

TABLE OF CONTENTS

Chapter 1. Introduction	1
Chapter 2. Beaches and Tidal Flats	13
2.1 Introduction	13
2.2 Food Chains, Energy, and Carbon Flow	15
2.2.1 Open Ecosystems	15
2.2.1.1 Sandy Beaches/Surf-Zone Systems	15
2.2.1.2 Tidal Flats and Mudbanks	22
2.2.1.3 Sediment Bacteria: Aerobic Links, Anaerobic Sinks	26
2.2.2 Closed Ecosystems	31
2.3 Nitrogen Cycling	35
2.3.1 Microbial Mats on Mudflats	36
2.3.2 Nitrogen Budgets	36
2.4 Linkages to Physical Processes	39
2.4.1 Water-Sediment Interactions: Effects of Tides, Waves, and Storms	39
2.4.2 Exchanges with Land and Sea	41
Chapter 3. Mangroves and Salt Marshes	43
3.1 Introduction	43
3.2 Global Trends in Plant Biomass and Primary Production	44
3.3 Factors Limiting Plant Production and Growth	50
3.3.1 Temperature and Light	50
3.3.2 Salinity	51
3.3.3 Anoxia and Water Movement	52
3.3.4 Bioturbation	55
3.3.5 Nutrient Availability	55
3.4 Food Webs and Decomposition Processes	58
3.4.1 Grazing Food Webs	59
3.4.1.1 Herbivory on Plant Tissue	59
3.4.1.2 Direct Consumption of Algal and Vascular Plant Matter	60

3.4.2	Decomposer Food Webs	63
3.4.2.1	Direct Consumption of Litter	64
3.4.2.2	Decomposition of Leaves, Roots, Shoots, and Wood	66
3.4.2.3	Sediment Carbon Cycling	71
3.4.2.4	Pelagic Detrital Processes	75
3.5	Nitrogen Flow	78
3.5.1	Nitrogen Flow Through Plants and Sediments	78
3.5.2	Nitrogen Budgets for Whole Ecosystems	83
3.6	Outwelling	87
<i>Chapter 4: Seaweed and Seagrass Ecosystems</i>		93
4.1	Introduction	93
4.2	Standing Crop and Primary Productivity	94
4.2.1	Seagrasses	94
4.2.2	Seaweeds	98
4.3	Photosynthesis and Whole-Plant Carbon Balance	99
4.4	Limiting Factors	101
4.4.1	Carbon Sources and Metabolism	101
4.4.2	Light and Temperature	103
4.4.3	Salinity	103
4.4.4	Water Movement	104
4.4.5	Nutrients	106
4.5	The Role of Grazers	109
4.5.1	Consumers of Living Macrophytes	110
4.5.2	Consumers of Periphyton	111
4.6	Detritus and Mineralization Processes	114
4.6.1	Detritus Composition and Decomposition	114
4.6.2	Benthic Mineralization and Plant-Microbe Relations	120
4.6.3	Benthic Detritivory	126
4.6.4	Detritus Mineralization in Overlying Water	126
4.6.5	Consumption of Pelagic Detrital-Microbial Aggregates	127
4.7	Ecosystem Budgets	130
4.8	Carbon Balance: Export and Links to Adjacent Systems	135
<i>Chapter 5. Coral Reefs</i>		139
5.1	Introduction	139
5.2	Sources of Carbon Production	140
5.2.1	Coral Photosynthesis and Calcification	140
5.2.1.1	Rates and Mechanisms	140
5.2.1.2	Limitations	142

