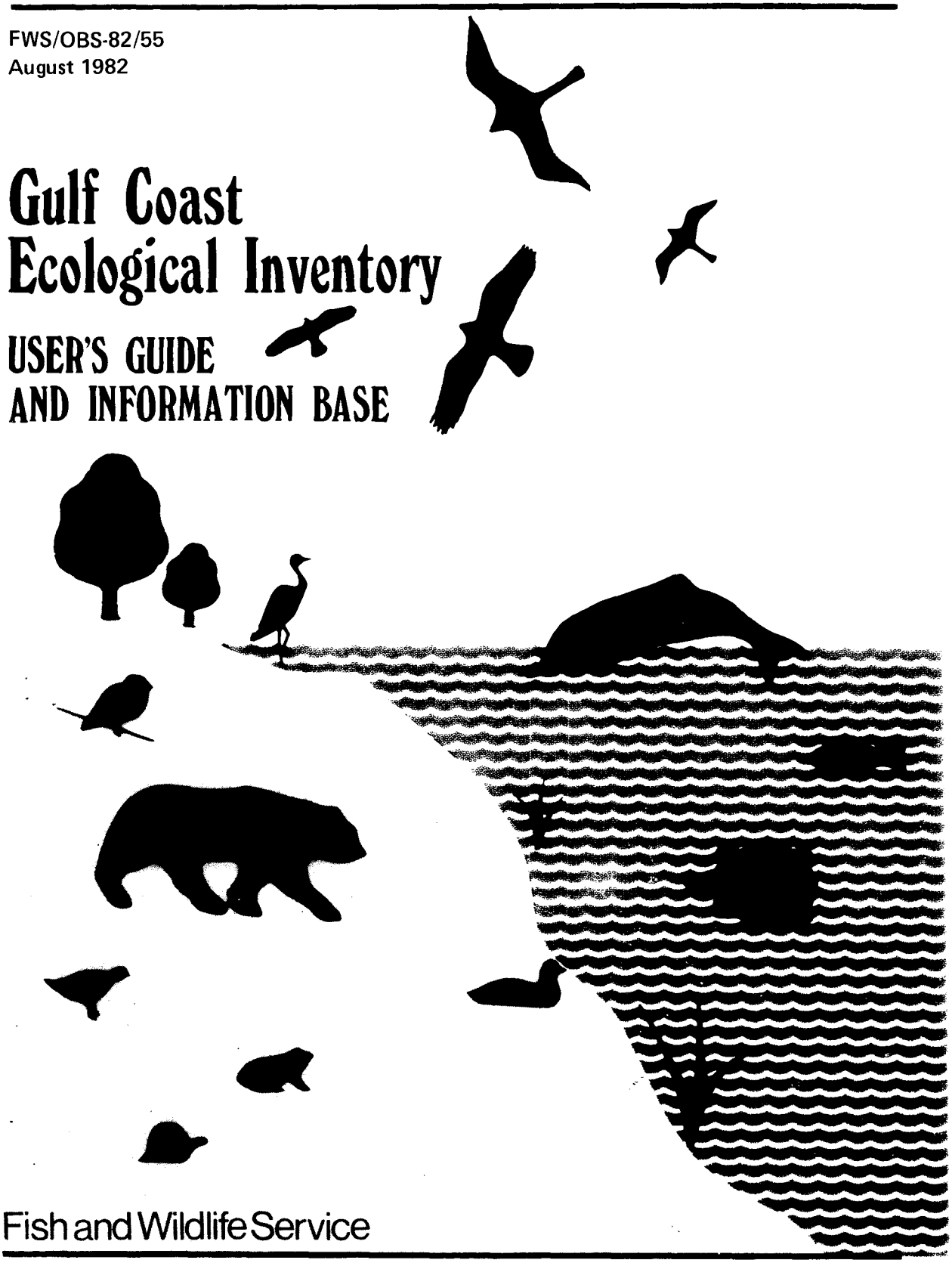
Biological Services Program

FWS/OBS-82/55
August 1982

# Gulf Coast Ecological Inventory

## USER'S GUIDE AND INFORMATION BASE



Fish and Wildlife Service

U.S. Department of the Interior

FWS/OBS-82/55
August 1982

# GULF COAST ECOLOGICAL INVENTORY
# USER'S GUIDE AND INFORMATION BASE

by

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# PREFACE

The U.S. Department of the Interior (USDI) and the Fish and Wildlife Service (FWS) have played major roles in issues involving the siting of coastal energy-related projects. The basis for the Department's position on these types of projects has been the National and regional significance of the fish and wildlife resources at the proposed sites and the susceptibility of these resources to new or added stress.

Given the projected needs for oil- and energy-related facilities along the Gulf coast, as well as the future likelihood for Departmental involvement in siting issues, the Secretary of the Interior "stressed the need for government to catalogue and inventory our natural resources. The availability of this resource information should ensure more informed decision making and help avoid resource conflicts." (USDI News Release, 3 December 1981). In addition, the Council on Environmental Quality has explored what Federal agencies might do to provide advance information on the environmental sensitivity of various coastal areas to the impacts of major energy facilities.

The objective is to produce an inventory of those important ecological resources along the Gulf coast on which coastal siting of refineries, petrochemical, and gas or liquid natural gas facilities could have an impact.

Questions about, or requests for copies of this publication should be addressed to:

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We would like to thank Mr. Bill Cole, FWS Austin, Texas, and Mr. James Barkuloo, FWS Panama City, Florida, for their role in coordinating the map review with various Federal, state, and local groups. We would also like to thank Dr. J. Albert Sherk (FWS) for his role in coordinating the inventory effort at the Washington, DC, office level.

Valuable resource information, which was key to the accomplishments of this inventory effort, was contributed by numerous Federal and state agencies, and private individuals and groups. These included biologists and experts from the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Mobile and New Orleans Districts, National Marine Fisheries Service, Alabama Department of Conservation and Natural Resources, Florida Department of Natural Resources, Florida Game and Fresh Water Fish Commission, Louisiana Department of Wildlife and Fisheries, Mississippi Department of Wildlife Conservation, and Texas Parks and Wildlife Department.

# PART 1

# INTRODUCTION

## 1.1 BACKGROUND

Recent developments, such as a new Federal emphasis on the deregulation of industries and an accelerated Outer Continental Shelf (OCS) oil and gas leasing program, have increased the need for advanced planning in siting Gulf coast energy facilities. The U.S. Department of the Interior and the Fish and Wildlife Service (FWS) have played major roles in issues involving large coastal projects. Given the projected needs for oil and gas exploration and associated production and support facilities along the Gulf coast, as well as the likelihood of future Department involvement in siting issues, the FWS has conducted an ecological inventory to assist industry in advanced planning and evaluation procedures. FWS's intent was to lessen the chance for serious disputes during the later permit review evaluation process.

This study resulted in the production of 22 fish and wildlife coastal inventory maps (referred to in this report as maps) and a User's Guide and Information Base (referred to as the report). This is the first phase of an effort by FWS to provide planners and industry officials with the appropriate assistance and guidance in their plans for environmental protection. The maps reduce the potential for conflict by depicting areas or resources that are most ecologically or economically valuable and that could be most vulnerable to the construction and operation of energy facilities. In addition, the maps should be of assistance in reducing environmental damage from energy facilities at any location along the Gulf coast.

Although the value of the inventory maps is somewhat restricted by their scale and the availability of fish, wildlife, and habitat information, this report and the maps provide a comprehensive inventory of the natural resources of the Gulf coast. These resource maps have been sought by coastal planners for coastal zone management and oil spill contingency planning. The FWS already has produced ecological inventories for the U.S. Atlantic and Pacific coasts.

## 1.2 PURPOSE AND SCOPE

The purpose of the User's Guide and Information Base report and the inventory maps is to establish the extent of natural resources, as well as their location and value. The report supplements the maps with biological descriptions and lends support and credence to the map inventories. The maps identify significant natural resource areas and fish and wildlife resource concentrations along the Gulf coast which are vulnerable to the construction and operation of oil- and gas-processing facilities and transportation systems. The focus of this inventory is on the ecological resources subject to

the provisions of the Fish and Wildlife Coordination Act, the Endangered Species Act, and other related legislation. The area covered by the inventory extends from Florida Bay, including the Florida Keys, to the United States-Mexico border. The inventory is not limited to mapping areas falling between the coastal zone boundary and the Federal-state, offshore demarcation, as were the Atlantic and Pacific coast inventories, but includes all terrestrial and marine areas presented on the 22 U.S. Geological Survey (USGS) 1:250,000-scale maps covering the Gulf coast.

The maps provide an inventory of important coastal fish and wildlife species and their habitats. Other land use designations, such as wildlife refuges, parks, and Federal Class I air quality areas, also are included. The maps and this report do not designate areas where energy facilities or transportation systems should be located, but rather they identify areas of significant concern. The maps are not intended to be the only source of resource information for the Gulf coast. Due to the maps' small scale and schedule constraints on data collection, only significant species' locations and distributions are presented.

## 1.3 COASTAL CLASSIFICATION AND DESCRIPTION

The study area (shaded area, Figure 1) covers portions of six coastal states and occupies approximately 475,000 square kilometers (183,400 square miles). The study area has been categorized according to the hierarchical classification scheme for coastal ecosystems developed by Terrell (1979). This report is organized according to the Level I (zones) and Level II (sections) subdivisions which compose Terrell's classification (Figure 2). A description of each section in each zone is given in Table 1. The ten sections provide the format for describing the resources identified in the inventory.

The Southern Florida (Coastal) Zone occupies the extreme eastern and southeastern portions of the study area (Figure 2) and extends from the Dry Tortugas to Cape Romano. Within this zone are the Florida Keys, Florida Bay, and Ten Thousand Islands sections.

The Florida Keys section, from the Dry Tortugas east and north to the southern tip of Biscayne Bay, is characterized by low relief limestone islands, with narrow shell beaches extending to coral reefs on the Atlantic Ocean side of the islands. This Florida Bay side of the islands is bordered with mangroves interspersed with extensive seagrass and algal beds.

The Florida Bay section extends from the southern tip of Biscayne Bay west to Cape Sable. This very low relief section occupies the coastal portions of Everglades National Park and contains numerous mangrove-covered islands and large areas of swamp.

The Ten Thousand Islands section covers the area from Cape Sable west-northwest to Cape Romano. The coastline, which characterizes this low relief area, is extremely complex and is subject to direct marine tidal and weather effects. The section is dominated by numerous small mangrove islands and tidal channels. Although most of the area is flat, interior hammocks rise a couple of meters (a few feet) above the surrounding plains and swamps.

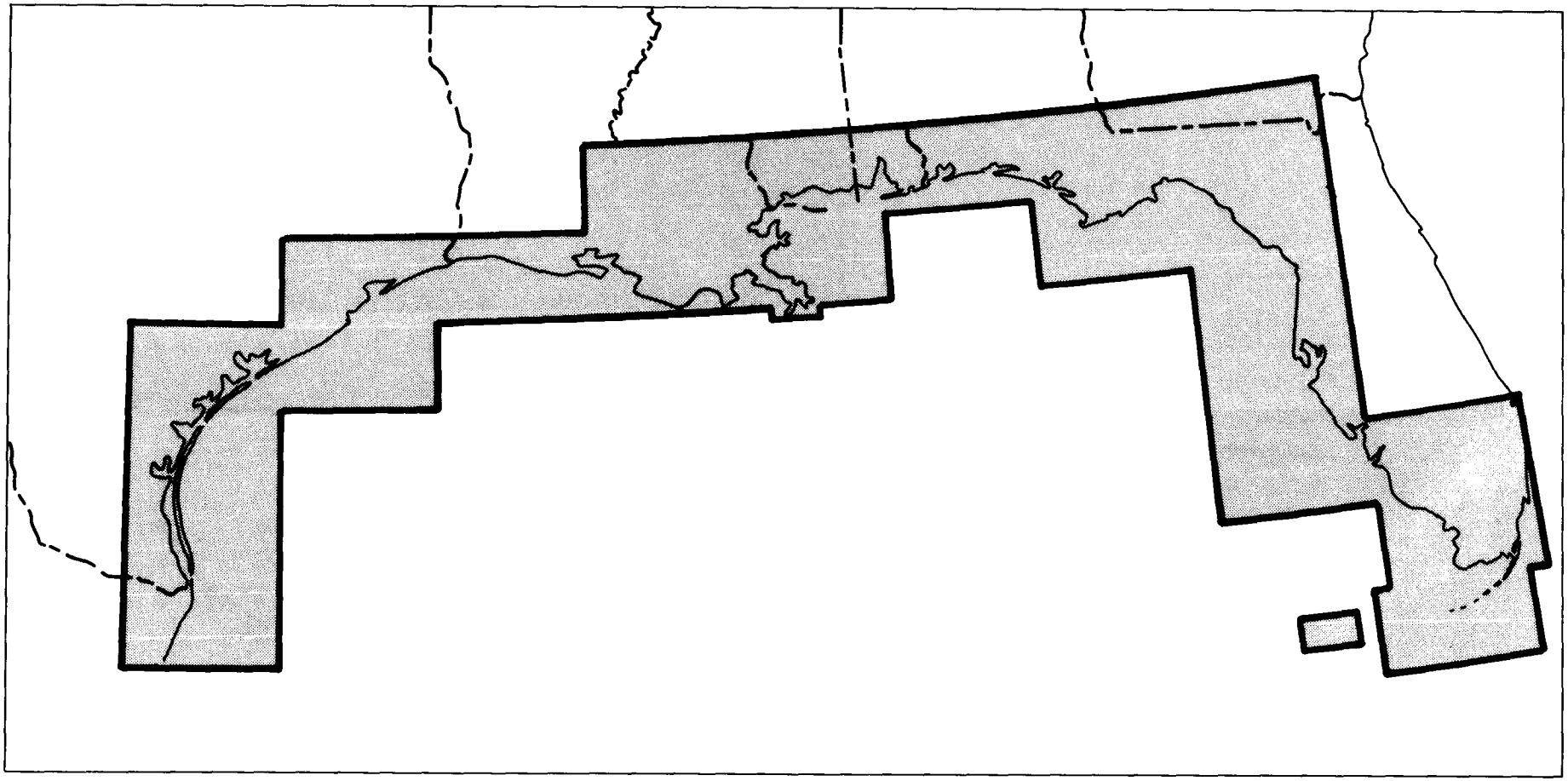

Figure 1. The study area for the Gulf coast ecological inventory (shaded area).

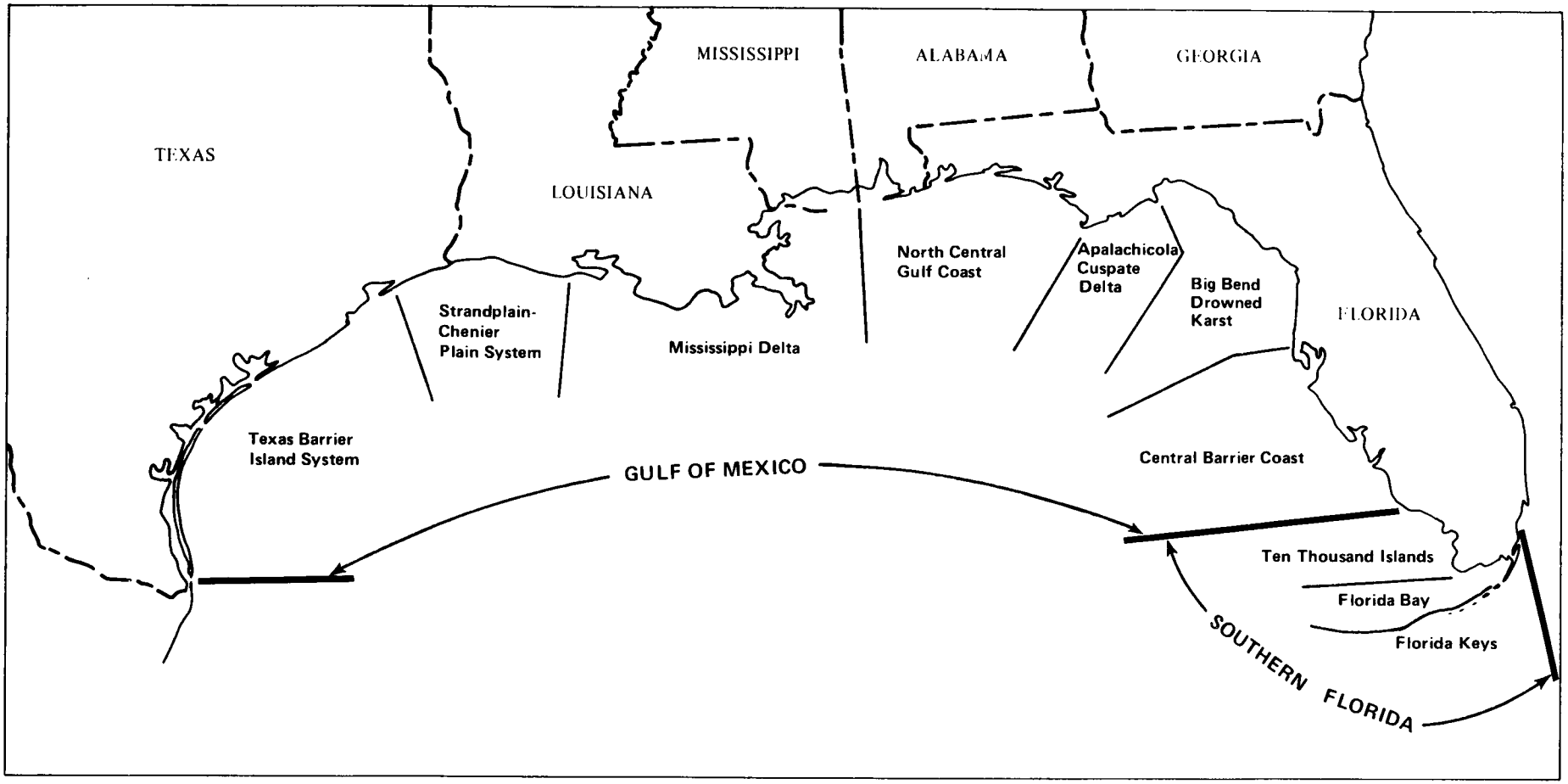


Figure 2. Classification scheme for Gulf coast ecosystems, showing zones and sections (modeled after Terrell, 1979).

