Coexistence Summary	197
7.4	Conclusion	198
	References	198
 8	 Synthesis: Back to Santa Rosalia, or No Wonder There Are So Many Species	 207
	U. SOMMER, B. WORM	
8.1	Trade-Offs	208
8.2	Disturbance, Predation and Competition	209
8.3	The Spatial Dimension	210
8.4	Self-Generated Heterogeneity	211
8.5	Exclusive Resources	212
8.6	Slow Exclusion	213
8.7	Equilibrium vs. Non-Equilibrium Concepts	213
8.7.1	The Semantic Problem	214
8.7.2	The Scale Problem	215
8.8	Future Challenges	216
	References	217
 Subject Index		 219