

Contents

VOLUME 2

CHAPTER 9	FISH RESOURCES OF THE GULF OF MEXICO	869
9.1	Introduction	869
9.2	Overview of the Gulf of Mexico Ecosystem for Finfish	878
9.2.1	Key Environmental Variables Influencing Spatiotemporal Dynamics of Fish Populations	879
9.2.2	The Fish Community in the Gulf of Mexico	881
9.3	Population Dynamics of Key Finfish Species of Ecological, Commercial, and Recreational Importance	884
9.3.1	Snappers (Family Lutjanidae)	885
9.3.2	Menhaden: Gulf Menhaden (<i>Brevoortia patronus</i>), Finescale Menhaden (<i>Brevoortia gunteri</i>), and Yellowfin Menhaden (<i>Brevoortia smithi</i>)	896
9.3.3	Groupers (Family Serranidae, Subfamily Epinephelinae)	904
9.3.4	Atlantic Bluefin Tuna (<i>Thunnus thynnus</i>)	913
9.3.5	Atlantic Blue Marlin (<i>Makaira nigricans</i>)	923
9.3.6	Atlantic Swordfish (<i>Xiphias gladius</i>)	931
9.3.7	Atlantic Sailfish (<i>Istiophorus albicans</i>)	939
9.3.8	Red Drum (<i>Sciaenops ocellatus</i>)	947
9.3.9	Tilefish (<i>Lopholatilus chamaeleonticeps</i>)	954
9.3.10	King Mackerel (<i>Scomberomorus cavalla</i>)	961
9.3.11	Dolphinfish (<i>Coryphaena hippurus</i>)	969
9.3.12	Striped Mullet (<i>Mugil cephalus</i>)	975
9.3.13	Greater Amberjack (<i>Seriola dumerili</i>)	980
9.4	Population Dynamics of Shark and Ray Species	986
9.4.1	General Introduction	986
9.4.2	Stock Assessment and Management History	988
9.4.3	Small Coastal Sharks Group	989
9.4.4	Large Coastal Sharks Group	992
9.4.5	Pelagic Sharks Group	998
9.4.6	Prohibited Sharks	999
9.4.7	Rays and Skates	1002
9.5	Summary	1004
	References	1008

CHAPTER 10 COMMERCIAL AND RECREATIONAL FISHERIES OF THE GULF OF MEXICO	1039
10.1 Introduction	1039
10.2 The Management Process at Its Base	1040
10.2.1 Federal Oversight: National Oceanic and Atmospheric Administration	1041
10.2.2 State Agency Management	1041
10.2.3 Gulf States Marine Fisheries Commission	1041
10.3 Gulf of Mexico Commercial Fisheries in Aggregate	1042
10.3.1 Gulf of Mexico Landings	1042
10.3.2 Aggregate Landings by State	1046
10.3.3 Catch by Distance from Shore	1047
10.3.4 Dockside Value of Landings	1048
10.3.5 Processing Plants and Related Employment	1049
10.3.6 Economic Impact of Gulf of Mexico Commercial Fishing	1050
10.3.7 Commercial Fisheries of State Managed Species	1052
10.3.8 Additional Detail on Key Commercial Species	1056
10.3.9 Additional Detail on Processing and Wholesaling	1100
10.4 The Gulf of Mexico Recreational Sector	1107
10.4.1 Expenditures and Multipliers	1109
10.4.2 Gulf of Mexico Fishing Activities	1111
10.4.3 Recreational Activities at the State Level	1141
10.5 Summary	1175
References	1183
CHAPTER 11 SEA TURTLES OF THE GULF OF MEXICO	1189
11.1 Introduction	1189
11.1.1 Generalized Life History of Gulf of Mexico Sea Turtles	1190
11.1.2 Historical Abundance of Gulf of Mexico Sea Turtles	1191
11.1.3 General Nesting Abundance of Gulf of Mexico Sea Turtles	1196
11.1.4 General In-Water Abundance of Gulf of Mexico Sea Turtles	1197
11.1.5 Regulation and Protection of Gulf of Mexico Sea Turtles	1199
11.2 Kemp's Ridley Sea Turtle (<i>Lepidochelys Kempii</i>)	1203
11.2.1 Kemp's Ridley Life History, Distribution, and Abundance	1204
11.2.2 Kemp's Ridley Recovery Program	1221
11.3 Loggerhead Sea Turtle (<i>Caretta Caretta</i>)	1223
11.3.1 Loggerhead Sea Turtle Life History, Distribution, and Abundance	1225
11.4 Green Sea Turtle (<i>Chelonia Mydas</i>)	1239
11.4.1 Green Sea Turtle Life History, Distribution, and Abundance	1239