Table 1. Classification scheme for Gulf coast ecosystems (modeled after Terrell, 1979).

| Level I (zones) | Level II (sections) | Boundaries | Section description |
|---|---|---|---|
| Southern Florida | Florida Keys | Biscayne National Park to Key West and Dry Tortugas | Low limestone islands with pinnacle rock coasts or very narrow shell beaches bordered with mangroves; extensive shallow areas with soft marl or shell fragment bottoms extending out to coral reefs; very extensive seagrass and algal beds. |
| | Florida Bay | South tip of Biscayne Bay to Cape Sable | Coastline part of Everglades National Park; area of numerous mangrove-covered islands and very extensive swamps covering entire southern tip of Florida. |
| | Ten Thousand Islands | Cape Sable to Cape Romano | Coastline dominated by a multitude of small mangrove islands and tidal channels; extremely complex, direct marine action on the coast. |
| Gulf of Mexico | Central Barrier Coast | Cape Romano to Tarpon Springs | Sandy beaches with a few rocky areas; extensive marshy and swampy areas present; narrow shallows area; Juncus, Spartina, or mangroves characteristic, depending on latitude. |
| | Big Bend Drowned Karst | Tarpon Springs to Lighthouse Point | Rugged shoreline; rocky bottoms; very wide shallows area; clear water; extensive seagrass beds and marshes; high fish production; extensive oyster bars. |
| | Apalachicola Cuspate Delta | Lighthouse Point to Cape San Blas | Smooth sand beaches; mud-bottomed bays; turbid water; barrier islands present; little or no seagrass. |
| | North Central Gulf Coast | Cape San Blas to Petit Bois Pass | White sand beaches; clear water; extensive dune system and barrier island system; high-energy beaches compared to others of the Gulf coast. |
| | Mississippi Delta | Petit Bois Pass to, and including, Vermilion Bay | Extensive marsh systems; barrier island system; sediments silty; silt terrigenous; water turbid; very extensive shallows area; extensive influence from Mississippi River. |
| | Strandplain-Chenier Plain System | Vermilion Bay to Galveston Bay | Extensive marsh system; freshwater inflow from several small river systems, but lacking direct influence from Mississippi River; cheniers present. |
| | Texas Barrier Island System | Galveston Bay to Texas-Mexico border | Extensive lagoon system formed by drowned rivermouths and barrier islands; freshwater inflow regular on upper coast to limited with hypersaline condition on lower coast; marshes common along upper coast; submerged grass beds common along lower coast; barrier islands of sand. |

The Gulf of Mexico (Coastal) Zone comprises approximately 90 percent of the study area, extending north and west in an arcuate pattern from Cape Romano in Florida to the United States-Mexico border at Brownsville, Texas. Within the Gulf of Mexico Zone are seven sections: the Central Barrier Coast, Big Bend Drowned Karst, Apalachicola Cuspate Delta, North Central Gulf Coast, Mississippi Delta, Strandplain-Chenier Plain System, and Texas Barrier Island System.

The Central Barrier Coast section extends from Cape Romano north to Tarpon Springs, Florida. The coastline is characterized by sandy beaches and extensive marshy and swampy areas. The nearly level coastal plain is mantled by sand of varying thickness over limestone. In the extreme northeastern portion of this section, the land surface is gently rolling and irregular due to the development of numerous sinkholes.

The Big Bend Drowned Karst section covers the coastal area between Tarpon Springs and Lighthouse Point. The shoreline is rugged and characterized by rocky bottoms, very wide shallows areas, and the occurrence of extensive seagrass beds and marshes. Inland areas are gently rolling with many lakes, ponds, and sinkholes developed from solution weathering of the underlying limestone. This section is drained by two major streams: the north and west flowing Withlacoochee River and the south flowing Suwannee River.

The Apalachicola Cuspate Delta section extends from Lighthouse Point west to Cape San Blas. This section is characterized by smooth sand beaches and barrier islands. The intervening bays contain turbid water, and there is very little seagrass occurrence. The major stream is the south flowing Apalachicola River.

The North Central Gulf Coast section, from Cape San Blas in Florida west to Petit Bois Pass on the Alabama-Mississippi border, contains high-energy, white sand beaches and an extensive system of dunes and barrier islands. The area is drained by many southerly flowing streams; the largest is the complex Mobile River system which occupies a broad marsh- and swamp-covered alluvial plain.

The Mississippi Delta section extends from Petit Bois Pass west to Vermilion Bay, Louisiana. This section is characterized by an extensive marsh and barrier island system; the marshes are broken by shallow lakes and bayous and are crossed by many stream channels. The dominant landform is the complex "birds-foot" delta, consisting of very extensive shallows areas. The waters are sediment-laden and turbid due to the dynamic fluvial influence of the Mississippi River. Except for narrow bands of gentle slopes on natural levees, the area is flat.

The Strandplain-Chenier Plain System covers the coastal area from Vermilion Bay, Louisiana, west to Galveston Bay, Texas. This section consists of a broad, low-relief, marshy plain characterized by a series of long, low, narrow, brushy beach ridges which lie roughly parallel to the coastline. Freshwater inflow is provided from several south flowing drainage systems, including the Calcasieu, Sabine, and Neches Rivers.

The Texas Barrier Island System extends from Galveston Bay south-southwest to the United States-Mexico border at Brownsville, Texas. This low relief section is characterized by an extensive lagoon system bordered by barrier islands. The upper portion of the coast, from Galveston Bay to Corpus Christi Bay, has freshwater inflow provided by numerous southeasterly flowing streams. Marshes are common along this coastal segment. The lower portion of the coast, from Corpus Christi Bay to the Texas-Mexico border has minimal freshwater inflow; hypersaline conditions predominate and submerged grass beds are common.

## 1.4 LIST OF SOURCES FOR THE COASTAL CLASSIFICATION AND DESCRIPTION

Fenneman, N. M. Physiography of the eastern United States. New York: McGraw-Hill Publishers; 1938.

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McNulty, J.K.; Lindall, W.N., Jr.; Sykes, J.E. Cooperative Gulf of Mexico estuarine inventory and study, Florida: Phase I, area description. NOAA Technical Report NMFS CIRC-368; November 1972.

Nowlin, W.D.; McCellan, H.J. A characterization of the Gulf of Mexico in winter. J. Mar. Res. 25:29-59; 1967.

Terrell, T. T. Physical regionalization of coastal ecosystems of the United States and its territories. U.S. Department of the Interior, Fish and Wildlife Service, Coastal Ecosystems Project; 1979. Available from: U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC; FWS/OBS-78/80.

Uchupi, E. Atlantic continental shelf and slope of the United States - Physiography. USGS Professional Paper 529-C; 1968.

# PART 2

# METHODOLOGY

## 2.1 DATA COLLECTION AND REPORTING

The data used to compile the habitat inventory maps and the supporting narrative report were collected from numerous organizations; Federal agencies included the FWS, the National Marine Fisheries Service (NMFS), the Bureau of Land Management (BLM), the National Oceanic and Atmospheric Administration (NOAA), and the Environmental Protection Agency (EPA). The water, natural resource, and parks and recreation divisions of the six states provided much of the information, as did private organizations, such as marine fisheries councils, state Audubon societies, and universities. The sources acquired from these agencies were reviewed and analyzed for each geographic area; information on major habitats and fish and wildlife resource groups was abstracted. For a complete listing of all information sources contacted, and the type of resource data each provided, see the List of Sources included at the end of each part of this report. Major emphasis was placed on information that was accurate, useful, and applicable to the inventory maps.

Because the base map scale was relatively small (1:250,000), the amount of information shown on each inventory map was selected carefully to avoid excessive detail and confusion. If more detailed information on specific biological resources is required, the user is advised to refer to the List of Sources at the end of each part as well as to contact the appropriate Federal and state agencies. Likewise, information on specific locations of accepted coastal zone boundaries can be obtained from the appropriate state coastal zone management agency.

Major elements of the map inventory were the depiction of species with special status and special land use areas. The location of every endangered or threatened species and all special land use areas (such as parks, wildlife refuges, and preserves) within the study boundaries was shown on the maps where data were available.

The maps represent significant resources using both point feature and area feature symbols. Instead of multiple overlays, the information on a single map was indicated by using various symbols, colors, and patterns. This method was found to provide the most uncluttered, readable, and understandable map.

Major categories shown on the inventory maps were species with special status (e.g., the endangered leatherback sea turtle), valuable resources (e.g., shellfish and waterfowl), migratory routes (e.g., Atlantic sturgeon), and seasonal habits (e.g., overwintering). Additional information about

distribution, density, and life history of a particular species or group was incorporated in this report (parts 4 and 5).

## 2.2 DATA REVIEW AND ANALYSIS

The data and literature search included cataloging, reviewing, and analyzing a large amount of ecological data. This review was a major task, and deciding what data should be included on the maps required considerable judgement.

One or more writers of this report visited selected areas within each of the two major zones. They collected information and corresponded with ecologists and fish and game agency personnel. However, most of the information was obtained by telephoning Federal, state, local, and private groups familiar with the resources of a particular area and by requesting appropriate reports and data.

A list of most of the important plants and animals (and their scientific names) in the study area (538 species) is given in Table 2. Data were compiled for each species which had a special status designation (endangered or threatened) and for groups (e.g., fish or birds) and types of habitat (e.g., seagrasses or marshes). When available, resource statistics also were compiled. The types and amount of detail shown on each map were dependent on the types and amount of information available.

In general, data were most available for species which are threatened or endangered, and for fish and wildlife species that support commercial or sport fishing and hunting industries. Data on the maps include legally designated boundaries of critical habitats for threatened or endangered species. For major fisheries, mapped data include breeding and nursery areas, shellfish bed locations, fishing areas, migratory species, and seasonal distributions. For birds, wildlife, and marine mammal species of major importance, the breeding, migratory, seasonal distribution, and major concentration areas were indicated on the maps if data were available. Because many groups or species occur ubiquitously, the notebox on each map indicates their occurrence in each area. Areas of special biological concern, such as seagrass beds, beaches/dunes, offshore islands, and marshes, are indicated on the maps, depending on their size and their economic, ecological, or scientific importance. The species, habitat, and status designations have been depicted by a combination of symbols keyed to alphanumeric descriptors and color. A list of the depicted aquatic and terrestrial species and their identifying numbers is shown on each map.

The data are only as reliable as the source material. Certain information was not included on the maps if reports were not readily available, if the reports contained proprietary information, if the data were ambiguous, or if the source material was difficult to obtain. Because of time constraints, a comprehensive review of published and unpublished reports was not possible. Nonetheless, the information presented on the inventory maps and in this report represents the most reliable information available as of April 1982 for the entire Gulf coastal zone.

Table 2. Species or groups of organisms (with identifying numbers) in the Gulf coast ecological inventory.*

AQUATIC ORGANISMS

PLANTS (1 through 49)

1 Turtle grass (Thalassia testudinum)
2 Widgeon grass (Ruppia maritima)
3 Shoal grass (Halodule beaudettei)

INVERTEBRATES (50 through 99)

50 Shrimp (Penaeidae)
51 White shrimp (Penaeus setiferus)
52 Brown shrimp (Penaeus aztecus)
53 Pink shrimp (Penaeus duorarum)
54 Blue crab (Callinectes sapidus)
55 Stone crab (Menippe mercenaria)
56 Spiny lobster (Panulirus argus)
57 Eastern oyster (Crassostrea virginica)
58 Crayfish (Procambarus spp.)
59 Brackish-water clam (Rangia cuneata)
60 Sponges (Porifera)
61 Southern quahog (Mercenaria campechiensis)
62 Northern quahog (Mercenaria mercenaria)
63 Sunray venus clam (Macrocallista nimbosa)
64 Bay scallop (Argopecten irradians)
65 Rock shrimp (Sicyonia dorsalis)
66 Calico scallop (Argopecten gibbus)
S 67 Unicolor mussel (Obovaria unicolor)
68 Fire coral (Millepora spp.)
69 Horny coral (Antipatharia)
70 Stony coral (Scleractinia)
71 Gorgonian coral (Gorgonacea)
72 Corals (Anthozoa)
73 Queen conch (Strombus gigas)
74 Pygmy octopus (Octopus joubini)
75 Atlantic geoduck (Panopea bitruncata)
76 Loose coiled snail (Aphaostracon chalarogyrus)
77 Athearns villosa (Villosa choctawensis)

FISH (100 through 299)

100 Jack (Carangidae)
101 Sharks, skates, rays (Chondrichthyes)
102 Grouper (Serranidae)
103 Mullet (Mugilidae)
104 Catfish and bullheads (Ictaluridae, Ariidae)
105 Snapper (Lutjanidae)
106 Sunfish and bass (Centrarchidae)
107 Drum (Sciaenidae)
108 Spotted seatrout (Cynoscion nebulosus)
109 Weakfish (Cynoscion regalis)
110 Sand seatrout (Cynoscion arenarius)
111 Atlantic croaker (Micropogon undulatus)
112 Red drum (Sciaenops ocellata)
113 Black drum (Pogonias cromis)
114 Star drum (Stellifer lanceolatus)
115 Spot (Leiostomus xanthurus)
116 Southern kingfish (Menticirrhus americanus)
117 Northern kingfish (Menticirrhus saxatilis)
118 Gulf kingfish (Menticirrhus littoralis)
119 Sheepshead (Archosargus probatocephalus)
120 Southern flounder (Paralichthys lethostigma)
121 Blue catfish (Ictalurus furcatus)
122 White catfish (Ictalurus catus)
123 Channel catfish (Ictalurus punctatus)
124 Yellow bullhead (Ictalurus natalis)
125 Brown bullhead (Ictalurus nebulosus)
126 White crappie (Pomoxis annularis)
127 Black crappie (Pomoxis nigromaculatus)
128 Largemouth bass (Micropterus salmoides)
129 Spotted bass (Micropterus punctulatus)
130 Green sunfish (Lepomis cyanellus)
131 Longear sunfish (Lepomis megalotis)
132 Warmouth (Lepomis gulosus)
133 Bluegill (Lepomis macrochirus)

continued

Table 2 (continued).

134 Redear sunfish (Lepomis microlophus)
135 Striped mullet (Mugil cephalus)
136 Red snapper (Lutjanus campechanus)
137 Florida pompano (Trachinotus carolinus)
138 Bluefish (Pomatomus saltatrix)
139 Cobia (Rachycentron canadum)
140 Atlantic spadefish (Chaetodipterus faber)
141 Little tunny (Euthynnus alletteratus)
142 Spanish mackerel (Scomberomorus maculatus)
143 King mackerel (Scomberomorus cavalla)
144 Sea catfish (Arius felis)
145 Gulf menhaden (Brevoortia patronus)
146 Bay anchovy (Anchoa mitchilli)
147 Gars (Lepisosteus spp.)
148 Buffalos (Ictiobus spp.)
149 Freshwater drum (Aplodinotus grunniens)
150 Bowfin (Amia calva)
151 Carp ( Cyprinus carpio)
S 152 Key silverside (Menidia conchorum)
153 Tarpon (Megalops atlantica)
154 Ladyfish (Elops saurus)
155 Permit (Trachinotus falcatus)
156 Bonefish (Albula vulpes)
157 Cero (Scomberomorus regalis)
158 Mutton snapper (Lutjanus analis)
159 Yellowtail snapper (Ocyurus chrysurus)
160 Red grouper (Epinephelus morio)
161 Gray snapper (Lutjanus griseus)
162 Grunts (Haemulidae)
163 Atlantic bonito (Sarda sarda)
164 Sailfish (Istiophorus platypterus)
165 Vermilion snapper (Rhomboplites aurorubens)
166 Warsaw grouper (Epinephelus nigritus)
167 Tilefish (Malacanthidae)
168 Great barracuda (Sphyraena barracuda)
169 Dolphin (Coryphaena hippurus)
170 Jewfish (Epinephelus itajara)
171 Snook (Centropomidae)
172 Tripletail (Lobotes surinamensis)
173 Lane snapper (Lutjanus synagris)
174 Nassau grouper (Epinephelus striatus)
175 Black grouper (Mycteroperca bonaci)
176 Gag (Mycteroperca microlepis)
177 White grunt (Haemulon plumieri)
178 Greater amberjack (Seriola dumerili)
179 Pinfish (Lagodon rhomboides)
180 Pigfish (Orthopristis chrysoptera)
181 Wrasses (Labridae)
182 Parrotfish (Scaridae)
183 Damselfish (Pomacentridae)
184 Butterflyfish (Chaetodontidae)
185 Surgeonfish (Acanthuridae)
186 Swordfish (Xiphias gladius)
187 Blue marlin (Makaira nigricans)
188 White marlin (Tetrapturus albidus)
189 Skipjack tuna (Euthynnus pelamis)
190 Blackfin tuna (Thunnus atlanticus)
191 White mullet (Mugil curema)
192 Crevalle jack (Caranx hippos)
193 Florida gar (Lepisosteus platyrhincus)
194 Gizzard shad (Dorosoma cepedianum)
195 Sunshine bass (Morone saxatilis x M. chrysops hybrid)
196 Silver perch (Bairdiella chrysoura)
197 Sea bass (Centropristis spp.)
198 Yellowmouth grouper (Mycteroperca interstitialis)
199 Striped mojarra (Diapterus plumieri)
200 Gulf flounder (Paralichthys albigutta)
201 Cardinalfish (Apogonidae)
202 Angelfish (Pomacanthidae)
203 Blue runner (Caranx crysos)
204 Atlantic thread herring (Opisthonema oglinum)
205 Chain pickerel (Esox niger)

continued

Table 2 (continued).

