

Contents

Introduction	1
K. Reise	

Part I Suspension Feeders in Coastal Mud and Sand

1 Benthic Suspension Feeders as Determinants of Ecosystem Structure and Function in Shallow Coastal Waters	11
R. Dame, D. Bushek, T. Prins	
1.1 Introduction	11
1.2 Reefs and Beds	12
1.2.1 Bivalve Molluscs (Bivalvia)	12
1.2.2 Vermetids (Gastropoda)	21
1.2.3 Sabellids (Polychaeta)	22
1.2.4 Serpulids (Polychaeta)	23
1.3 Encrustations	24
1.4 Species Groups	24
1.5 Discussion	26
References	31
2 Dynamics of Spatial and Temporal Complexity in European and North American Soft-Bottom Mussel Beds	39
J.A. Committo, N.M.J.A. Dankers	
2.1 Introduction	39
2.2 The Dynamic Nature of Mussel-Bed Structure	40
2.3 Quantifying Mussel-Bed Structure Using Fractal Geometry	44

2.4	Effects of Mussel Beds on Soft-Bottom Community Structure	46
2.5	Mechanisms of Mussel-Bed Impacts on Soft-Bottom Community Structure	50
2.6	Top-Down vs. Bottom-Up Control of Soft-Bottom Mussel-Bed Community Structure	52
2.7	Conclusions	54
	References	54
3	Suspension Feeders on Sandy Beaches	61
	E. Jaramillo, M. Lastra	
3.1	Introduction	61
3.2	Beach Morphodynamic Types vs. Community Structure of the Macrofauna	64
3.3	Beach Morphodynamic Types and Abundances and Population Biology of <i>E. analoga</i>	67
3.4	Tidal Movements and Burrowing Behaviour	68
3.5	Across- and Along-Shore Zonation	68
3.6	Conclusions	70
	References	70
4	Switching Between Deposit and Suspension Feeding in Coastal Zoobenthos	73
	H.U. Riisgård, P. Kamermans	
4.1	Overview	73
4.1.1	Polychaetes	75
4.1.2	Echinoderms	80
4.1.3	Bivalves	81
4.1.4	Amphipods	82
4.1.5	Soft Corals	83
4.1.6	Most Examples Among Passive Suspension Feeders	84
4.1.7	Adaptation to Suspension Feeding	84
4.2	Example I: Switching to Suspension Feeding in <i>Nereis diversicolor</i>	85
4.2.1	Suspension-Feeding Behaviour	86
4.2.2	Mucus-Net and Particle-Retention Efficiency	86
4.2.3	Filtration Rates	87
4.2.4	Energy Cost of Pumping	87

Contents	IX
4.2.5 Adaptation to Suspension Feeding	88
4.2.6 Time Spent on Suspension Feeding	88
4.2.7 Phytoplankton Reduction in Near-Bottom Water	89
4.3 Example II: Switching to Suspension Feeding in <i>Macoma balthica</i>	90
4.3.1 Switching to Suspension Feeding	91
4.3.2 Current Velocity	92
4.3.3 Food Availability	92
4.3.4 Feeding on Siphon Tips	94
4.3.5 Protection Against Lethal Predation	94
4.4 Conclusions	95
References	95

Part II Biogenic Stabilization and Disturbances in Coastal Sediments

5 Microphytobenthos in Contrasting Coastal Ecosystems: Biology and Dynamics	105
D.M. Paterson, S.E. Hagerthey	
5.1 Contrasting Shores	105
5.2 The Microphytobenthos	105
5.3 Physical and Biological Sediment Properties	107
5.3.1 Sediment Types and Stability	107
5.3.2 Physical Dynamics	109
5.4 Redefining Intertidal Sediments – The Five Phases of Depositional Environments	112
5.5 Comparative Biodiversity	113
5.5.1 Non-cohesive Sediments	114
5.5.2 Cohesive Sediments	115
5.5.3 Niche Diversity	116
5.6 Sediment Stability	118
5.7 Conceptual Model	119
5.8 Conclusions	121
References	121
6 Sediment Dynamics by Bioturbating Organisms	127
G.C. Cadée	
6.1 Introduction	127
6.2 History of Bioturbation Research	130