11.5	Leatherback Sea Turtle (<i>Dermochelys Coriacea</i>)	1253
11.5.1	Leatherback Sea Turtle Life History, Distribution, and Abundance	1254
11.6	Hawksbill Sea Turtle (<i>Eretmochelys Imbricata</i>)	1263
11.6.1	Hawksbill Sea Turtle Life History, Distribution, and Abundance	1264
11.7	Threats to Gulf of Mexico Sea Turtle Populations	1276
11.7.1	Incidental Capture of Sea Turtles in Commercial and Recreational Fisheries	1276
11.7.2	Terrestrial Zone Threats	1284
11.7.3	Neritic and Oceanic Zone Threats	1287
11.7.4	Sea Turtle Stranding Data	1293
11.8	Summary and Discussion	1312
11.9	Future Considerations and Research Needs	1315
	References	1317

**CHAPTER 12 AVIAN RESOURCES OF THE NORTHERN
GULF OF MEXICO** 1353

12.1	Introduction	1353
12.1.1	Objectives	1354
12.1.2	Methods	1354
12.2	Laws, Regulations, and Status Designations	1357
12.3	Land-Water Interface	1360
12.3.1	Birds of the Gulf of Mexico as a Whole	1361
12.3.2	The Southern Gulf of Mexico Avian Community	1363
12.4	Avian Uses of Marine-Land Interfaces	1366
12.4.1	Functional Avian Uses	1366
12.4.2	Temporal and Spatial Constraints	1366
12.5	Factors Affecting Avian Populations	1373
12.5.1	Habitat Loss	1374
12.5.2	Invasive Species	1374
12.5.3	Food Resources	1375
12.5.4	Tides, Hurricanes, and Other Weather Events	1375
12.5.5	Climate Change, Sea Level Rise, and Land Subsidence	1377
12.5.6	Predation, Competition, and Other Social Interactions	1377
12.5.7	Parasites and Disease	1378
12.5.8	Pollutants	1379
12.5.9	Management and Physical Anthropogenic Disruptions	1381
12.5.10	Direct Human Activities	1382

12.6	Status of Birds in the Gulf of Mexico	1384
12.6.1	Overview of Indicator Species and Groups	1384
12.6.2	Indicator Species	1384
12.6.3	Indicator Species Groups	1426
12.7	Discussion	1443
12.7.1	Management	1443
12.7.2	Patterns of Population Changes	1444
12.7.3	Recovery and Population Dynamics	1447
12.8	Summary of Birds in the Gulf of Mexico	1448
	References	1450
CHAPTER 13	MARINE MAMMALS OF THE GULF OF MEXICO	1489
13.1	Introduction	1489
13.2	History of Research in the Gulf	1491
13.2.1	Whaling	1491
13.2.2	Early Opportunistic Research	1492
13.2.3	The Modern Era	1492
13.3	Species Summaries, Habitat Use, and Numbers	1495
13.3.1	Overview of Species	1495
13.3.2	Species, Habitats, and Numbers	1496
13.3.3	Multispecies Aggregations	1546
13.3.4	Cetacean Occurrences Relative to Oceanographic Features	1548
13.4	Anthropogenic Impacts	1551
13.4.1	Prey Depletion	1552
13.4.2	Incidental Mortality and Injury in Fisheries (Bycatch)	1552
13.4.3	Intentional and Unintentional Direct Takes	1554
13.4.4	Vessel Strikes	1555
13.4.5	Disturbance and Acoustic Pollution (Noise)	1555
13.4.6	Chemical Contamination	1557
13.4.7	Ingestion of Solid Debris	1558
13.4.8	Oil Pollution	1559
13.4.9	Unusual Mortality Events	1559
13.4.10	Climate Change	1561
13.4.11	Strandings	1561
13.4.12	Global Status and U.S. Population Trends	1562
13.5	Conclusions: Brief Summary of Present Knowledge	1565
	References	1575