206 Rivulus (Rivulus marmoratus)
207 Key blenny (Starksia starcki)
208 Striped bass (Morone saxatilis)
S 209 Atlantic sturgeon (Acipenser oxyrhynchus desotoi)
210 Suwannee bass (Micropterus notius)
211 Redbreast sunfish (Lepomis auritus)
212 Spotted sunfish (Lepomis punctatus)
213 Flier (Centrarchus macropterus)
214 Redfin pickerel (Esox americanus americanus)
215 Red porgy (Pagrus pagrus)
216 Alabama shad (Alosa alabamae)
217 Skipjack herring (Alosa chrysochloris)
218 Spanish sardine (Sardinella aurita)
S 219 Bluestripe shiner (Notropis callitaenia)
220 Shoal bass (Micropterus unnamed species)
S 221 Blackmouth shiner (Notropis unnamed species)
222 Saltmarsh topminnow (Fundulus jenkinsi)
S 223 Crystal darter (Ammocrypta asprella)
224 Harlequin darter (Etheostoma histrio)
F 225 Okaloosa darter (Etheostoma okaloosae)
226 Flathead catfish (Pylodictis olivaris)
227 White bass (Morone chrysops)
228 Yellow bass (Morone mississippiensis)
229 Alligator gar (Lepisosteus spatula)
230 Blue sucker (Cycleptus elongatus)
S 231 Frecklebelly madtom (Noturus munitus)
232 Rock bass (Ambloplites rupestris)
233 Gafftopsail catfish (Bagre marinus)
234 Silver seatrout (Cynoscion nothus)
235 Bluenose shiner (Notropis welaka)
236 River redhorse (Moxostoma carinatum)
237 Freckled darter (Percina lenticula)
238 Bluntnose minnow (Pimephales notatus)
239 Bluntface shiner (Notropis camurus)
240 Rainbow darter (Etheostoma caeruleum)
S 241 Paddlefish (Polyodon spathula)
242 Triggerfish (Balistidae)
243 Squirrelfish (Holocentridae)
S 244 River darter (Percina shumardi)
245 Rio Grande cichlid (Cichlasoma cyanoguttatum)
246 Silk snapper (Lutjanus vivanus)
247 Hinds (Epinephelus spp.)
248 Yellowfin grouper (Mycteroperca venenosa)
249 Scamp (Mycteroperca phenax)
250 Yellowedge grouper (Epinephelus flavolimbatus)
251 Palometa (Trachinotus goodei)
252 Yellow jack (Caranx bartholomaei)
253 Bar jack (Caranx ruber)
254 Horse-eye jack (Caranx latus)
255 Hogfish (Lachnolaimus maximus)
256 Dwarf seahorse (Hippocampus zosterae)

REPTILES AND AMPHIBIANS (300 through 349)

F 300 Green sea turtle (Chelonia mydas)
F 301 Loggerhead sea turtle (Caretta caretta)
F 302 Hawksbill sea turtle (Eretmochelys imbricata)
F 303 Kemp's Ridley sea turtle (Lepidochelys kempi)
F 304 Leatherback sea turtle (Dermochelys coriacea)

MAMMALS (350 through 399)

F 350 West Indian manatee (Trichechus manatus)
351 Atlantic bottlenose dolphin (Tursiops truncatus)
352 Atlantic spotted dolphin (Stenella plagiodon)
F 353 Finback whale (Balaenoptera physalus)
F 354 Sperm whale (Physeter catodon)
F 355 Right whale (Eubalaena glacialis)
356 Short-finned pilot whale (Globicephala macrorhynchus)
357 False killer whale (Pseudorea crassidens)
358 Pygmy sperm whale (Kogia breviceps)
359 Minke whale (Balaenoptera acutorostrata)
360 Striped dolphin (Stenella coeruleoalba)
361 Killer whale (Orcinus orca)

continued

## Table 2 (continued).

TERRESTRIAL ORGANISMS

PLANTS (400 through 499)

S 400 Lance-leaved wake-robin (Trillium lancifolium)
S 401 Florida royal palm (Roystonea elata)
S 402 Orchids
S 403 Bromeliads
404 Royal palm - bald cypress forest
S 405 Ferns
S 406 Cacti
S 407 Lignum vitae (Guaiacum sanctum)
S 408 Palms
F 409 Chapman's rhododendron (Rhododendron chapmanii)
S 410 Hollies (Ilex spp.)
S 411 Peppers (Peperomia spp.)
S 412 Coonties (Zamia spp.)
S 413 Four-petal pawpaw (Asimina tetramera)
S 414 Sandhill milkweed (Asclepias curtissii)
S 415 Sea lavender (Tournefortia gnaphalodes)
S 416 Catopsis (Catopsis spp.)
S 417 Giant dewflower (Commelina gigas)
S 418 Pagoda dogwood (Cornus alternifolia)
S 419 Okeechobee gourd (Cucurbita okeechobeensis)
S 420 Manchineel (Hippomane mancinella)
S 421 Fall-flowering ixia (Nemastylis floridana)
S 422 Key cassia (Cassia keyensis)
S 423 Ashe magnolia (Magnolia ashei)
S 424 Dune lily-thorn (Catesbaea parviflora)
S 425 Cupania (Cupania glabra)
S 426 White-top pitcher plant (Sarracenia leucophylla)
S 427 Grass of parnassus (Parnassia grandifolia)
S 428 Florida yew (Taxus floridana)
S 429 Mahogany (Swietenia mahagoni)
430 Timberland
S 431 Tree cactus (Cereus robinii)
S 432 Pride-of-big-pine (Strumpfia maritima)
S 433 Guzmania (Guzmania spp.)
S 434 Cowhorn orchid (Cyrtopodium punctatum)
S 435 Dollar orchid (Encyclia boothiana)
S 436 Narrow swamp fern (Campyloneurum angustifolium)
S 437 Prickly-apple cactus (Cereus gracilis)
S 438 Silver palm (Coccothrinax argentata)
S 439 Hidden orchid (Maxillaria crassifolia)
S 440 Hand fern (Ophioglossum palmatum)
S 441 Auricled spleenwort (Asplenium auritum)
S 442 Sinkhole fern (Blechnum occidentale)
S 443 Trailing arbutus (Epigaea repens)
S 444 Orange azalea (Rhododendron austrinum)
S 445 Miccosukee gooseberry (Ribes echinellum)
S 446 Red-flowered pitcher plant (Sarracenia rubra)
S 447 Florida torreya (Torreya taxifolia)
S 448 Mountain laurel (Kalmia latifolia)
S 449 Bartram's ixia (Sphenostigma coelestinum)
F 450 Harper's beauty (Harperocallis flava)
451 Overmature and original growth trees
S 452 Hartwrightia (Hartwrightia floridana)
S 453 Pond-spice (Litsea aestivalis)
S 454 Trumpets (Sarracenia flava)
S 455 Hooded pitcher plant (Sarracenia minor)
S 456 Parrot pitcher plant (Sarracenia psittacina)
S 457 Riparian autumngrass (Schizachyrium niveum)
458 Pond cypress (Taxodium distichum nutans)
459 Ogeeche tupelo (Nyssa ogeche)
460 Croomia (Croomia pauciflora)
461 Vahl's fimbry (Fimbristylis perpusilla)
462 Curtiss' lythrum (Lythrum curtissii)
463 Piedmont water-milfoil (Myriophyllum laxum)
464 Fringed campion (Silene polypetala)
465 Unique vegetation association
466 False-leaved false-foxglove (Agalinis pseudophylla)
467 False-coco (Eulophia ecristata)
468 Juneberry holly (Ilex amelanchier)
469 Carolina lilaeopsis (Lilaeopsis carolinensis)

continued

Table 2 (continued).

| | |
|---|---|
| 470 | Naked-stemmed panic-grass (Panicum nudicaule) |
| 471 | Chapman's butterwort (Pinguicula planifolia) |
| 472 | Yellow fringeless orchid (Platanthera integra) |
| 473 | American chaffseed (Schwalbea americana) |
| 474 | Drummond's yellow-eyed grass (Xyris drummondii) |
| 475 | Black mangrove (Avicennia nitida) |
| 476 | Laurel oak (Quercus laurifolia) |
| F 477 | Black lace cactus (Echinocereus reichenbachii var. albertii) |
| | INVERTEBRATES (500 through 549) |
| F 500 | Bahama swallowtail butterfly (Papilio andraemon bonhotei) |
| F 501 | Schaus swallowtail butterfly (Papilio aristodemus ponceanus) |
| F 502 | Stock Island tree snail (Orthalicus reses) |
| 503 | Florida tree snail (Liguus fasciatus) |
| 504 | Atala butterfly (Eumaeus atala florida) |
| 505 | Maesites hairstreak (Chlorostrymon maesites maesites) |
| | BIRDS (550 through 849) |
| 550 | Shorebirds (550 through 599) |
| 551 | Gulls and terns (Laridae) |
| 552 | Sandpipers (Scolopacidae) |
| 553 | Jacana (Jacana spinosa) |
| 554 | American oystercatcher (Haematopus palliatus) |
| 555 | Plovers (Charadriinae) |
| S 556 | Cuban snowy plover (Charadrius alexandrinus tenuirostris) |
| S 557 | Least tern (Sterna albifrons) |
| 558 | Long-billed curlew (Numenius americanus) |
| 559 | Marbled godwit (Limosa fedoa) |
| 560 | Royal tern (Sterna maxima) |
| 561 | Black tern (Childonias niger) |
| 562 | American avocet (Recurvirostra americana) |
| 563 | Forster's tern (Sterna forsteri) |
| 564 | Sandwich tern (Sterna sandvicensis) |
| 565 | Gull-billed tern (Gelochelidon nilotica) |
| S 566 | Roseate tern (Sterna dougallii) |
| 567 | Black skimmer (Rynchops nigra) |
| 568 | Laughing gull (Larus atricilla) |
| 569 | Wilson's plover (Charadrius wilsonia) |
| 570 | Common snipe (Capella gallinago) |
| 571 | Sooty tern (Sterna fuscata) |
| 572 | Black-necked stilt (Himantopus mexicanus) |
| 573 | Common tern (Sterna hirundo) |
| 574 | Whimbrel (Numenius phaeopus) |
| 575 | Hudsonian godwit (Limosa haemastica) |
| 600 | Wading birds (600 through 649) |
| 601 | Herons (Ardeinae) |
| 602 | Egrets (Ardeinae) |
| S 603 | Wood stork (Mycteria americana) |
| 604 | Great blue heron (Ardea herodias) |
| S 605 | Reddish egret (Dichromanassa rufescens) |
| S 606 | White-faced ibis (Plegadis chihi) |
| 607 | White ibis (Eudocimus albus) |
| 608 | Roseate spoonbill (Ajaia ajaja) |
| 609 | Great egret (Casmerodius albus) |
| 610 | Snowy egret (Egretta thula) |
| 611 | Louisiana heron (Hydranassa tricolor) |
| 612 | Black-crowned night heron (Nycticorax nycticorax) |
| 613 | Little blue heron (Florida caerulea) |
| 614 | Cattle egret (Bubulcus ibis) |
| 615 | Ibises (Threskiornithinae) |
| 616 | Yellow-crowned night heron (Nyctanassa violacea) |
| 617 | Rails (Rallinae) |
| 618 | Least bittern (Ixobrychus exilis) |
| 619 | Gallinules (Rallinae) |
| S 620 | Florida sandhill crane (Grus canadensis pratensis) |

continued

Table 2 (continued).

| | | |
|---|---|---|
| | 621 | Great white heron (Ardea herodias occidentalis) |
| | 622 | American bittern (Botaurus lentiginosus) |
| | 623 | Limpkin (Aramus guarauna) |
| F | 624 | Mississippi sandhill crane (Grus canadensis pulla) |
| F | 625 | Whooping crane (Grus americana) |
| | 626 | Least grebe (Podiceps dominicus) |
| | 627 | Sandhill cranes (Grus canadensis) |
| | 650 | Waterfowl (650 through 699) |
| | 651 | Dabbling ducks (Anatinae) |
| | 652 | Diving ducks (Aythyinae) |
| | 653 | Geese (Anserinae) |
| | 654 | Anhinga (Anhinga anhinga) |
| | 655 | Canvasback (Aytha valisineria) |
| | 656 | Northern shoveler (Anas clypeata) |
| | 657 | Pintail (Anas acuta) |
| | 658 | Wood duck (Aix sponsa) |
| | 659 | Ruddy duck (Oxyura jamaicensis) |
| | 660 | Snow goose (Chen caerulescens) |
| | 661 | Canada goose (Branta canadensis) |
| | 662 | Mottled duck (Anas fulvigula) |
| | 663 | Fulvous whistling-duck (Dendrocygna bicolor) |
| | 664 | Masked duck (Oxyura dominica) |
| | 665 | Redhead (Aytha americana) |
| | 666 | White-fronted goose (Anser albifrons) |
| | 667 | Common loon (Gavia immer) |
| | 668 | Teals (Anas spp.) |
| | 669 | Lesser scaup (Aytha affinis) |
| | 670 | American coot (Fulica americana) |
| | 671 | American wigeon (Anas americana) |
| | 672 | Black-bellied whistling-duck (Dendrocygna autumnalis) |
| | 700 | Raptors (700 through 749) |
| | 701 | Bird hawks (Accipitrinae) |
| S | 702 | Swallow-tailed kite (Elanoides forficatus) |
| | 703 | Mississippi kite (Ictinia mississippiensis) |
| F | 704 | Everglade kite (Rostrhamus sociabilis plumbeus) |
| | 705 | Owls (Strigiformes) |
| | 706 | Marsh hawk (Circus cyaneus) |
| F | 707 | Bald eagle (Haliaeetus leucocephalus) |
| S | 708 | Audubon's caracara (Caracara cheriway auduboni) |
| F | 709 | Peregrine falcon (Falco peregrinus) |
| | 710 | Hawks and eagles (Buteoninae) |
| | 711 | Red-shouldered hawk (Buteo lineatus) |
| S | 712 | Osprey (Pandion haliaetus) |
| S | 713 | Southeastern American kestrel (Falco sparverius sparverius) |
| | 714 | Florida burrowing owl (Athene cunicularia floridana) |
| | 715 | Short-tailed hawk (Buteo brachyurus) |
| | 716 | Sharp-shinned hawk (Accipiter striatus) |
| S | 717 | White-tailed hawk (Buteo albicaudatus) |
| | 718 | Harris' hawk (Parabuteo unicinctus) |
| S | 719 | Zone-tailed hawk (Buteo albonotatus) |
| S | 720 | Gray hawk (Buteo nitidus) |
| S | 721 | Black hawk (Buteogallus anthracinus) |
| | 722 | White-tailed kite (Elanus leucurus) |
| | 750 | Seabirds (750 through 799) |
| | 751 | Magnificent frigate-bird (Fregata magnificens) |
| | 752 | Brown noddy (Anous stolidus stolidus) |
| | 753 | Olivaceous cormorant (Phalacrocorax olivaceus) |
| | 754 | Double-crested cormorant (Phalacrocorax auritus) |
| | 755 | Cormorants (Phalacrocorax spp.) |
| | 756 | Brown booby (Sula leucogaster) |
| | 757 | Blue-faced booby (Sula dactylatra) |
| | 758 | Horned grebe (Podiceps auritus) |
| | 759 | White pelican (Pelecanus erythrorhynchos) |
| F | 760 | Brown pelican (Pelecanus occidentalis) |
| | 761 | Gannet (Morus bassanus) |
| | 762 | Scoters (Melanitta spp.) |
| | 763 | Eared grebe (Podiceps nigricollis) |

continued

Table 2 (continued).