6.3	Types of Bioturbation	132
6.3.1	Crawling and Dwelling Traces	132
6.3.2	Deposit Feeders	133
6.3.3	Larger Predators and Grazers	134
6.4	Seasonal Variation	138
6.5	Latitudinal Variation	139
6.6	Changes in Historical Times	141
6.7	Conclusions	142
	References	143

7 **Competitive Bioturbators on Intertidal Sand Flats in the European Wadden Sea and Ariake Sound in Japan** 149
E. Flach, A. Tamaki

7.1	Introduction	149
7.2	Large Bioturbators	150
7.3	Lugworms in the Wadden Sea	151
7.4	Effects of Lugworms on the Benthic Community	153
7.5	Ghost Shrimps in the Ariake Sound Estuarine System in Japan	158
7.6	Effects of the Ghost Shrimp Expansion and Decline	163
7.6.1	Effects on Sediment Properties	163
7.6.2	Effects on Invertebrates	164
7.7	Comparisons Between Biogeographic Regions	165
	References	168

8 **Biological and Physical Processes
That Affect Saltmarsh Erosion and Saltmarsh Restoration:
Development of Hypotheses** 173
R.G. Hughes

8.1	Introduction	173
8.2	Managed Realignment	178
8.2.1	Physical Factors	178
8.2.2	Biological Factors	179
8.2.2.1	Effects of the Flora	179
8.2.2.2	Effects of Invertebrates	180
8.3	Managing Sediment Accretion and Development of Saltmarsh Vegetation in Managed Realignment Sites	182
8.3.1	Physical Factors	182

Contents	XI
8.3.2 Biological Factors	183
8.4 Loss of Saltmarsh Vegetation by Lateral Erosion of Creeks	185
8.5 Managing Reduction of Lateral Creek Erosion	187
8.6 Conclusions	189
References	190

Part III Seagrasses and Benthic Fauna of Sediment Shores

9 Common Structures and Properties of Seagrass Beds Fringing the Coasts of the World	195
C. den Hartog, R.C. Phillips	
9.1 Introduction	195
9.2 Distribution and Zonation	195
9.3 Structure of the Seagrass Community	199
9.4 Seagrass Production	202
9.5 Seagrass Dynamics	204
9.6 Worldwide Decline of Seagrass Beds	205
9.7 Conclusions	208
References	208
10 The Leaf Canopy of Seagrass Beds: Faunal Community Structure and Function in a Salinity Gradient Along the Swedish Coast	213
S.P. Baden, C. Boström	
10.1 Introduction	213
10.1.1 <i>Zostera marina</i> (L.)	213
10.1.2 Aims of the Study	214
10.2 Features of the Study Area	215
10.2.1 Effects of Salinity	215
10.2.2 Physical Settings and Substrate Characteristics	217
10.3 Methods	219
10.3.1 Vegetation and Leaf Canopy Fauna	219
10.3.2 Predators	220
10.4 Results	220
10.4.1 <i>Zostera marina</i> : Standing Stock and Leaf Area	220
10.4.2 Leaf Fauna	222

10.4.3	Couplings Between Leaf Fauna and Infauna	227
10.4.4	Predators	228
10.5	Concluding Remarks	230
References	231

**11 Energy Flow in Benthic Assemblages of Tidal Basins:
Ria Formosa (Portugal)
and Sylt-Rømø Bay (North Sea) Compared** 237
M. Sprung, H. Asmus, R. Asmus