CHAPTER 14 DISEASES AND MORTALITIES OF FISHES AND OTHER ANIMALS IN THE GULF OF MEXICO	1589
14.1 Introduction	1589
14.2 Definitions	1590
14.3 Mass Mortalities, Primarily Including Fish Kills	1592
14.3.1 Eutrophication	1592
14.3.2 Hypoxia “The Dead Zone”	1596
14.3.3 Nuisance Algae	1602
14.3.4 Toxic Algae: HABs, Including Red Tide	1603
14.3.5 Cold Kill	1610
14.3.6 Pseudo-Fish Kills	1614
14.3.7 Heat Kills	1614
14.3.8 Hypersalinity (Over-Salinity)	1617
14.3.9 Sulfate Reduction and Anaerobic Methane Oxidation	1617
14.3.10 Sediments and Drilling Fluids	1618
14.4 Fishes	1619
14.4.1 Infectious Parasites and Diseases	1619
14.4.2 Use of Parasites to Evaluate the Effects of Catastrophic Events	1659
14.4.3 Biodiversity	1665
14.4.4 Noninfectious Diseases and Conditions	1672
14.5 Other Vertebrate Representatives	1686
14.5.1 Sea Turtles	1686
14.5.2 Birds	1688
14.5.3 Marine Mammals	1692
14.6 Invertebrates	1696
14.6.1 Shrimps	1696
14.6.2 Crabs	1699
14.6.3 Oyster	1702
14.6.4 Corals	1706
14.6.5 Micropredators	1710
14.7 What Is Necessary for a Good Baseline for the Future?	1710
14.8 Conclusions	1711
References	1713
Appendix A: List of Acronyms, Abbreviations, and Symbols	1739
Appendix B: Unit Conversion Table	1743
Index	1745

VOLUME 1

CHAPTER 1 HABITATS AND BIOTA OF THE GULF OF MEXICO: AN OVERVIEW	1
1.1 Introduction and Overview of Chapter Topics	1
1.2 Water Quality in the Gulf of Mexico (Chapter 2)	3
1.3 Sediments of the Gulf of Mexico (Chapter 3)	7
1.4 Sediment Contaminants of the Gulf of Mexico (Chapter 4)	9
1.5 Oil and Gas Seeps in the Gulf of Mexico (Chapter 5)	12
1.6 Coastal Habitats of the Gulf of Mexico (Chapter 6)	15
1.7 Offshore Plankton and Benthos of the Gulf of Mexico (Chapter 7)	18
1.8 Shellfish of the Gulf of Mexico (Chapter 8)	23
1.9 Fish Resources of the Gulf of Mexico (Chapter 9)	26
1.10 Commercial and Recreational Fisheries of the Gulf of Mexico (Chapter 10)	29
1.11 Sea Turtles of the Gulf of Mexico (Chapter 11)	33
1.12 Avian Resources of the Gulf of Mexico (Chapter 12)	37
1.13 Marine Mammals of the Gulf of Mexico (Chapter 13)	41
1.14 Diseases and Mortalities of Fishes and Other Animals in the Gulf of Mexico (Chapter 14)	43
1.15 Conclusions	46
References	51
 CHAPTER 2 WATER QUALITY OF THE GULF OF MEXICO	 55
2.1 Introduction	55
2.2 Determinants and Measures of Water Quality	56
2.2.1 Physiographic Setting	56
2.2.2 Human Activities	58
2.2.3 Water Clarity	60
2.2.4 Eutrophication	62
2.2.5 Chemical Contaminants	65
2.2.6 Water Quality Impairment and Biological Contaminants	71
2.3 Coastal Water Quality	73
2.3.1 NOAA's Estuarine Eutrophication Assessment (1999)	73
2.3.2 USEPA's National Coastal Condition Reports I (2001) and II (2004)	75