| | | |
|---|---|---|
| | 800 | Songbirds and others (800 through 849) |
| | 801 | Woodpeckers (Picinae) |
| | 802 | Turkey (Meleagris gallapavo) |
| | 803 | Bobwhite (Colinus virginianus) |
| F | 804 | Attwater's greater prairie chicken (Tympanuchus cupido attwateri) |
| | 805 | Scissor-tailed flycatcher (Muscivora forficata) |
| | 806 | Black-whiskered vireo (Vireo altiloquus) |
| | 807 | Sparrows (Fringillidae) |
| F | 808 | Kirtland's warbler (Dendroica kirtlandii) |
| F | 809 | Red-cockaded woodpecker (Dendrocopos borealis) |
| | 810 | Antillean nighthawk (Chordeiles minor gundlachii) |
| | 811 | Gray kingbird (Tyrannus dominicensis) |
| | 812 | Cuckoos, roadrunners, anis (Cuculidae) |
| | 813 | Mangrove cuckoo (Coccyzus minor) |
| | 814 | Smooth-billed ani (Crotophaga ani) |
| | 815 | Western kingbird (Tyrannus verticalis) |
| S | 816 | White-crowned pigeon (Columba leucocephala) |
| | 817 | Scarlet ibis (Eudocimus ruber) |
| F | 818 | Cape Sable seaside sparrow (Ammospiza maritima mirabilis) |
| | 819 | Spotted-breasted oriole (Icterus pectoralis) |
| S | 820 | Florida grasshopper sparrow (Ammodramus savannarum floridanus) |
| | 821 | Parrots and parakeets (Psittaciformes) |
| | 822 | Hummingbirds (Trochilidae) |
| S | 823 | Florida scrub jay (Aphelocoma coerulescens coerulescens) |
| | 824 | Yellow-rumped warbler (Dendroica coronata) |
| | 825 | Ringed turtle dove (Streptopelia risoria) |
| | 826 | Bachman's sparrow (Aimophila aestivalis) |
| | 827 | Hooded warbler (Wilsonia citrina) |
| | 828 | Brown-headed nuthatch (Sitta pusilla) |
| | 829 | Perching birds (Passeriformes) |
| | 830 | Groove-billed ani (Crotophaga sulcirostris) |
| | 831 | Yellow-headed blackbird (Xanthocephalus xanthocephalus) |
| | 832 | Warblers (Parulidae) |
| | 833 | Goatsuckers (Caprimulgiformes) |
| | 834 | Fringillids (Fringillidae) |
| | 835 | Louisiana waterthrush (Seiurus motacilla) |
| | 836 | Sprague's pipit (Anthus spragueii) |
| | 837 | Stoddard's yellow-throated warbler (Dendroica dominica stoddardi) |
| | 838 | Mourning dove (Zenaida macroura) |
| | 839 | Ring-necked pheasant (Phasianus colchicus) |
| | 840 | Pauraque (Nyctidromus albicollis) |
| | 841 | Rio Grande turkey (Meleagris gallopavo intermedia) |
| | 842 | Chachalaca (Ortalis vetula) |
| | 843 | Kiskadee flycatcher (Pitangus sulphuratus) |
| | 844 | Tropical kingbird (Tyrannus melancholicus) |
| | 845 | Long-billed thrasher (Toxostoma longirostre) |
| | 846 | Lichtenstein's oriole (Icterus gularis) |
| | 847 | Green jay (Cyanocorax yncas) |
| | 848 | Black-headed oriole (Icterus graduacauda) |
| | 849 | White-winged dove (Zenaida asiatica) |
| | | REPTILES AND AMPHIBIANS (850 through 899) |
| | 850 | Reptiles and amphibians |
| F | 851 | American alligator (Alligator mississipiensis) |
| F | 852 | American crocodile (Crocodylus acutus) |
| F | 853 | Eastern indigo snake (Drymarchon corais couperi) |
| | 854 | Florida gopher frog (Rana areolata aesopus) |
| | 855 | Florida key mole skink (Eumeces egregius egregius) |
| S | 856 | Miami black-headed snake (Tantilla oolitica) |
| | 857 | Gopher tortoise (Gopherus polyphemus) |
| | 858 | Suwannee cooter (Chrysemys concinna suwanniensis) |
| S | 859 | Key mud turtle (Kinosternon bauri bauri) |
| S | 860 | Big Pine Key ringneck snake (Diadophis punctatus acricus) |
| S | 861 | Florida brown snake (Storeria dekayi victa) |
| S | 862 | Florida ribbon snake (Thamnophis sauritus sackeni) |

continued

Table 2 (continued).

S 863 Short-tailed snake (Stilosoma extenuatum)
S 864 Sand skink (Neoseps reynoldsi)
865 Apalachicola kingsnake (Lampropeltis getulus goini)
866 Barbour's map turtle (Graptemys barbouri)
867 One-toed amphiuma (Amphiuma pholeter)
868 Four-toed salamander (Hemidactylium scutatum)
869 Georgia blind salamander (Haideotriton wallacei)
870 Southern copperhead (Agkistrodon contortrix contortrix)
F 871 Pine barrens treefrog (Hyla andersonii)
872 Seal salamander (Desmognathus monticola)
S 873 Black pine snake (Pituophis melanoleucus lodingi)
S 874 Rainbow snake (Farancia erytrogramma)
S 875 Yellow-blotched sawback turtle (Graptemys flavimaculata)
S 876 Ringed sawback turtle (Graptemys oculifera)
S 877 Southern hognose snake (Heterodon simus)
S 878 Texas indigo snake (Drymarchon corais erebennus)
879 Cottonmouth (Agkistrodon spp.)
S 880 Mexican treefrog (Smilisca baudini)
S 881 Rio Grande frog (Syrrhophus cystignathoides campi)
S 882 Giant toad (Bufo marinus)
S 883 Texas tortoise (Gopherus berlandieri)
S 884 Texas horned lizard (Phrynosoma cornutum)
S 885 White-lipped frog (Leptodactylus labialis)
886 Diamondback terrapin (Malaclemys terrapin)

MAMMALS (900 through 999)

F 900 Red wolf (Canis rufus)
S 901 Black bear (Ursus americanus)
902 Western cougar (Felis concolor stanleyana)
903 Bobcat (Lynx rufus)
S 904 Ocelot (Felis pardalis)
F 905 Jaguarundi (Felis yagouaroundi)
906 Whitetail deer (Odocoileus virginianus)
F 907 Key deer (Odocoileus virginianus clavium)
908 Beaver (Castor canadensis)
909 Mink (Mustela vison)
910 Eastern chipmunk (Tamias striatus)
911 River otter (Lutra canadensis)
912 Gray fox (Urocyon cinereoargenteus)
913 Nutria (Myocastor coypus)
914 Muskrat (Ondatra zibethicus)
915 Feral hog (Sus scrofa)
916 Collared peccary (Dicotyles tajacu)
917 Coyote (Canis latrans)
918 Swamp rabbit (Sylvilagus aquaticus)
919 Marsh rabbit (Sylvilagus palustris)
920 Tree squirrels (Sciurus spp., Tamiasciurus spp., Glaucomys spp.)
921 Raccoon (Procyon lotor)
S 922 Key Largo woodrat (Neotoma floridana smalli)
923 Lower keys cotton rat (Sigmodon hispidus exsputus)
S 924 Key Largo cotton mouse (Peromyscus gossypinus allapaticola)
S 925 Florida mouse (Peromyscus floridanus)
926 Sherman's fox squirrel (Sciurus niger shermani)
F 927 Gray bat (Myotis grisescens)
F 928 Indiana bat (Myotis sodalis)
929 Round-tailed muskrat (Neofiber alleni)
S 930 Silver rice rat (Oryzomys argentatus)
S 931 Key Vaca raccoon (Procyon lotor auspicatus)
S 932 Mangrove fox squirrel (Sciurus niger avicennia)
S 933 Florida black bear (Ursus americanus floridanus)
S 934 Everglades mink (Mustela vison evergladensis)
F 935 Florida panther (Felis concolor coryi)
936 Blacktail jackrabbit (Lepus californicus)
937 Opossum, skunks, armadillo (Didelphis virginiana, Spilogale spp., Mephitis spp., Dasypus novemcinctus)
938 Eastern cottontail (Sylvilagus floridanus)
939 Red fox (Vulpes vulpes)

continued

Table 2 (concluded).

| | |
|---|---|
| S 940 | Perdido Bay beach mouse (*Peromyscus polionotus trissyllepsis*) |
| S 941 | Choctawhatchee beach mouse (*Peromyscus polionotus allophrys*) |
| 942 | Badger (*Taxidea taxus*) |
| 943 | Marsh deer (*Odocoileus virginianus mcilhennyi*) |
| 944 | Axis deer (*Axis axis*) |
| 945 | Sambar deer (*Cervus unicolor*) |
| 946 | Fox squirrel (*Sciurus niger*) |
| 947 | Coati (*Nasua nasua*) |

F = Federally listed threatened or endangered species.

S = State-listed threatened or endangered species.

## 2.3 INVENTORY GRAPHICS

### 2.3.1 The Maps and Grid System

The base maps used in this study are the USGS National Topographic Map Series with a scale of 1:250,000. These maps contain the Universal Transverse Mercator (UTM) grid system. The 22 Gulf coast ecological inventory maps are shown in Figure 3 and listed in Table 3.

The 10,000-meter centered UTM grid system is used on the maps as an aid in locating specific point and area features. The UTM east-west grid lines are employed to great advantage in describing the biological resources along the north-south trending coastlines of Florida and Texas. The appropriate north-south grid lines are used to describe the resources along the east-west trending coasts of Alabama, Mississippi, and Louisiana.

Instructions on how to use the UTM system are found in the User's Guide (part 3) of this report and on the legend of each map. Standard alphanumeric coding is employed to identify the geographic location of specific points.

### 2.3.2 Cartographic Discussion

USGS supplied the separation plates for each of the base map sheets used in this study. Each map sheet generally consists of a series of separation plates that show drainage, open water, contour, road, and cultural features. The individual separation plates composing each base map were aligned and pin registered before being used for the inventory graphics. A black and white composite of each base map was reproduced on stable base mylar. These individual prepunched mylar maps then were used as the data base during the synthesis and compilation of the biological and land use resources of the study region. Special land use delineations were compiled directly on the mylar base. The terrestrial and aquatic resources were compiled on separate mylar overlays and pin registered to each of the mylar base maps.

The cartographic effort involved a series of coordinated tasks leading to the production of 22 color-coded maps showing the ecological resources of the Gulf coast. The tasks included negative engraving (scribing process), preparation of negative open windows (peel coat process), composition of type nomenclature, placement of type, and photo laboratory processing.

All linework and map unit boundaries were prepared by scribing to ensure consistent line weights and close tolerance. The resulting scribe plates subsequently were used to make press-ready negatives for printing by contact photographic methods. In addition, the scribe plates provided the capability for applying special colors to specific map unit boundaries. For example, this process made it possible to separate and portray aquatic map unit boundaries in blue, terrestrial map unit boundaries in brown, and species with special status map unit boundaries in red. The peel coat process allowed large areas to be portrayed with special tints. For example, yellow highlights the land areas, blue defines the marine and inland water areas, and light green shows the extent of special land use areas.

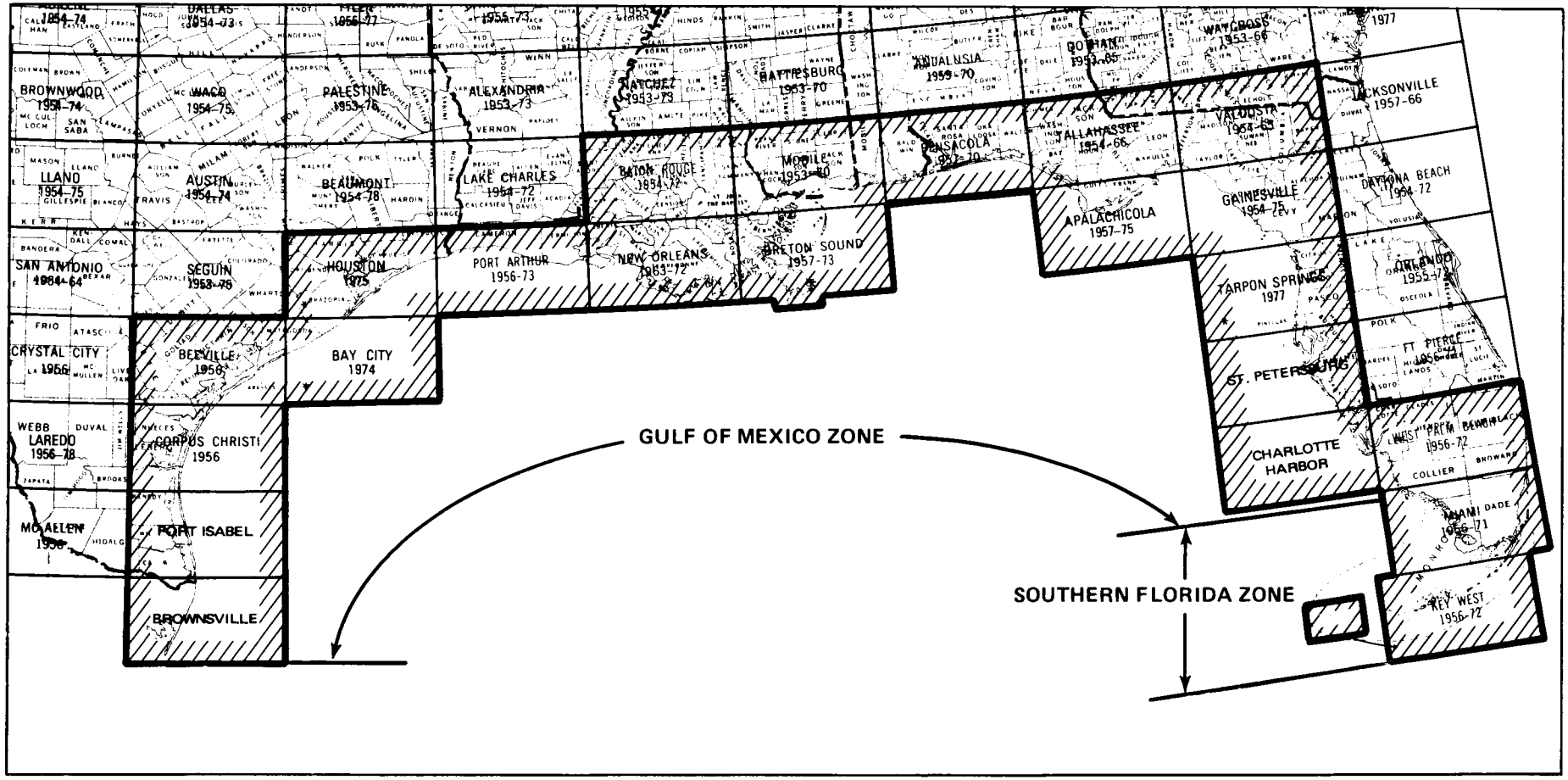


**Figure 3. Index to USGS map sheets (scale 1:250,000) and major zones of the Gulf coast ecological inventory.**

Table 3. USGS maps (1:250,000) used in the Gulf coast ecological inventory and corresponding Terrell zones and sections.

| | | Southern Florida | | | Gulf of Mexico | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | State | Florida Keys | Florida Bay | Ten Thousand Islands | Central Barrier Coast | Big Bend Drowned Karst | Apalachicola Cuspate Delta | North Central Gulf Coast | Mississippi Delta | Strandplain-Chenier Plain System | Texas Barrier Island System |
| Key West | FL | X | X | | | | | | | | |
| Miami | FL | X | X | X | X | | | | | | |
| West Palm Beach | FL | | | | X | | | | | | |
| Charlotte Harbor | FL | | | | X | | | | | | |
| Saint Petersburg | FL | | | | X | | | | | | |
| Tarpon Springs | FL | | | | X | X | | | | | |
| Gainesville | FL | | | | | X | | | | | |
| Valdosta | GA, FL | | | | | X | | | | | |
| Tallahassee | FL, GA | | | | | X | X | X | | | |
| Apalachicola | FL | | | | | X | X | X | | | |
| Pensacola | FL, AL | | | | | | | X | | | |
| Mobile | AL, MS, LA | | | | | | | X | X | | |
| Breton Sound | LA | | | | | | | X | X | | |
| New Orleans | LA | | | | | | | | X | | |
| Baton Rouge | LA | | | | | | | | X | | |
| Port Arthur | TX, LA | | | | | | | | X | X | |
| Houston | TX | | | | | | | | | X | X |
| Bay City | TX | | | | | | | | | | X |
| Beeville | TX | | | | | | | | | | X |
| Corpus Christi | TX | | | | | | | | | | X |
| Port Isabel | TX | | | | | | | | | | X |
| Brownsville | TX | | | | | | | | | | X |

Each map sheet contains an average of 14 separate pin-registered flats--a single flat represents a specific set of similar items, such as base map information, symbols, patterns, linework, and nomenclature. Flats with the same color code were combined and photographed individually to produce a final press-ready negative. A total of five press-ready negatives were produced for each map sheet; each negative represents one of the five colors depicted on the map. The press-ready negatives subsequently were placed into a frame collar prior to printing.

### 2.3.3 Inventory Map Development

The inventory maps are the major data source for the location of important biological and ecological resources along the Gulf coast. Prior to preparing the final set of inventory maps, two areas along the Gulf coast were selected for trial graphics display sets. The 1:250,000-scale quadrangles of Houston, Texas, and New Orleans, Louisiana, were used for this purpose. Sample color-coded maps were submitted to FWS for review and comments.

The final inventory graphics were prepared after draft copies of the inventory graphics were reviewed by various field offices of Federal, state, and local agencies. The respective comments on the accuracy and reliability of the mapped resource data were evaluated and screened prior to incorporating the suggestions onto the appropriate draft compilation manuscript. The individual map sheets then were revised and format registered prior to the preparation of press-ready negatives.

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# PART 3

# USER'S GUIDE

## 3.1 THE INVENTORY MAPS

The purpose of the inventory maps is to provide basic information on the biological and land use resources of the Gulf coast. The maps are intended to assist the user in the initial planning of energy facilities by showing the location and occurrence of important fish and wildlife species and highlighting the location of special land use areas.

The inventory maps have been designed for use either independently or in association with this report. However, for best results, the user should consult the narrative report during his or her review of the inventory maps.

The frame portion of each map contains a comprehensive legend and supplemental information, showing symbols, colors, patterns and lines, and alphanumeric descriptors, each representing a specific biological resource, habitat, or special land use feature. The base map information from the standard 1:250,000-scale National Topographic Map Series also has been retained for this inventory. Table 4 summarizes the types of cultural and ecological information shown on the inventory maps.

## 3.2 HOW TO USE THE INVENTORY MAPS

The inventory maps are multipurpose in scope and cover many aspects of the biological environment of the Gulf coastal zone. The reader should pay attention to the legend and explanatory text while using the inventory maps.