11.1	Introduction	237
11.2	Description of the Sites	239
11.3	Material and Methods	241
11.3.1	Primary Production	241
11.3.2	Secondary Production	242
11.4	Production	243
11.4.1	Primary Production	243
11.4.2	Secondary Production	245
11.5	Energy Flow and Nutrient Cycle	248
References	251

**12 Soft-Bottom Fauna of a Tropical (Banc d'Arguin,
Mauritania) and a Temperate
(Juist Area, German North Sea Coast) Intertidal Area . . . 255**
H. Michaelis, W.J. Wolff

12.1	Introduction	255
12.2	Areas, Materials and Methods	256
12.3	Results	260
12.3.1	Habitat Division	260
12.3.2	Faunal Inventories	261
12.3.3	Structure and Distribution of Macrozoobenthos Assemblages	261
12.4	Discussion	268
References	272

13	Tropical Tidal Flat Benthos Compared Between Australia and Central America	275
S. Dittmann, J.A. Vargas		
13.1	Introduction	275
13.2	Tropical Tidal Flats in Australia and Central America	277
13.3	Species Diversity and Abundance	279
13.3.1	Species Richness in Tropical Tidal Flats	279
13.3.2	Similarity in Taxonomic Compositions	281
13.3.3	Individual Abundances	282
13.4	Community Structure and Distribution	284
13.4.1	Spatial Zonation Along Environmental Gradients	284
13.4.2	Trophic Groups	284
13.4.3	Species Interactions	286
13.4.3.1	Promotive Interactions	286
13.4.3.2	Repressive Interactions	288
13.5	Conclusions	289
References		290

Part IV Structural Dynamics and Trophic Supplies to Sedimentary Shores

14	Recovery Dynamics in Benthic Communities: Balancing Detail with Simplification	297
S.F. Thrush, R.B. Whitlatch		
14.1	Introduction	297
14.2	Searching for Generality Part I	299
14.3	Some General Mechanisms Influencing Recovery	301
14.3.1	Seasonality	301
14.3.2	Hydrodynamics	301
14.3.3	Mobility	302
14.3.4	Opportunistic Responses	302
14.3.5	Biotic Interactions	303
14.4	Searching for Generality Part II	304
14.5	Critical Scales of Disturbance and Recovery Dynamics	306
14.6.	Recovery: a Useful Tool for Assessing Broad-Scale and Cumulative Effects?	309
14.7	Searching for Generality Part III: the Need to Improve the Information Base	310

14.8	Conclusions	310
References		311
15	Population Dynamics of Benthic Species on Tidal Flats: the Possible Roles of Shorebird Predation	317
	J. van der Meer, T. Piersma, J.J. Beukema	
15.1	Introduction	317
15.2	Production-Consumption Comparisons	317
15.3	The Balgzand Area: a Long-Term Study	319
15.4	Long-Term Variability in Production and Consumption at the Balgzand	320
15.5	Density-Dependent Survival?	324
15.6	Recruitment and the Regulation of Populations	326
15.7	The Scale of Population Studies	329
15.8	Exclosure Experiments	329
15.9	Conclusions	330
References		332
16	Experimental Approaches to Integrating Production, Structure and Dynamics in Sediment Communities . . .	337
	D. Raffaelli, M. Emmerson	
16.1	Introduction	337
16.2	Effects of Production Subsidies on Food Chain Dynamics	340
16.2.1	Effects of Subsidised Primary Producers	341
16.2.2	Effects of Subsidised Predators	343
16.3	Production and Body-Size Distributions	343
16.3.1	Constraint Space Plots	344
16.3.2	Biomass Size Spectra	345
16.4	Production and Biodiversity	347
16.5	Conclusions	350
References		350

Contents	XV
Synthesis: Comparative Ecology of Sedimentary Shores	357
K. Reise	
 Suspension Feeders	357
Biogenic Stabilization and Disturbances	361
Seagrasses and the Benthic Fauna	361
Dynamic Structures and Trophic Supplies	367
General Conclusions	369
References	371
 Species Index	373
 Subject Index	379