5.2.2	Free-Living Primary Producers	145
5.3	The Fate of Organic Matter	149
5.3.1	Herbivory, Carnivory, and Mixotrophy	149
5.3.2	Detritus and Detritivory	154
5.3.2.1	Detritus Sources and Fluxes	154
5.3.2.2	The Role of Sediment Bacteria	157
5.3.2.3	The Role of Pelagic Bacteria	160
5.4	Nitrogen and Phosphorus: Cycles and Limitation	163
5.4.1	Nitrogen	164
5.4.2	Phosphorus	167
5.5	The Coral Factory: Carbon and Energy Budgets	169
5.6	Systems-Level Perspectives: Models and Budgets	173
5.6.1	Recent Models of Energy and Carbon Flow: What Do They Tell Us?	173
5.6.2	Mass Balance Estimates: Are Coral Reefs Sources or Sinks for Carbon?	175
5.7	The Role of Coral Reefs in the Tropical Biosphere	181
<i>Chapter 6. The Coastal Ocean I. The Coastal Zone</i>		183
6.1	Introduction	183
6.2	The Coastal Ocean Defined	183
6.3	What Is an Estuary?	185
6.4	Hydrographic Classification of Coastal Systems	186
6.5	Coastal Plain Estuaries, Tidal Lagoons, and Bays (Types IV, V, VI)	187
6.5.1	Pelagic Processes	188
6.5.1.1	Sources of Primary Production and Regulatory Factors	188
6.5.1.2	Nutrient and Food Web Dynamics	192
6.5.2	Benthic Processes	199
6.5.2.1	Sources and the Composition of Sediment Organic Matter	199
6.5.2.2	Detrital Food Chains	201
6.5.2.3	Mineralization of Organic Matter	203
6.5.3	Whole-System Budgets and Fisheries Yield: Some Perspectives	211
6.5.3.1	Benthic-Pelagic Coupling	211
6.5.3.2	Carbon and Nitrogen Budgets: Trophic Inferences	214
6.5.3.3	Factors Regulating Coastal Fisheries	218
6.6	Coastal Lagoons (Type VII)	219
6.6.1	Pelagic Food Chain Dynamics	220
6.6.2	Benthic Processes	223

6.6.3	Whole-Lagoon Budgets and Fisheries Implications	226
6.7	River-Dominated Systems (Types I, II, and III).....	230
6.7.1	Global Estimates of River Loads	230
6.7.2	River Deltas With and Without Coastal Barriers (Types I and II)	231
6.7.3	Tidal Rivers and Their Dominance in the Tropical Ocean (Type III)	239
6.7.3.1	Physical Characteristics	242
6.7.3.2	Pelagic Processes.....	243
6.7.3.3	Benthic Processes and Potential Fishery Connections	247
<i>Chapter 7. The Coastal Ocean II. The Shelf Proper and Shelf Edge</i>		255
7.1	Introduction	255
7.2	Shelf-Sea Fronts	258
7.3	Along- and Across-Shelf Gradients	261
7.3.1	The North Sea	262
7.3.2	Eastern North American Shelf	268
7.3.2.1	The Acadian Province	268
7.3.2.2	The Virginian Province	275
7.3.2.3	The Carolinian Province	281
7.3.3	The Bering and Chukchi Seas	283
7.3.4	The Great Barrier Reef Shelf	291
7.3.5	Other Tropical Continental Margins: The West African and Sunda Shelves	297
7.4	Processes at the Shelf Edge	299
7.4.1	Wind-Driven, Coastal Upwelling	299
7.4.2	Export to the Deep Ocean: The Tropics Revisited	308
7.5	Nutrient Cycles and Global Change in the Coastal Ocean	311
7.5.1	Mass Balance Estimates and Ocean-Atmospheric Exchanges	311
7.5.2	Accumulation and Preservation of Organic Carbon	317
7.5.3	Are Coastal Ecosystems Net Heterotrophic or Net Autotrophic?	319
7.6	Global Estimates of Fishery Yields to Humans	321
<i>Chapter 8. Degradation and Conservation</i>		325
8.1	A Glimpse at the Global Problem	325
8.2	Eutrophication	328

8.3	Habitat Modification and Destruction	334
8.4	Restoration Attempts: Problems and Progress	340
8.4.1	Seagrass Beds	340
8.4.2	Mangrove Forests	341
8.4.3	Salt Marshes	344
8.5	Sustainability: Implications for Management	345
8.6	Conservation: Tools and Impediments	349
8.7	Global Climate Change: Coastal Implications	353
8.8	A Final Remark	356
<i>References</i>		359
<i>Index</i>		399