The Gulf coast ecological inventory includes the total area shown on each map sheet and is not limited to the narrow coastal zone, as were the Atlantic and Pacific coast inventories. However, for ease of identification, the inland and seaward boundaries of the coastal zone are framed by a wide hatched line pattern. Inland or land portions of the map sheet are printed in yellow, and seaward or water portions are printed in light blue.

The ecological information shown on the inventory maps may be divided into three general categories (see Table 4): land use/land cover, aquatic organisms, and terrestrial organisms. Figure 4 is a portion of the New Orleans, Louisiana, sheet reproduced in black and white.

### 3.2.1 Land Use/Land Cover

Special land use areas, such as national wildlife refuges, national parks, state parks, and state wildlife management areas, always are shown with a gray boundary and light green tint. Depending upon its size, a special land

Table 4. Summary of information shown on Gulf coast ecological inventory maps.

Base Map

- Water features (oceans, lakes, rivers, canals)
- Cultural features (roads, railroads, airfields, civil boundaries)
- Cartographic information (map sheet name, scale, location diagram, UTM grid system)

Land Use/Land Cover

- Coastal zone boundary and Federal-state demarcation
- Special land use areas (refuges, wildlife management areas, national or state parks, etc.)
- Marsh or Swamp
- Beach/Dunes
- Seagrass
- Reef

Aquatic Organisms

- Estuarine and riverine areas, indicated by lines depicting high, middle, and low salinity, and freshwater habitats
- Point and area boundaries showing locations and concentrations of aquatic organisms, including species that are threatened or endangered
- Symbol, number, and letter designators identifying general class, species or group, and habitat use for aquatic organisms
- Comprehensive species list keyed to five general classes of aquatic organisms (plants, invertebrates, fish, reptiles and amphibians, and mammals)

Terrestrial Organisms

- Point and area boundaries showing locations and concentrations of terrestrial organisms, including species that are threatened or endangered

continued

Table 4 (concluded).

Terrestrial Organisms (cont'd)

- Symbol, number, and letter designators identifying general class, species or group, and habitat use for terrestrial organisms
- Comprehensive species list keyed to five general classes of terrestrial organisms (plants, invertebrates, birds, reptiles and amphibians, and mammals), including six subclasses of birds (shorebirds, wading birds, waterfowl, raptors, seabirds, and songbirds and others)

Notebox

- Special explanatory text, appearing in the map area or frame border, which supplements the biological and land use information shown on the corresponding inventory map

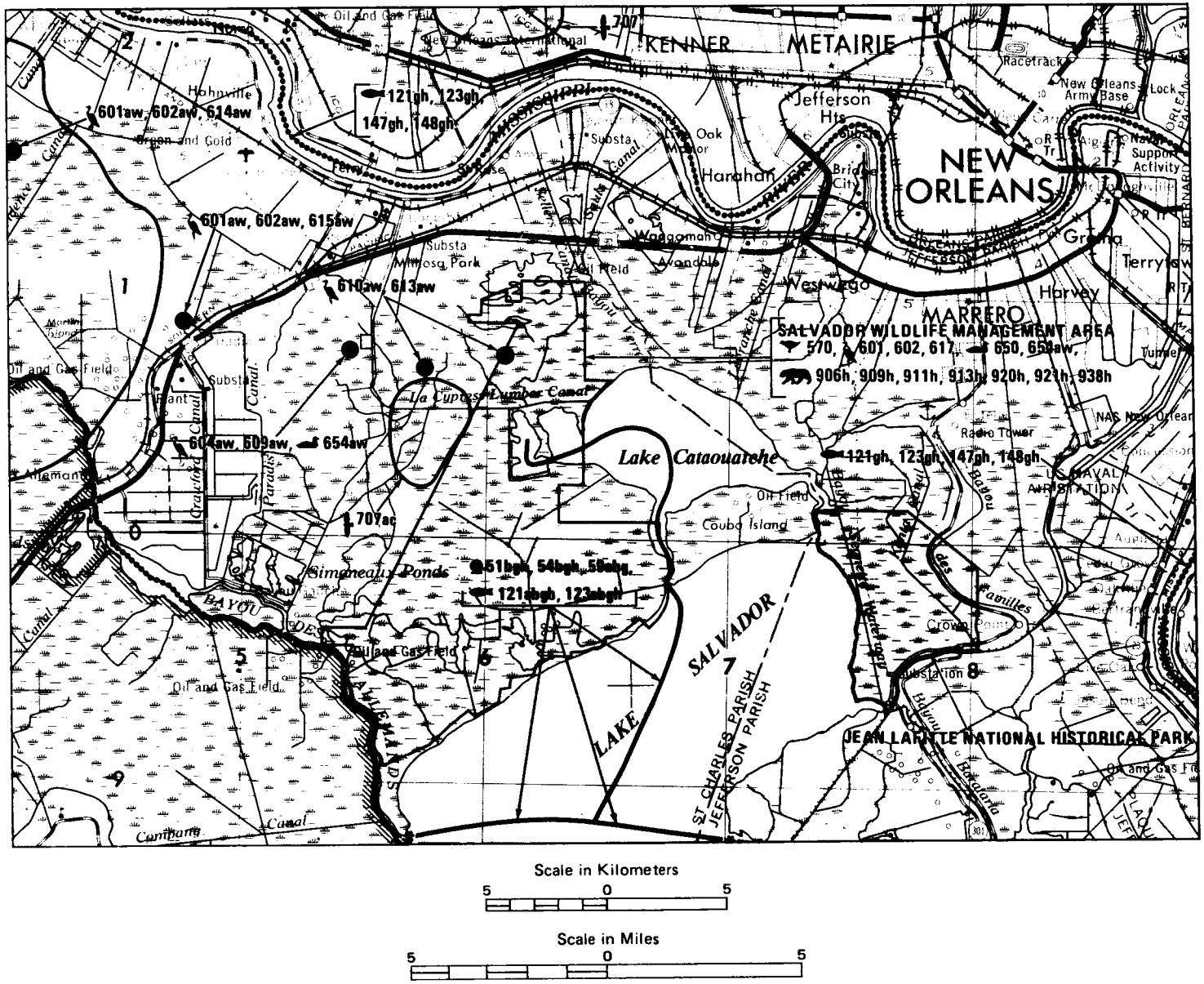



**Figure 4. Portion of the Gulf coast ecological inventory map of New Orleans, Louisiana.**

use area can appear as either a small circle centered over the area's location or as the official boundary of the area. A special land use area always is identified on the inventory maps by its official name, for example, Everglades National Park in Florida, Edward Douglass White State Commemorative Area in Louisiana, and Brazos Island State Recreation Area in Texas.

Land cover features appearing on the inventory maps are marshes or swamps, beaches/dunes, seagrass beds, and reefs. Marshes or swamps are identified by a screen pattern and overprinted with light blue. Beaches/dunes, seagrass beds, and reefs are depicted by individual patterns overprinted in gray.

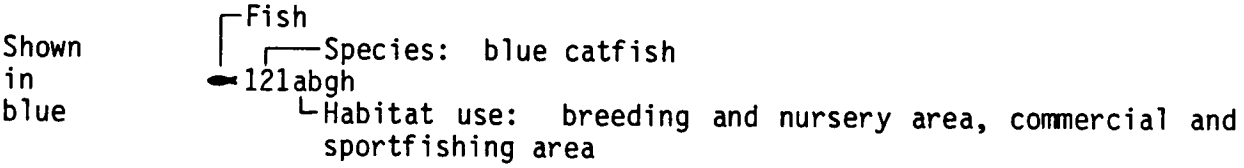
### 3.2.2 Aquatic Organisms

Aquatic organisms are identified on the inventory maps by a variety of line widths, symbols, numbers, and letter designators. Aquatic organisms, including plants, invertebrates, fish, reptiles and amphibians, and mammals, usually are shown in blue unless the particular species has special status. Species with special status--that is, those species which are endangered or threatened--always are shown in red on the inventory maps.

Local concentrations of aquatic organisms are identified by a point feature (a solid dot of appropriate color); larger areas of concentration are delineated by an enclosed boundary; and estuarine and riverine habitats are differentiated by line symbols of varying widths. These line symbols can be solid, dashed, or dotted, depending on the salinity range in an area. For example, a heavy solid line shown in an estuary signifies a high-salinity habitat; sequential dashed, narrow solid, and dotted lines indicate progressively lower salinity habitats. Point features, the boundary lines enclosing area features, and estuarine and riverine habitat line symbols are shown in blue, unless the particular species has special status, in which case the point, boundary, or line features always are highlighted in red.

The classification scheme used on the inventory maps to identify a specific aquatic species and its corresponding habitat use consists of a generalized pictorial symbol, a number, and one or more lowercase letters. The pictorial symbol denotes one of five general aquatic classes; the number refers to the individual species or group from the species list, which appears in the right-hand frame margin of each inventory map; and the lowercase letters (a through h and w through z) refer to the specific habitat use of the particular species and the time of year the species is present.

A representative example, showing the manner in which this classification scheme is used on the maps to identify a specific aquatic species and its habitat use designation, is shown below (see also Figure 4).



### 3.2.3 Terrestrial Organisms

Terrestrial symbols are identified on the inventory maps by a variety of symbols, numbers, and letter designators. Terrestrial organisms, including plants, invertebrates, birds, reptiles and amphibians, and mammals, usually are shown in brown unless the particular species has special status. Species with special status--that is, species which are endangered or threatened--always are shown in red on the inventory maps.

Local concentrations of terrestrial organisms are identified by a point feature (a solid dot of appropriate color); larger areas of concentration are delineated by an enclosed boundary. Point features and boundary lines enclosing area features are shown in brown, unless the particular species has special status, in which case the point or boundary features always are highlighted in red.

The classification scheme used on the inventory maps to identify a specific terrestrial species and its corresponding habitat use consists of a generalized pictorial symbol, a number, and one or more lowercase letters. The pictorial symbol denotes one of four general terrestrial classes or six bird subclasses; the number refers to the individual species or group from the species list, which appears in the right-hand frame margin of each inventory map; and the lowercase letters (a through h and w through z) refer to the specific habitat use of the particular species and the time of year the species is present.

Representative examples, showing the manner in which this classification scheme is used on the maps to identify a specific terrestrial species and its habitat, are shown below (see also Figure 4).

Always shown in red

Raptors
Species with special status: bald eagle
707ac
Habitat use: breeding area, adult concentration area

Shown in brown

Waterfowl
Species: anhinga
654aw
Habitat use: breeding area, spring

Mammals
Species: whitetail deer
906ch
Habitat use: adult concentration area, hunting area

### 3.3 HOW TO USE THE GRID REFERENCE SYSTEM

Each inventory map contains the standard UTM grid system, made up of a network of 10,000-meter vertical and horizontal grid lines keyed to corresponding grid reference numbers. The legend block in the frame portion of each map identifies the map's grid zone designation, the 100,000-meter square identification for each map area, and a set of general instructions on how to use the UTM grid reference system.

In this inventory, the UTM grid reference system is used to identify the geographic location of biological resources. Specifically, the 10,000-meter grid lines, consisting of a series of alphanumeric reference points, provide the basic location system for describing the biological resources within discrete intervals, or swaths along the Gulf coast. The east-west or horizontal grid lines are used to subdivide sections of the north-south trending coasts of Florida and Texas. Two horizontal grid lines define a swath generally perpendicular to the coast. The swath locates geographically the biological resources to be described. In a similar way, the north-south or vertical grid lines are used to define swaths across sections of coast which trend in an east-west direction (Alabama, Mississippi, and Louisiana). The UTM grid reference system has been used with Terrell's Level II regional classification scheme for Gulf coast ecosystems (Table 1 and Figure 2).

UTM grid locations are identified by their alphanumeric designators, consisting of two letters followed by two numbers (for example, grid reference YC79 or TD90). The two letters of the grid reference designator identify the appropriate 100,000-meter square in which the biological resource occurs; the two numbers refine the location of the feature to the nearest 10,000-meter square. The first number identifies the north-south or vertical grid line; the second number designates the intersecting east-west or horizontal grid line. The vertical grid line always is located to the left, or west, of the feature being described; the intersecting horizontal grid line always is located below, or south, of the feature of interest.

Two representative examples on how to use the UTM grid reference system are presented below.

Example 1

Map: Houston, TX
Species of interest: Blue crabs
Identify appropriate 100,000-meter square (legend block): UC
Locate 10,000-meter vertical grid number (always to left of point): 2
Locate 10,000-meter horizontal grid number (always below point): 5

The location is identified in the report as grid reference UC25.

Example 2

Map: New Orleans, LA
The location is identified in report as: grid reference YD62
Consult UTM legend block to identify appropriate 100,000-meter square: YD
Locate 10,000-meter vertical grid number (always to left of point): 6
Locate 10,000-meter horizontal grid number (always below point): 2

The grid reference refers to the location of the bald eagle nest at the end of the New Orleans International Airport runway.

# PART 4

# SOUTHERN FLORIDA ZONE
# (GRID REFERENCE NU82 to MU35)

## 4.1 INTRODUCTION

For best results, much of the preparatory information in parts 1, 2, and 3 should be read before using the maps or using the information in this part. This part presents some of the physiographic, land use, and geographic features of the Southern Florida Zone and the characteristics and habits of some of the major biological resources.

### 4.1.1 Physical Description

The Southern Florida Zone (Figure 5) constitutes approximately 10 percent of the study area and extends from the south end of Biscayne Bay to Cape Romano, Florida (grid reference NU82 to MU35). The climate and biota of this zone are affected by the main branch of the Florida Current, which flows eastward along the outer edge of the Florida Keys and merges with the Gulf Stream along the east coast of Florida. The Florida peninsular land mass and the warm-water marine environment at its southern tip effectively isolate many warm temperate marine populations in the Gulf of Mexico from similar populations in the Atlantic. Many of these populations were continuous prior to the uplift of the Florida peninsula. The Southern Florida Zone contains three subdivisions or sections: the Florida Keys, Florida Bay, and the Ten Thousand Islands area. (Terrell's original classification included Biscayne Bay within this zone; however, Biscayne Bay was studied as part of the previously completed Atlantic coast ecological inventory--available from the U.S. Fish and Wildlife Service, publication FWS/OBS-80/51.)

The ecological inventory of the Southern Florida Zone is covered by all or portions of the following USGS 1:250,000-scale maps:

- Key West, FL
- Miami, FL.

The Florida Keys consist of a series of low, limestone islands extending southwest approximately 370 kilometers (230 miles) from the southeast corner of the Florida peninsula. The outer shore of these islands typically forms rocky pinnacles or narrow beaches extending into coral reefs on a very narrow continental shelf. These coral reefs, and the keys themselves, are remnants of a much larger ancient coral formation. The northwest (Florida Bay) side of these islands is characterized by a mosaic of mangrove stands and low mangrove-covered islands interspersed with extensive seagrass and algal beds in shallow embayments. Tides within the keys are semidiurnal; their range varies from 0.2 to 0.8 meters (0.5 to 2.5 feet), being greatest in the northeast. Water

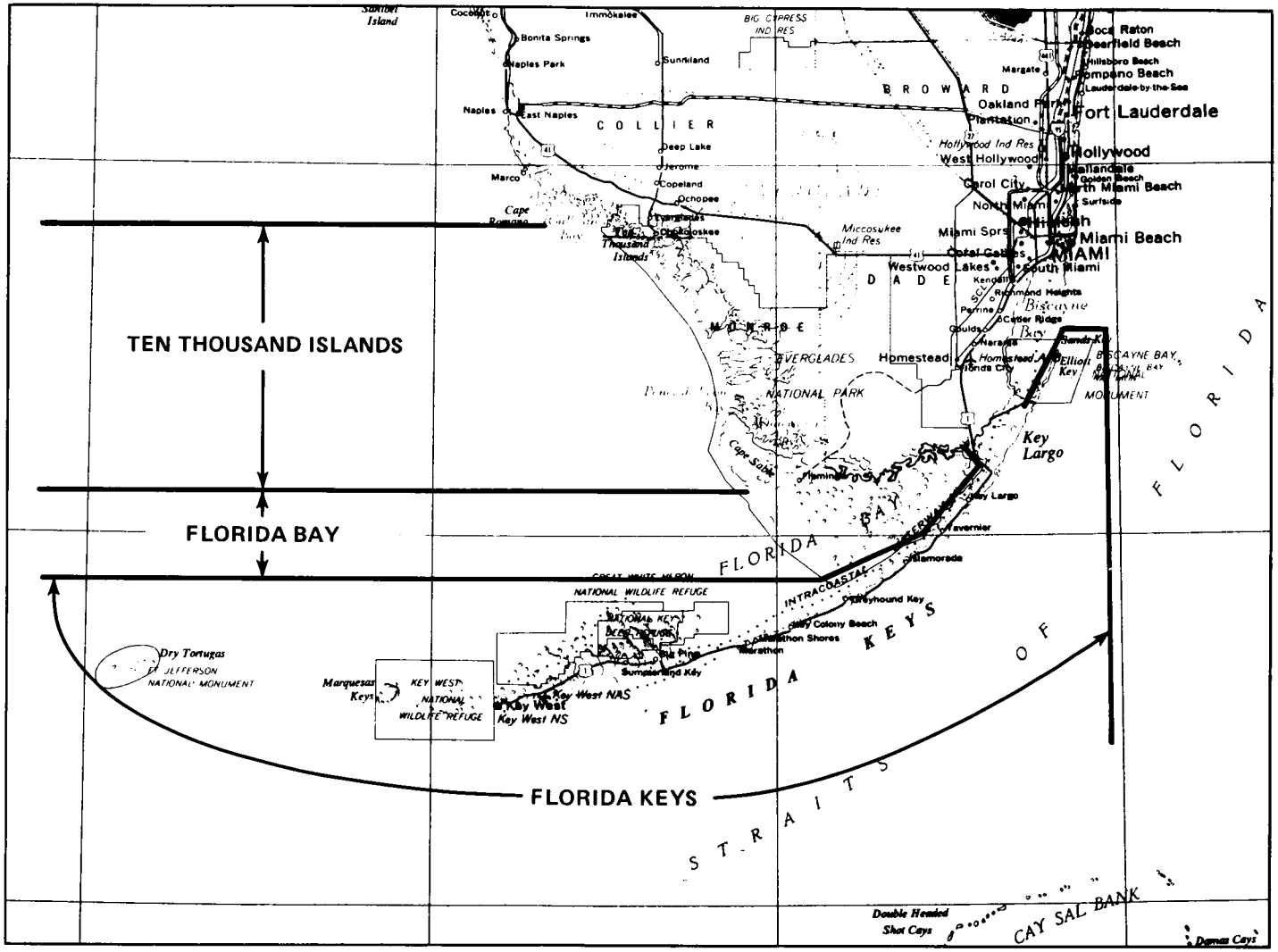



**Figure 5. Major sections of the Southern Florida Zone.**

temperatures at Key West have ranged from 13.9°C (57.0°F) to 33.3°C (91.9°F). Freshwater input to the keys is almost entirely dependent on direct precipitation; except in the northeast portions of this section, no stream discharge reaches the keys.