2.3.3	USEPA National Estuarine Condition (2006)	81
2.3.4	USEPA's National Coastal Condition Report III (2008)	85
2.3.5	USEPA's National Coastal Condition Report IV (2012)	87
2.3.6	State of the Bays	89
2.3.7	Coastal Water Quality and Petroleum	102
2.3.8	Coastal Water Quality and Utilization of Water	116
2.3.9	Temporal Trends in Coastal Water Quality	126
2.4	Continental Shelf/Slope and Abyssal Water Quality	136
2.4.1	Hypoxia on the Continental Shelf	136
2.4.2	Continental Shelf/Slope and Abyssal Water Quality and Contaminants	139
2.5	Summary	145
	References	147
CHAPTER 3	SEDIMENTS OF THE GULF OF MEXICO	165
3.1	Introduction	165
3.2	Bathymetric Provinces	166
3.2.1	Sigsbee Abyssal Plain	168
3.2.2	Mississippi Fan (Cone)	168
3.2.3	Continental Slope	169
3.2.4	Continental Shelf	170
3.2.5	Coastal Environments	174
3.3	General Characteristics of Sediments	177
3.3.1	Terrigenous Sediments	178
3.3.2	Biogenic Sediments	180
3.3.3	Chemical Sediments	181
3.3.4	Sediment Grain Size	181
3.4	General Sediment Distribution	182
3.4.1	Abyssal Plain	183
3.4.2	Mississippi Fan	184
3.4.3	Continental Slope	184
3.4.4	Continental Shelf	186
3.4.5	Mississippi Delta	193
3.4.6	Beach Sediments	193
3.4.7	Estuaries and Lagoons	194
3.5	Summary	209
	References	210

CHAPTER 4	SEDIMENT CONTAMINANTS OF THE GULF OF MEXICO	217
4.1	Introduction	217
4.1.1	Classes of Contaminants	217
4.1.2	Scope of the Summary	218
4.2	The Origins and Behavior of Contaminants in the Environment	219
4.2.1	The Mississippi River	221
4.2.2	Biological Effects Levels: Usage and Limitations	222
4.3	Coastal Sediments	223
4.3.1	NOAA National Status and Trends Program	225
4.3.2	USEPA Environmental Monitoring and Assessment Program	226
4.3.3	USEPA National Coastal Condition Report I	228
4.3.4	USEPA National Coastal Condition Report II	231
4.3.5	USEPA National Coastal Condition Report III	232
4.3.6	USEPA National Coastal Condition Report IV	232
4.3.7	Gulf of Mexico Bays	235
4.3.8	Temporal Variations	240
4.4	Continental Shelf/Slope and Abyssal Sediments	241
4.4.1	Natural Oil and Gas Seepage	243
4.4.2	Other Contaminants Attributable to Humans	244
4.4.3	Mass Loading of Petroleum Hydrocarbons	255
4.4.4	Temporal Variations	257
4.5	Summary	258
	References	260
CHAPTER 5	OIL AND GAS SEEPS IN THE GULF OF MEXICO	275
5.1	Introduction	275
5.2	History	275
5.2.1	History of Oil and Gas Seeps Worldwide	275
5.2.2	History of Oil and Gas Seeps in the Gulf of Mexico	278
5.3	Prevalence	279
5.4	Petroleum Geology	286
5.4.1	Source Rocks and Petroleum Generation	288
5.4.2	Migration Pathways	294
5.5	Biogeochemistry	295
5.5.1	Chemistry	297
5.5.2	Weathering	301
5.5.3	Biochemistry	303
5.5.4	Geochemistry	305