Florida Bay is a drowned lacustrine plain extending from the shoreline of the Everglades National Park seaward along the northwest edge of the Florida Keys. Water depths are typically less than 2 meters (6 feet). Numerous mangrove islands and hammocks are scattered among drowned remnants of shallow lakes. Vegetation greatly impedes tidal exchange, such that the tidal range diminishes from nearly 0.8 meters (2.5 feet) offshore to approximately 0.1 meter (a few inches) in the northeast portion of the bay. Stream discharge to this section (through the Everglades) is very low; so little runoff reaches Florida Bay relative to its rate of evaporation that much of the bay often is hypersaline.

The Ten Thousand Islands section extends from Cape Sable to Cape Romano on the west coast of Florida. This coastline is dominated by numerous small mangrove islands separated by tidal channels and shallow embayments. The continental shelf in this area is very broad, extending up to 1,350 kilometers (840 miles) from the coastline. Corals and associated organisms dominate large portions of the offshore bottoms, but reefal structures are poorly developed. The diurnal tidal range is approximately 1.2 meters (4 feet). Stream discharge in this area (through the Everglades) is low: approximately 3 cubic meters per second (100 cubic feet per second) is an annual average discharge.

### 4.1.2 Special Land Use Areas

The Southern Florida Zone is composed of varying degrees of development, such as the high urbanization of the Miami area, the isolation of the Dry Tortugas, and the wilderness of the Everglades. Within this limited but diverse area, a total of 25 special land use areas have been identified (Table 5).

Of these special land use areas, 11 are owned by the Federal Government; the remainder are state owned. Everglades National Park is designated as a Class I air quality area. Natural or ecological significance can be attached to 80 percent of the areas, ranging from the coral reefs and marine sanctuaries to the tiny Lignumvitae Key State Botanical Site. Approximately 40 percent of the areas have recreational significance, ranging from diving at John Pennekamp Coral Reef State Park to leisurely walks at Collier-Seminole State Park. In addition, approximately 10 percent of the areas have been denoted as having historic or cultural significance. Because of scale limitations, some sites which are very small in areal extent have not been shown on the maps.

## 4.2 RESOURCES OVERVIEW

The following paragraphs summarize the locations and habitats of various species in the Southern Florida Zone. Only the more important species of the zone have been shown on the inventory maps due to scale limitations.

Table 5. Designated land use areas for the Southern Florida Zone.

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA | | | | | | |
| Biscayne Bay Aquatic Preserve | | X | | X | | |
| Biscayne National Park | X | | | X | | X |
| Crocodile Lake National Wildlife Refuge | X | | | X | | |
| John Pennekamp Coral Reef State Park | | X | | X | | X |
| Key Largo Coral Reef Marine Sanctuary | X | | | X | | |
| Lignumvitae Key Aquatic Preserve | | X | | X | | |
| Lignumvitae Key State Botanical Site | | X | | X | X | |
| Indian Key State Historic Site | | X | | | X | |
| Long Key State Recreation Area | | X | | | | X |
| Bahia Honda State Recreation Area | | X | | | | X |
| Coupon Bight Aquatic Preserve | | X | | X | | |
| Looe Key National Marine Sanctuary | X | | | X | | |
| Florida Keys Wilderness | X | | | X | | |
| Great White Heron National Wildlife Refuge | X | | | X | | |
| National Key Deer Refuge | X | | | X | | |
| Key West National Wildlife Refuge | X | | | X | | |
| Fort Jefferson National Monument | X | | | X | X | |

continued

Table 5 (concluded).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Everglades National Park* | X | | | X | | X |
| Chekika State Recreation Area | | X | | | | X |
| Everglades Wildlife Management Area | | X | | X | | X |
| Big Cypress National Preserve | X | | | X | | X |
| Big Cypress Wildlife Management Area | | X | | X | | X |
| Fakahatchee Strand State Preserve | | X | | X | | X |
| Cape Romano-Ten Thousand Islands Aquatic Preserve | | X | | X | | |
| Collier-Seminole State Park | | X | | | X | X |

*Class I air quality area.

### 4.2.1 Species with Special Status

Species with special status shown on the accompanying inventory maps include only those known to occur in the Southern Florida Zone which are designated as either threatened or endangered on the Federal list and/or on the Florida state list (Table 6) and for which supporting data were available. Species proposed for consideration as endangered, threatened, rare, or other classification are discussed only when appropriate in the applicable aquatic or terrestrial sections of this report.

Species with special status that are known to occur in the Southern Florida Zone include 1 fish, 5 marine reptiles, 4 marine mammals, 28 terrestrial plants or plant groups, 3 terrestrial invertebrates, 13 birds, 8 terrestrial reptiles and amphibians, and 9 terrestrial mammals. In accordance with the Florida list of threatened plants, several plant groups have been included in the species with special status; with specific exceptions, all members of these plant groups are listed as threatened in the State of Florida and specific plant species are not identified in this study. Plants that are members of one of these groups, but that also are included on Florida's list of endangered plant species, have been identified as individual species in the inventory.

The key silverside (152) is essentially a marine fish, although it is tolerant of wide ranges of salinity. It typically inhabits shallow, open bays in the lower Florida Keys. Spawning probably occurs during middle-to-late winter; however, its life history is not well known at this time. The species is of interest as a marine species with a very limited range; it currently is being studied.

Green sea turtles (300) are herbivorous and migrate extensively in search of feeding areas. They inhabit comparatively shallow water inside reefs and in bays and inlets, although they may be seen in open waters. Favored habitats appear to be lagoons and shoals with a high density of seagrass. Individuals nest nocturnally at 2- to 4-year intervals during May through August; as many as seven clutches may be laid in a year, with each clutch containing from 75 to 200 eggs. At one time, nesting was probably widespread in Florida, but it now is confined to the east coast between Cape Canaveral and Palm Beach, outside the study area.

The loggerhead sea turtle (301) is the most common sea turtle in the Southern Florida Zone, occurring mainly during the late spring and summer in the open ocean, bays, marshes, and rivers. The nesting range within this zone is restricted to the Ten Thousand Islands section. Females nest nocturnally at intervals of 2 or 3 years, often returning to the same beach. During the breeding season, from May to September, a turtle may lay from two to five clutches, each consisting of 70 to 150 eggs.

Hawksbill sea turtles (302) frequent rocky areas, reefs, shallow coastal areas, lagoons, and narrow creeks and passes; they generally are found in water less than 20 meters (66 feet) deep. Nesting in the continental United States is limited to infrequent occurrences along the Florida coast.

Table 6. Species with special status in the Southern Florida Zone.

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | FISH | | | | |
| 152 | Key silverside | | | X | |
| | AQUATIC REPTILES AND AMPHIBIANS | | | | |
| 300 | Green sea turtle | X | X | X | |
| 301 | Loggerhead sea turtle | | X | | X |
| 302 | Hawksbill sea turtle | X | | X | |
| 303 | Kemp's Ridley sea turtle | X | | X | |
| 304 | Leatherback sea turtle | X | | X | |
| | MARINE MAMMALS | | | | |
| 350 | West Indian manatee | X | | X | |
| 353 | Finback whale | X | | X | |
| 354 | Sperm whale | X | | X | |
| 355 | Right whale | X | | | |
| | TERRESTRIAL PLANTS | | | | |
| 401 | Florida royal palm | | | X | |
| 402 | Orchids | | | | X |
| 403 | Bromeliads | | | | X |
| 405 | Ferns | | | | X |
| 406 | Cacti | | | | X |

continued

Table 6 (continued).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | TERRESTRIAL PLANTS (cont'd) | | | | |
| 407 | Lignum vitae | | | X | |
| 408 | Palms | | | | X |
| 410 | Hollies | | | | X |
| 411 | Peppers | | | | X |
| 412 | Coonties | | | | X |
| 415 | Sea lavender | | | X | |
| 416 | Catopsis | | | X | |
| 420 | Manchineel | | | | X |
| 422 | Key cassia | | | X | |
| 424 | Dune lily-thorn | | | X | |
| 425 | Cupania | | | X | |
| 429 | Mahogany | | | | X |
| 431 | Tree cactus | | | X | |
| 432 | Pride-of-big-pine | | | X | |
| 433 | Guzmania | | | X | |
| 434 | Cowhorn orchid | | | X | |
| 435 | Dollar orchid | | | X | |
| 436 | Narrow swamp fern | | | X | |
| 437 | Prickly-apple cactus | | | X | |
| 438 | Silver palm | | | X | |
| 439 | Hidden orchid | | | X | |
| 440 | Hand fern | | | X | |
| 441 | Auricled spleenwort | | | X | |

continued

Table 6 (continued).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | TERRESTRIAL INVERTEBRATES | | | | |
| 500 | Bahama swallowtail butterfly | | X | | X |
| 501 | Schaus swallowtail butterfly | | X | | X |
| 502 | Stock Island tree snail | | X | | X |
| | BIRDS | | | | |
| 556 | Cuban snowy plover | | | X | |
| 557 | Least tern | | | | X |
| 566 | Roseate tern | | | | X |
| 603 | Wood stork | | | X | |
| 620 | Florida sandhill crane | | | | X |
| 704 | Everglade kite | X | | X | |
| 707 | Bald eagle | X | | | X |
| 709 | Peregrine falcon | X | | X | |
| 713 | Southeastern American kestrel | | | | X |
| 760 | Brown pelican | X | | | X |
| 808 | Kirtland's warbler | X | | X | |
| 816 | White-crowned pigeon | | | | X |
| 818 | Cape Sable seaside sparrow | X | | X | |
| | TERRESTRIAL REPTILES AND AMPHIBIANS | | | | |
| 851 | American alligator | X | X | X | |
| 852 | American crocodile | X | | X | |

continued

Table 6 (concluded).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | TERRESTRIAL REPTILES AND AMPHIBIANS (cont'd) | | | | |
| 853 | Eastern indigo snake | | X | | X |
| 856 | Miami black-headed snake | | | | X |
| 859 | Key mud turtle | | | | X |
| 860 | Big Pine Key ringneck snake | | | | X |
| 861 | Florida brown snake | | | | X |
| 862 | Florida ribbon snake | | | | X |
| | TERRESTRIAL MAMMALS | | | | |
| 907 | Key deer | X | | | X |
| 922 | Key Largo woodrat | | | X | |
| 924 | Key Largo cotton mouse | | | X | |
| 930 | Silver rice rat | | | X | |
| 931 | Key Vaca raccoon | | | | X |
| 932 | Mangrove fox squirrel | | | | X |
| 933 | Florida black bear | | | | X |
| 934 | Everglades mink | | | | X |
| 935 | Florida panther | X | | X | |

Adult Kemp's Ridley sea turtles (303) are restricted to the Gulf of Mexico, whereas immature specimens are found along the Atlantic coast. The Ridley turtle inhabits shallow coastal and estuarine waters and often is associated with red mangrove shorelines. Nesting is restricted to a stretch of approximately 24 kilometers (15 miles) of beach in the State of Tamaulipas, Mexico, outside the study area.

Leatherback sea turtles (304) are the most pelagic of the sea turtles and often are found near the edge of the continental shelf. At intervals of 2 to 3 years, females lay as many as six clutches in a season, generally April to August, with an average clutch containing 80 to 85 eggs. Nesting in the United States is restricted to the Atlantic coast of Florida, between Flagler Beach and Miami, outside the study area.

The West Indian manatee (350) is found in the Southern Florida Zone throughout the year. It inhabits both fresh and salt water and may be encountered in waterways with access to coastal habitats, including canals, sluggish rivers, estuaries, and saltwater bays. Individuals also are found as far as 6 kilometers (4 miles) off the coast of Florida in the Gulf of Mexico. Manatees are herbivorous, consuming almost any vegetation available. Manatee calves are born throughout the year and nursed in the water. The reproductive rate for the species is one calf per adult female every 2 to 2.5 years. The United States population has been estimated to be from 750 to over 1,000 individuals, many of which occur in the Southern Florida Zone.

Three endangered whale species are found within the Southern Florida Zone. Finback whales (353) may occur in oceanic waters around the southern coast of Florida throughout the year; they migrate northward and inshore during the summer and southward and offshore in the winter. Sperm whales (354) occur along the edge of the continental shelf in the Atlantic Ocean and Gulf of Mexico, but they are rarely found over the shelf itself. Most recorded sightings in the Gulf of Mexico and lower Florida Keys have occurred April through July, but sperm whales have been seen throughout the year. Right whales (355), mostly females and their calves, commonly pass nearshore along the Atlantic coast of Florida during their northerly winter and early spring migrations.

The Bahama swallowtail butterfly (500) is restricted to islands in the Biscayne National Park, Dade County, Florida (grid reference PU70 to PU81), where it resides in tropical hardwood hammocks. Peak emergence of adults occurs in April or May when they breed; adults die within about a month after breeding. Overcollecting is suspected to be the main cause in eliminating this species beyond its current limits, although habitat destruction and natural factors probably also are to blame.

The Schaus swallowtail butterfly (501) is limited to tropical hardwood hammocks containing at least some second growth vegetation, which it finds on keys within and south of Biscayne National Park. Reproduction extends from April to June; the pupal stage remains dormant for a year or two before maturing. Although it once was found in the South Miami area, the species has declined as a result of habitat destruction and overcollecting.

Currently found only on Stock Island (grid reference MT21), the Stock Island tree snail (502) is confined to several patches of natural hammock

totaling approximately 2 hectares (5 acres) in size. The estimated 200 to 800 individuals of the species feed at night in trees only during wet periods from June through December; at other times, the snail normally is dormant. Reproductive biology is unknown, although indications are that eggs are laid from September to November.

The Cuban snowy plover (556) breeds in the spring and summer on the outer beaches and sand bars of the Gulf coast throughout the northern portion of the Southern Florida Zone; no other Florida bird both feeds and breeds on open, dry sand. Because of its very specialized habitat requirements, breeding locations are few and scattered. It is unlikely that more than 100 pairs of these birds now breed in Florida; throughout its range, increased human use of beaches has been a major factor in reducing population numbers.

Arriving in early spring (March or April) in Florida, the least tern (557) nests in any gravelly or sandy area that is devoid of vegetation, including dredge and fill spoils. Nests frequently are disturbed by human activities, storms, or waves. Nesting locations change from year to year, as well as during the breeding season; regularly used locations have been depicted on the maps.

The slim, medium-sized roseate tern (566) nests on the Gulf coast only in the Florida Keys. They usually arrive in late April or early May, nest, and leave the area by early September. The roseate tern population of Florida is no more than 250 to 300 breeding pairs, and although nesting success tends to be poor, the population appears to be stable.

The wood stork (603) is the only true stork native to North America. It is found in freshwater and brackish wetlands, nesting in cypress or mangrove swamps in about 20 colonies throughout peninsular Florida. In the Southern Florida Zone, colonies are found on the mainland. The storks migrate into the area and form colonies from November through January. A significant decline from about 75,000 breeding storks in the 1930's to only 10,000 by 1979, is attributed to drainage and destruction of wetlands in Florida.

The Florida sandhill crane (620) occasionally is found in non-coastal, mainland, marshy habitats in the Southern Florida Zone. In this zone, nesting begins as early as January; eggs hatch in March. This species does not migrate and individuals tend to use the same territories as long as conditions are suitable.

The major range of the everglade kite (704), a subspecies restricted to Florida, lies within the central portions of peninsular Florida in the Southern Florida Zone. It feeds exclusively on the freshwater apple snail in shallow marshes, the most specialized feeding habit known of all the world's raptorial birds. The breeding season extends from February to July, and the population level is estimated to be between 100 and 150 individuals.

The bald eagle (707) ranges throughout this zone, but nesting is restricted primarily to coastal areas. Heaviest concentrations occur in Florida Bay and along the Gulf coast. Eagles mate for life, and established pairs begin to repair nests in early fall and lay eggs in October. Florida has the only viable population of bald eagles on the Gulf coast, although scattered

pairs do breed along the central Gulf coast. There are an estimated 250 to 300 pairs in Florida.

Although peregrine falcons (709) do not breed in Florida, the coastal areas in this zone provide primary wintering habitat. Wintering peregrines arrive in September or October, usually with the passage of a cold front, and depart from March to May. During their stay, the falcons tend to remain on fairly small, well-defined wintering grounds.

The southeastern American kestrel (713) is found in northern portions of the Southern Florida Zone in open habitats. Pairs do not migrate; eggs are laid between mid-March and early June. Recent observations indicate a decline in breeding populations in the central and southern parts of Florida.

The brown pelican (760) is a familiar, year-round resident of the Florida coast. In 1980, the estimated number of nesting pairs in Florida was 8,095. The birds nest in colonies, usually on small coastal islands, often in mangrove trees. Most nesting occurs in early spring or summer. Individuals may be long-lived, sometimes over 30 years old.

Kirtland's warblers (808) leave their Bahaman wintering grounds in April and migrate through the Southern Florida Zone, primarily along the Atlantic coast. Fall migrations occur in September and October. The species breeds in a limited area of northern lower Michigan. In 1980, only 242 breeding pairs were known.

In North America, the white-crowned pigeon (816) only breeds in the Florida Keys and along the extreme southern fringe of the peninsula. Mangroves are the preferred habitat. A few birds arrive on the keys in March, but most wait until April. Most of the population leaves in winter.

The Cape Sable seaside sparrow (818) only occurs in marshes in extreme southern and southwestern peninsular Florida. Except for a few small populations in Collier County, nearly all the individuals are residents of the Southern Florida Zone, especially Everglades National Park (grid reference MT97 to MU74). The total population has been estimated at 1,900 to 2,300 pairs.

The American alligator (851) occurs in various, suitable, wetland habitats throughout Florida. It generally is not associated with salt water, although it occasionally may be found in brackish water. The total population in Florida is estimated to be in excess of one million.

The American crocodile (852) is restricted in North America to the Southern Florida Zone. It breeds only in the southern portions of Everglades National Park, chiefly in Florida Bay, and also on Key Largo. Another population has been reported on a few lower Florida Keys within the National Key Deer Refuge (grid reference MT43 to MT73). The population is declining; only about 200 to 400 individuals are known, including fewer than 25 breeding females.

The eastern indigo snake (853) is among the largest colubrid snakes in the New World, reaching a length of 263 centimeters (103.5 inches). It occurs throughout Florida, including the keys, often in dry, sandy areas, but most

characteristically in moister habitats. In drier habitats, it depends on gopher tortoise burrows as protection against desiccation. It is known for its mild disposition and, as a result, overcollecting has been the main threat to the species.

The Miami black-headed snake (856) is restricted to Dade and Monroe Counties, Florida. Little is known about its life history or preferred habitat. It is a secretive burrower, usually found beneath trash, rocks, and in rotting logs.

The key mud turtle (859) only occurs on the lower Florida Keys. It is primarily aquatic; but often forages on land. Nests are built in sand or piles of vegetation from April to June. It is the only freshwater turtle known from the keys, and uncontrolled development threatens to destroy the swamps it requires.

Big Pine Key (grid reference MT62 to MT63) is the only documented location for the Big Pine Key ringneck snake (860). Almost nothing is known concerning its life history and ecology.

The Florida brown snake (861) has been found on only three keys in Florida: Big Pine (grid reference MT63), No Name (grid reference MT42), and Sugarloaf (grid reference MT42). Its life history and ecology are essentially unknown.

Similarly, the subspecies Florida ribbon snake (862) is known only from three lower keys: Big Pine, No Name, and Cudjoe (grid reference MT42). It inhabits mangroves, Spartina, and freshwater areas. It is little known, except for its amphibious nature and agility as a tree climber.

The key deer (907) is restricted now to islands in the vicinity of Big Pine Key, particularly within the National Key Deer Refuge (grid reference MT43 to MT73). These animals are found only on those islands having extensive pine and hardwood habitats and permanent fresh water. Most breeding occurs in September and October; fawns are born in April and May. This is the smallest race of North American deer; adults measure 64 to 76 centimeters (25 to 30 inches) at the shoulder. Only about 350 to 400 of these permanent resident deer survive.

The natural range of the Key Largo woodrat (922) is confined to the northern one-third of Key Largo (grid reference NT68 to NT69). It occurs only in mature, tropical hammock forest, containing trees with trunk diameters of about 25 to 30 centimeters (10 to 12 inches). Currently, only about 120 to 160 hectares (300 to 400 acres) of suitable habitat are left for woodrats on Key Largo; however, a small population has been introduced on Lignum Vitae Key (grid reference NT35). The most unique feature of this animal is its construction of very large stick houses on the ground, resembling small beaver lodges.

The Key Largo cotton mouse (924) also is restricted to the northern half of Key Largo within the same habitat type as the Key Largo woodrat. This species constructs small nests in logs, tree hollows, and rock crevices. Few details are known of its life history and ecology. A small population has been introduced on Lignum Vitae Key.

The secretive, silver rice rat (930) was discovered in 1973. Only two specimens have been collected from a small marsh on Cudjoe Key (grid reference MT42). It is a little known, inoffensive animal with a unique silvery grey coat. If not already extinct, it is seriously threatened.

The smallest race of the North American raccoon is the Key Vaca raccoon (931), which is known only from the Key Vaca-Grassy Key area (grid reference MT93 to NT03). It inhabits areas dominated by red mangroves with sand above high tide, which it excavates for fresh water.

The mangrove fox squirrel (932) once occurred in Everglades National Park, and it still may exist there in remote areas. It is most abundant in mature pinelands with open understories. Its major distribution lies within the extreme southern portions of the Gulf of Mexico Zone.

Florida black bears (933) occur on the mainland in small, widely scattered populations in the immediate vicinity of large swamps, bays, and thickets, where cover is very dense. They are nocturnal and solitary, forming temporary breeding pairs; usually two young are produced per litter. The race has not been studied well in Florida. It is not a serious economic pest in the state, and it is hunted.

The everglades mink (934) is confined to the southern third of the Florida peninsula, including the non-coastal mainland within the Southern Florida Zone. It only occurs in freshwater wetlands such as streams, lakes, and swamps. The species is extremely wary and secretive, and little is known about its life history. Breeding occurs during the winter months and the race is not numerous in any area where it occurs.

Overhunting and loss of wilderness habitat have caused a serious decline of the endangered Florida panther (935) population throughout its range. Few recent sightings have been confirmed, and the race may be extirpated outside of Florida. It requires large wilderness areas with an adequate food supply; the home range may be 130 to 194 square kilometers (50 to 75 square miles). In Florida, armadillo seems to be the most important food item, although many other species also are taken, including deer. The breeding season is unknown, but cougars, of which the Florida panther is a subspecies, are believed to be at least 2 or 3 years old before they begin breeding, and they breed once every 2 to 3 years. The total population of the Florida panther is estimated at 20 in south Florida.

### 4.2.2 Aquatic Resources

Brief descriptions of the life histories of some of the commercially, recreationally, and ecologically important aquatic organisms which occur within the Southern Florida Zone are provided below.

#### Plants

Seagrasses are widespread throughout the Southern Florida Zone and are found in intertidal and subtidal areas. Major species include turtle grass, shoal grass, and manatee grass. Turtle and manatee grass are found only below low water levels and do not tolerate exposure to air. They grow best in water

with salinity between 20 and 40 parts per thousand. Shoal grass tolerates exposure to air and a wider salinity range than the other two species. As a result, it is abundant intertidally and in other areas where turtle and manatee grass are not able to survive. The seagrass beds serve an extremely important ecological function by providing food for herbivorous marine turtles, fish, and invertebrates and by forming nursery areas for juveniles of numerous important invertebrates and fish species.

Invertebrates

Pink shrimp compose the most important fishery in the Southern Florida Zone in terms of yield and value. These shrimp mainly spawn spring through fall in water depths of 4 to 52 meters (13 to 170 feet). Larval development occurs in open water and requires 15 to 30 days, depending on temperature. Upon attaining the postlarval stage, the shrimp use tidal currents and salinity gradients to enter the bay and marsh nursery areas. Juvenile growth occurs in 3 to 4 months, after which the shrimp emigrate to open water; shrimp not old enough to emigrate may overwinter in deeper portions of bays and then move offshore the following spring. Pink shrimp normally are active in the water column at night and burrow into the bottom during the day. They inhabit firm mud, silt, or sand bottoms, or coral sand bottoms containing a mixture of mollusk shells. Commercial fishing occurs throughout the year mostly in water 10 to 36 meters (30 to 120 feet) deep.

The stone crab constitutes an important commercial fishery in Florida. This fishery does not deplete the crab population because the crabs are returned to the water alive after the large pair of claws has been removed. Since stone crabs are capable of regenerating their claws after autotomizing them as a defense mechanism, they will regenerate them after the fishermen remove them. The effect of the fishery is believed, therefore, to be insignificant. Although the fishery occurs from shore to depths of 18 meters (60 feet), adults are found on the bottom out to depths of 70 meters (230 feet), where they burrow under rock ledges, coral heads, dead shell or grass clumps, and alongside tidal channels. Harvest is prohibited between May 15 and October 15, during the reproductive season. Spawning occurs during the spring and summer mostly in nearshore grass beds. These beds also serve as important mating areas. Larval development encompasses six stages and requires about a month. Juveniles have been found in all adult habitats, but seem to concentrate in oyster bars and deep seagrass beds.

Spiny lobster constitute Florida's second most valuable fishery. The commercial season extends from July 26 to March 31 (during non-spawning periods) and a special 2-day recreational season is allowed on July 20 and 21. Adults are present on reefs and among rubble from nearly intertidal areas to depths as great as 450 meters (1,500 feet). They are active nocturnal predators and during daylight occupy dens or crevices in broken bottom. Spawning season in southern Florida is from March through August; females produce from 300,000 to more than 1,000,000 eggs per spawn and may spawn twice per season. Eggs are carried by the female for 3 to 4 weeks before being released as larvae in oceanic waters bordering deep reefs. The larvae pass through 11 planktonic stages over 11 months before metamorphosing into an active swimming stage; each then settles when it encounters suitable habitat. Juveniles

generally are found in seagrass and algal beds, but move to deeper waters and reefs as they grow.

Three species of sponges are sought commercially in the Southern Florida Zone: wool or sheepwool sponge, yellow sponge, and grass sponge. Reproduction occurs both asexually and sexually; asexual reproduction involves budding or release of an aggregate of essential cells, while sexual reproduction involves the release of sperm which enter other sponges. Sponges prefer hard substrate for anchoring and have a great regenerative capability.

Corals make up the basic structure of the reefs which extend along the Florida Keys and out to the Dry Tortugas. A large variety of marine organisms are classed as corals; some are soft bodied with little evidence of skeletal material, while others, such as sea fans, have horny axial skeletons which branch into slender stems. The stony or true corals have skeletons of calcareous material and provide the basic frame of a reef. Corals develop where water temperatures during the year do not go below 18°C (64°F) and flourish where annual average temperatures range between 22°C and 24°C (72°F and 75°F). Corals are colonial; that is, individual polyps, averaging 1 to 3 millimeters (0.04 to 0.12 inches), are interconnected to form large masses. Coral polyps reproduce both asexually through budding and sexually. The polyps are active mostly at night, feeding by capturing prey with stinging cells or with ciliary currents. Growth rates are influenced by species and environmental conditions, but range from 6 millimeters (0.25 inches) per year for the massive types to 100 to 200 millimeters (4 to 8 inches) per year for the faster growing branching types.

Although its populations are declining rapidly, the queen conch provides a popular recreational fishery, both for food and shells, and a minor commercial fishery. Adults live on or near grass beds at depths of 2 to 30 meters (6.5 to 98 feet), but more commonly 3 to 10 meters (10 to 33 feet). Gelatinous egg masses are laid on sand in water depths of 3 to 20 meters (10 to 66 feet). Eggs hatch as planktonic larvae and after 60 days metamorphose into benthic juveniles. The juveniles bury in the sand or gravel during the day and emerge at night to feed.

Fish

Commercially important fish in the Southern Florida Zone include the following: Spanish and king mackerel, bluefish, white and striped mullet, several grouper and snapper species, white grunt, spotted and sand seatrout, crevalle jack, Florida pompano, and catfish. Important sport species include the above as well as sunfish, bonefish, red drum, sheepshead, tarpon, snook, cobia, ladyfish, sailfish, dolphin, greater amberjack, and blue and white marlin.

a. Freshwater species. Freshwater fish, especially members of the catfish and sunfish families, occur in the upper reaches of estuaries, in nontidal rivers, creeks, and ditches, and in lakes. Within the Southern Florida Zone, major species include the channel and white catfish, brown bullhead, largemouth bass, black crappie, warmouth, bluegill, and redear sunfish.

The three catfish, the channel and white catfish and the brown bullhead, are of commercial importance within the Southern Florida Zone. These fish construct nests and spawn during the spring and summer; adults remain at their nests during this time to protect the eggs and developing young.

The largemouth bass is probably the most sought-after freshwater sport fish in the Southern Florida Zone, where the species is represented by the Florida subspecies, which tends to be larger than the northern subspecies. In Florida, spawning occurs from mid-November to August, and the eggs are deposited in nests. Several spawns may occur during a season.

The black crappie typically is found in quiet clear water amongst dense vegetation. This sport species spawns from February through August. The adults construct nests and the early stage larvae are guarded in their nest by the adult male. As the young develop, they move from the nest into more open water.

The warmouth, bluegill, and redear sunfish, collectively known as bream, are popular sport species. They are found throughout the freshwater and low salinity tidal portions of the zone. The first two species usually are associated with dense vegetation, while the latter species prefers open water. The warmouth probably spawns year-round, while the bluegill and redear spawn spring through fall. All of these species construct nests, which the male guards during egg and larval development.

b. Anadromous species. There are no major anadromous species in the Southern Florida Zone.

c. Estuarine-dependent species. The vast estuaries, tidal marshes, seagrass beds, and mangrove swamps of the Southern Florida Zone serve a major function as breeding, nursery, and feeding grounds for fish such as tarpon, ladyfish, snook, sheepshead, members of the drum family, and mullets.

Tarpon is a popular sport species, known for its jumping ability. It usually occurs nearshore and in estuaries, inlets, passes, and occasionally freshwater rivers. Spawning occurs from May to August in offshore waters. The larvae move inshore and juveniles are found in nearshore, estuarine, and freshwater areas. As size increases, movement toward ocean waters occurs. The ladyfish is closely related to the tarpon and has similar habitat distribution and life history, although spawning extends throughout most of the year. Sportfishing for these species occurs year-round.

Snook occur throughout the water column offshore to 18 meters (60 feet) water depth and in brackish and fresh water; however, they tend to aggregate in inlets, passes, channels, and holes. They spawn during the spring; the larvae move inshore and develop as juveniles in estuarine habitats. Sportfishing for this species occurs throughout the year, although greatest activity is during the summer.

Sheepshead thrive in a wide range of salinities and temperatures. They spend most of their time over sand and soft bottom, although they aggregate around hard surfaces such as oyster beds, wrecks, jetties, and pilings. This species spawns in schools in shallow, sandy, nearshore water during the late

winter to early summer. The larvae migrate into shallow estuaries and as juveniles congregate in grass beds. During the summer, adults are found nearshore and in estuaries. In late fall, all age classes move offshore to overwinter in deeper water. In the Southern Florida Zone, this species is fished year-round, mainly for sport, while in the rest of the Gulf of Mexico it is both a sport and commercial species.

The drum family has several commercial and sport species represented in the Southern Florida Zone. These include the spotted seatrout, sand seatrout, and red drum. Spotted seatrout are restricted mainly to estuaries and emigrate only during periods of environmental extremes. They spawn from spring through early fall in deep channels and depressions in the estuaries. Larvae move into grass beds and marshes, where growth occurs rapidly; as they develop, they move into deeper portions of the estuary. Adults concentrate in inlets and passes during spring and summer to feed on migrating shrimp and small fish; most fishing activity occurs at this time.

Sand seatrout are found offshore--to depths of 100 meters (330 feet)--more often than most members of the drum family, although adults also are found in estuaries. Spawning occurs offshore, near passes and inlets, from March to September. The larvae migrate into shallow areas of upper estuaries and as they grow move into deeper, open bay water; juveniles prefer grass beds and marshes. Adults also move into the estuaries following spawning and concentrate around hard objects. In the fall, most juveniles and adults move offshore.

The red drum inhabits estuaries and coastal waters out to 22 kilometers (13 miles) at depths up to 40 meters (130 feet). After first spawning, the adults tend to spend more time in Gulf waters and less time in estuaries. Spawning occurs in the fall and winter in and near barrier island passes. The young fish are carried into the shallow estuaries and tend to associate with seagrasses and marshes. Although found in coastal areas throughout the year, the red drum resides in estuaries in the summer and offshore in the winter. This highly prized fish is sought throughout the year, with heaviest pressure in the fall.

The gray snapper is the most common inshore snapper and the most euryhaline, occurring in deep channels and offshore reefs as well as shallow water around mangroves and estuaries; it also moves into freshwater rivers during summer months. Spawning occurs offshore over sand or rock bottom from April to September. The larvae move inshore and juveniles are found in shallow grassy areas or near mangrove growth. Adults tend to move inshore after spawning; both adults and juveniles migrate to deeper water in the fall. Gray snappers are fished commercially and for sport throughout the year.

Two species of mullet are common in the Southern Florida Zone: the striped and white mullet. Unlike the rest of the Gulf of Mexico, in the Southern Florida Zone the white mullet is the dominant sport and commercial species. Both mullets have similar life histories. They are found from fresh to hypersaline waters and from shallow estuaries to deep offshore areas. Peak spawning is believed to occur in the spring in offshore waters. Larvae move inshore in the spring and the juveniles are found in the shallow areas of the estuaries; offshore movement from the estuaries occurs during the fall.

d. Oceanic species. Oceanic species occur within open Gulf of Mexico waters, although some may periodically enter nearshore waters and estuaries during their early life stages or as adults to feed. Important species in the Southern Florida Zone include groupers, jacks, snappers, mackerels, and billfish.