Contents	xxv
5.6 Terrestrial Environments	308
5.7 Marine Environments	311
5.7.1 Sea-Surface Slicks and Water Column Plumes	312
5.7.2 Seafloor Sediments	315
5.7.3 Gas Hydrate	320
5.7.4 Cold-Seep Communities	327
5.7.5 Exemplar Sites	337
5.8 Summary	344
References	347
CHAPTER 6 COASTAL HABITATS OF THE GULF OF MEXICO	359
6.1 Introduction	359
6.2 Physiographic Framework	360
6.2.1 Marine Ecoregions	361
6.2.2 Terrestrial Ecoregions	365
6.3 Physical Setting	371
6.3.1 Formation of the Gulf of Mexico Basin	372
6.3.2 Terrestrial Controls on Coastal Evolution	375
6.3.3 Oceanographic Processes	378
6.3.4 Shoreline Change and Longshore Sediment Transport	395
6.4 Biogeographic Setting	437
6.4.1 Introduction to Vegetated Marine Habitats	438
6.4.2 Depositional Characteristics of Vegetated Marine Habitats	447
6.4.3 Introduction to Aquatic Fauna of Vegetated Marine Habitats	472
6.4.4 Ecosystem Services and Societal Benefits of Vegetated Marine Habitats	491
6.5 Coastal Habitat Ecology	494
6.5.1 Barrier Strand Habitats	495
6.5.2 Salt Marshes	508
6.5.3 Mangroves	526
6.5.4 <i>Phragmites</i> Reed Beds	543
6.5.5 Seagrass Meadows	551
6.5.6 Intertidal Flats and Subtidal Soft Bottoms	567
6.6 Disturbances and Ecological Impacts	573
6.6.1 Natural Disturbances	573
6.6.2 Human-Induced Disturbances	577
6.7 Summary	582
References	586

CHAPTER 7	OFFSHORE PLANKTON AND BENTHOS OF THE GULF OF MEXICO	641
7.1	Introduction	641
7.2	Historical Perspectives: Exploring the Deep Gulf of Mexico	642
7.3	Habitat Definitions	644
7.3.1	Continental Shelf (Ken Sherman's Large Marine Ecosystem)	644
7.3.2	Continental Slope and Abyssal Plain	644
7.4	Plankton	646
7.4.1	Functional Categories	646
7.5	Mesopelagic (Mid-Water) Fishes and Pelagic Megafaunal Invertebrates (Micronekton or Macroplankton)	705
7.6	Seafloor Communities: The Benthos	707
7.6.1	Continental Shelf Benthos	707
7.6.2	Corals and Live-Bottom Assemblages	711
7.6.3	Cold Seep Communities	718
7.6.4	Continental Slope and Abyssal Plain Assemblages	720
7.7	Offshore Community Dynamics, Carbon Cycling, and Ecosystem Services	738
7.8	Stressors and Altered Habitats	744
7.9	Remaining Unknowns	746
7.10	Summary	747
	References	750
CHAPTER 8	SHELLFISH OF THE GULF OF MEXICO	769
8.1	Introduction	769
8.2	Jurisdictional Boundaries and Governing Agencies	772
8.2.1	The United States (Federal and State)	772
8.2.2	Mexico (Federal with State Input)	773
8.2.3	Cuba (Federal with Provincial Fishing Associations)	773
8.3	Shellfish of the Gulf of Mexico	774
8.3.1	Mollusks	781
8.3.2	Crustaceans	786
8.3.3	Echinoderms	788
8.4	Major Shellfish Species	789
8.4.1	Penaeid Shrimp	789
8.4.2	Eastern Oyster	793
8.4.3	Blue Crab	796
8.4.4	Peak Spawning, Recruitment, and Migration	797

Habitats and Biota of the Gulf of Mexico: Before the
Deepwater Horizon Oil Spill

Volume 2: Fish Resources, Fisheries, Sea Turtles, Avian
Resources, Marine Mammals, Diseases and Mortalities

Ward, C.H. (Ed.)

2017, LXV, 891 p. 551 illus., 519 illus. in color.,

Hardcover

ISBN: 978-1-4939-3454-6