The bonefish is found mostly on the extreme lower east coast of Florida and the Florida Keys over mud and sand flats in shallow water. This popular sport fish is sought throughout the year with spring and fall being the best seasons. Spawning probably occurs offshore throughout the year and the larvae move inshore as they develop. Juveniles and young adults are found in bays and nearshore coastal waters.

The cobia is a relatively large sport fish that inhabits the shallow--less than 100 meters (330 feet)--portions of the Gulf of Mexico. The species tends to concentrate around pilings, buoys, reefs, and wrecks. Cobia spawn offshore, primarily in the spring, but also through August. The eggs hatch at sea and, although the young are uncommon in estuaries, they are found in lower bays and near beaches, bays, and inlets.

The groupers are a major recreational and commercial fishery in the Southern Florida Zone. Three species, the red hind, Nassau grouper, and black grouper are restricted mainly to the Florida Keys, while the jewfish, red grouper, gag, warsaw grouper, and yellowmouth grouper are found throughout the zone. With some exceptions, these fish are found offshore around reefs and rough bottoms. Some are found inshore around ledges, bridges, and pilings.

The red grouper, considered Florida's most important grouper, is the most common grouper taken by party and commercial boats and is fished throughout the year. It usually is found along ledges or in crevices of reefs, although it also frequents smooth mud, sand, coral rubble, or broken rock bottoms from the shore out to depths of 275 meters (900 feet). Spawning occurs from March to July on offshore banks at depths of 24 to 91 meters (80 to 300 feet). Juveniles are found in seagrass beds and shallow reefs. Young adults remain nearshore for several years, moving offshore as they mature.

The gag is probably the second most popular recreational and commercial grouper species; it is sought for its excellent taste and its aggressive nature. The gag generally is found around wrecks and rocky inshore reefs, but prefers areas beneath ledges or around reef caves; it also is found inshore around holes and in rivers during winter and spring. Spawning probably occurs between January and March. Juveniles are widespread over grassy flats, near river mouths, and throughout rocky areas offshore.

The jewfish is the largest of the groupers, attaining weights up to 340 kilograms (750 pounds) and lengths to 2.7 meters (9 feet); average weights are between 18 and 54 kilograms (40 and 120 pounds). They are found offshore on reefs, in holes, under ledges, and around wrecks and inshore around jetties and pilings and in channels and estuaries. Spawning occurs offshore in July and August; juveniles are found inshore in seagrass beds, mangroves, and in bay shallows. Commercial and recreational fishing occurs throughout the year.

The warsaw grouper is another popular recreational and commercial grouper that rivals the jewfish in size. Specimens 2 meters (6 feet) long and over 225 kilograms (500 pounds) have been recorded, although average weight is between 9 and 27 kilograms (20 and 60 pounds). Adults are found at depths of 16 to 464 meters (52 to 1,500 feet) over bottoms of rock, coral, mud, sand, and shell. Spawning is presumed to occur offshore. Juveniles are found in lower estuaries and nearshore Gulf waters.

The yellowmouth grouper (also known as scamp) is not taken in abundance in sport and commercial catches, but is considered the best table fish of all the groupers. It is fished throughout the year, mainly over reefs. Spawning occurs during March and April offshore and the juveniles are found in inshore and estuarine waters.

Bluefish are a major sport and commercial species in the Southern Florida Zone. They are fished throughout the year, but mainly in the late fall and winter. Bluefish are migratory and pelagic, moving in large schools northward during the spring and summer and southward during the fall and winter. In southern Florida, they are found throughout the year with largest numbers in the fall and winter. Spawning occurs on the outer half of the continental shelf, but the season is not known. Juveniles are widely distributed from offshore waters to rivers, although young of the year tend to move inshore as they grow. Adults may move inshore and into estuaries during the summer to feed.

Three members of the jack family, the Florida pompano, crevalle jack, and greater amberjack, sustain both important recreational and commercial fisheries. Florida pompano are abundant around inlets and sandy beaches in the surf zone, although in response to lower temperatures, they move offshore to deeper water in fall and winter. They spawn offshore from March through September. The larvae develop offshore and move into lower energy surf zones where the juveniles mature.

The crevalle jack schools in inshore waters and throughout estuaries, although large fish usually are taken from deeper offshore water. Commercial and recreational fishing occurs throughout the year, but the best fishing is from March through November. Crevalle jack spawn offshore from March through September. The larvae remain offshore and juveniles move inshore to various habitats including estuaries.

The fast-swimming greater amberjack school in oceanic and continental shelf waters from the surface to depths of 300 meters (1,000 feet). They often concentrate over high relief rock or coral bottom or around wrecks or buoys. Greater amberjack spawn in oceanic waters, probably from fall through spring, and develop offshore. Commercial and recreational fishing occurs throughout the year.

The dolphin is a pelagic species found closely associated with floating and drifting objects in waters offshore of the 18-meter (60-foot) bottom contour. It spawns offshore, possibly throughout the year, but mainly in spring and summer; it also develops offshore. Most of the recreational and commercial fishing for this species within Florida occurs in the Southern Florida Zone.

Several species of snapper compose a major commercial and recreational fishery in the Southern Florida Zone. Yellowtail snapper make up the largest portions of the commercial snapper fishery in the Southern Florida Zone. They are fished commercially at night, but can be taken during the day; commercial and recreational fishing occurs throughout the year. Yellowtail snapper schools are found near rocky cliffs, reef edges, and shoal areas from just below the tide line out to 45 meters (150 feet). Spawning occurs offshore during July and juveniles are found in high salinity grass beds in late summer and early fall.

Mutton snapper are found from 5 to 86 meters (16 to 282 feet) deep in open water around reefs and rocks and inshore in mangrove swamps, grassy bays, and tidal creeks. They compose the third largest snapper fishery in the Southern Florida Zone, behind the yellowtail and grey snappers. Mutton snappers form schools nearshore during spawning season, between June and August. Juveniles are found inshore around shallow reefs and grassy areas and sometimes in harbors and river mouths.

The red snapper, the most popular sport and commercial snapper in the Gulf of Mexico, usually is found seaward of the 18-meter (60-foot) bottom contour over a variety of surfaces, congregating in depressions or near coral and rock outcrops. Individuals generally move inshore in the summer and offshore in the winter. Spawning occurs offshore, in water depths from 16 to 37 meters (52 to 120 feet), over hard sand and reefs from June to mid-September. Larvae remain in offshore waters near the bottom; juveniles are found inshore along beaches and in channels. Fishing occurs throughout the year, but is best in spring and fall.

The demersal lane snapper is found on mud, sand, coral, or rock bottoms from the shoreline out to reported depths of 400 meters (1,300 feet). It spawns offshore from March to September. Juveniles move inshore during the spring and summer and occasionally are found in low salinity bays; they migrate offshore in the fall. Fishing occurs throughout the year, but is best in spring and fall.

The silk and vermilion snapper usually are restricted to deeper water. The former species is found on the bottom at depths of 60 to 244 meters (200 to 800 feet) and the latter at depths of 27 to 107 meters (90 to 350 feet). The vermilion snapper is found on the bottom over mud, sand, gravel, and especially rock and coral outcrops. Both species are sought throughout the year.

The white grunt is the most common grunt in southern Florida sport and commercial catches. Adults are found from the shore to outer reefs and in high salinity estuaries; they are most abundant at depths from 6 to 24 meters (20 to 80 feet). Large schools form during spawning, which occurs offshore in the spring. Juveniles are especially abundant on grass beds at the edge of sand flats during summer and fall. Fishing occurs throughout the year, but is best between August and October.

King and Spanish mackerels constitute the primary and secondary commercial finfish fisheries, respectively, in the Southern Florida Zone, and are probably the most popular offshore sport fish (especially the king) in the entire Gulf of Mexico. Both species are sought throughout the year, but

particularly from late fall to early spring in the Southern Florida Zone. The king mackerel averages 7 to 9 kilograms (15 to 20 pounds), while the Spanish mackerel averages 0.7 to 1.8 kilograms (1.5 to 4 pounds). Both mackerel are highly migratory and pelagic, wintering off southern Florida, moving northward in large schools in the spring, and moving southward in the fall. King mackerel spawn from May to September over the continental shelf; early juveniles rarely move into estuaries. Adults usually are found on the continental shelf offshore of the 15-meter (50-foot) contour.

Spanish mackerel usually inhabit shallower water than the king mackerel and freely enter estuaries in pursuit of food. Spawning occurs from May through September over the continental shelf in the northern Gulf; most larvae and juveniles are found in Gulf waters, although some juveniles are found in estuaries.

Three migratory, pelagic billfish are sought recreationally in the Southern Florida Zone: sailfish, white marlin, and blue marlin. Sailfish occur over the continental shelf beyond the 15-meter (50-foot) contour and especially between the 90- and 180-meter (300- and 600-foot) contour. Adults average 29 kilograms (65 pounds) in weight and 2 meters (7 feet) in length. The species is present year-round in the Southern Florida Zone, although it migrates northward in the spring and southward in the late fall. Spawning takes place from April through August; spawning and development occur offshore.

White and blue marlin generally are found at the edge of the continental slope throughout the year, but mainly during the spring in the Southern Florida Zone. The white marlin is more common than the blue marlin. Spawning takes place spring through fall; spawning and development occur in oceanic waters. White marlin average 27 kilograms (60 pounds) in weight and 2 meters (7 feet) in length and blue marlin average 113 kilograms (250 pounds) in weight and 3 meters (10 feet) in length as adults.

### 4.2.3 Terrestrial Resources

The mild climate, diversity of habitats, and extensive wild lands of Florida support a great variety of wildlife. This is especially true of the Southern Florida Zone where temperate and subtropical species mix on the mainland and tropical species from the West Indies reach their northern limits on the Florida Keys. Despite the richness of flora and fauna, many species have very limited distributions, and they are threatened by habitat destruction and overcollecting in some cases.

A unique aspect of southern Florida's wildlife is the great variety of introduced exotics. Most are tropical species, which have been released or have escaped, and are unable to survive farther north; some have established populations and are competing for resources with native wildlife.

#### Plants

The proximity of the Southern Florida Zone to the tropics is reflected in the diverse vegetation. A great number of tropical floral species can grow in Florida that are found nowhere else in the continental United States. Most of

the plants mapped in this zone are species with special status. Nearly half of the tree species native to the United States occur in Florida, but today less than half of the original forest land remains. Land used especially for commercial timber operations, and overmature and original growth trees, will be discussed in the geographic inventory of areas in which they are found.

Invertebrates

All six of the invertebrates mapped occur exclusively in this zone; three are species with special status and are restricted to the Florida Keys. The two races of swallowtail butterfly and the two species of tree snail all inhabit tropical hardwood hammocks, which, in North America, are unique to southern Florida.

The atala butterfly, believed to be extinct in 1965, was rediscovered in 1979 and only occurs in southern Florida. It always is found in localized colonies where the host plant, the Florida coontie, occurs. The Florida populations of the maesites hairstreak represent the only United States colonies. This butterly inhabits tropical hammocks, where it visits flowers and possibly breeds in treetops.

Birds

The avifauna of Florida is unique in the United States because it contains species and subspecies not found elsewhere in the country, it attracts great concentrations of breeding and wintering species, and it lies along important migration routes. Due to its proximity to the West Indies, the Southern Florida Zone, particularly the Florida Keys, receives frequent visits by tropical species of birds unusual to this continent. Vast marshes, wooded swamps, innumerable lagoons and other waterways, hammocks, and forests provide important breeding, feeding, and wintering habitat for many bird species. Within this zone, there exists an abundance of shorebirds, wading birds, waterfowl, raptors, seabirds, and songbirds and others.

Areas mapped for bird species were selected based on an area's importance to a species within the geographic interval. Thus, no absolute boundaries were used throughout the inventory. The selection of mapped areas was based on published information and unpublished data from knowledgeable individuals concerning areas and species of importance.

a. Shorebirds. Shorebirds, including gulls, terns, sandpipers, plovers, stilts, and skimmers, are common around shore and intertidal areas. Northern species are found in the Southern Florida Zone in all seasons except early summer, but are especially abundant in spring and fall, when many shorebirds migrate to and from wintering grounds farther south. The majority of transients are present from March 15 to May 15 and from August 15 to October 20. The roseate tern is a rare migrant along the Florida coast.

American avocets and long-billed curlews are winter visitors to diverse parts of the Southern Florida Zone. The American avocet is an uncommon winter visitor to salt marshes in southern Florida. The long-billed curlew is an uncommon winter visitor to coastal beaches in the area.

Many species nest in March and April and remain in the area all year or are summer residents. American oystercatchers are permanent residents of coastal beaches and tidal flats. Cuban snowy plovers are uncommon permanent residents of outer beaches. Summer residents include the black-necked stilt, which prefers marshes, and the gull-billed tern, found in salt marshes and coastal bays. Also in the zone, a large colony of sooty terns may be found in the Dry Tortugas from March to September, but are rare elsewhere in North America.

b. Wading birds. Wading birds, including herons, egrets, bitterns, rails, ibises, and cranes, are found throughout this zone in both freshwater and saltwater areas. Most species, such as herons and egrets, are residents and breed during the spring and summer months. Of all the animals in Florida, the wading birds are undoubtedly the most conspicuous in wetland areas.

Roseate spoonbills are uncommon permanent residents of mangrove swamps and shallow bays. They nest in the Southern Florida Zone in winter, then migrate to more northern Florida areas. The roseate spoonbill is considered a species of special concern in the State of Florida.

c. Waterfowl. Loons, coots, geese, and most ducks make up the waterfowl category. Dabbling ducks are surface-feeders commonly found in freshwater and saltwater marshes; they include wigeons, pintails, and teals. Diving ducks, or bay ducks, dive from the surface and feed under water. They are found most often in coastal bays and river mouths, and include canvasbacks, scamps, and ruddy ducks. Most waterfowl are winter visitors to the Southern Florida Zone, but some, such as the mottled duck, breed in the zone during summer and are permanent residents. The anhinga is considered in the waterfowl category based on its habits; it is an abundant resident of swamps throughout the zone, where it also nests in summer.

d. Raptors. Raptors include kites, hawks, falcons, eagles, and owls. Owls are generally residents of wooded areas, although several species are found in coastal areas or open fields and meadows. Most hawks, eagles, and falcons are residents, although a few are winter visitors. The swallow-tailed kite is common only in the summer. The short-tailed hawk is a rare and localized permanent resident of moist habitats.

e. Seabirds. For the purposes of this study, seabirds include pelicans, gannets, scoters, cormorants, boobies, noddies, and frigate-birds. Some are pelagic species, normally coming to land only in summer to breed. Most of the mapped species nest within the coastal zone; white pelicans, however, are winter residents. Brown pelicans are common, and the only seabird of special status. Although courtship may begin as early as March, most nesting and egg laying does not occur until May or June in the Southern Florida Zone. Offshore islands and islets are the major breeding areas for this group.

f. Songbirds and others. This category includes all of the passerines (perching birds) and a variety of other birds such as woodpeckers, doves, and quail. Some species are important as recreational and economic resources, especially the gallinaceous species such as quail and turkey. Others are aesthetically and recreationally important and are sought by birdwatchers and photographers. Many species are resident, breeding in the spring and early

summer. Many species pass through the Southern Florida Zone as they migrate along the Atlantic Flyway. These are generally fall and spring transients or visitors during summer or winter. Principal migrations occur from March 15 to May 1 and September 15 to November 10. A number of species are of special interest because of their rarity or restricted distribution, including: mangrove cuckoos, smooth-billed anis, black-whiskered vireos, Antillean nighthawks, gray and western kingbirds, and scissor-tailed flycatchers.

Reptiles and Amphibians

A large variety of reptiles and amphibians are found within the Southern Florida Zone. Although many of these species are very abundant, some species are being threatened by destruction of their limited habitat or by steady or increased removal of individuals by reptile and amphibian collectors. Several species which have decreasing populations are of special concern and are mapped. Some species, especially the snakes, may have fairly extensive home ranges, but most are relatively sedentary. Most reptiles and amphibians do not migrate extensively, although some salamanders will travel several miles to breeding streams. Aquatic habitats, especially freshwater areas, are extremely important as breeding and feeding areas to many of these animals.

Mammals

Important mammals of the Southern Florida Zone include whitetail and key deer, rabbits, squirrels, bobcats, raccoons, black bears, and feral hogs. Most of the mammalian species are more likely to be found in the less developed areas within the zone, but some species are either indifferent to or actively seek out urbanized areas. Most are found in pairs or small family groups.

The whitetail deer is the most important big game species in the Southern Florida Zone, but many other mammals also are hunted or trapped.

## 4.3 FLORIDA KEYS INCLUDING THE DRY TORTUGAS (GRID REFERENCE NU82 to KT92).

The Florida Keys section of the Southern Florida Zone, extending from Biscayne National Park (grid reference NU82) to Key West and the Dry Tortugas (grid reference KT92), represents a remnant of once massive coral formations which flourished along the eastern seaboard as far north as Cape Hatteras, North Carolina. The keys rest on a limestone foundation formed from this larger, ancient structure. The islands are nearly surrounded by mangrove stands, except where narrow shell beaches or rock faces are exposed on their seaward side. The tropical to subtropical climate is influenced by the warm Florida Current, which flows parallel to the keys adjacent to a very narrow continental shelf. Coral formations continue to thrive along this shelf.

The biotic resources of this section are keyed geographically using north-south UTM grid swaths.

### 4.3.1 Aquatic Resources

#### Widespread Species

The Florida Keys are the continental United States' most extensive coral reef habitat, stretching 370 kilometers (230 miles) from Soldier Key to the Dry Tortugas (grid reference NU83 to KT92). With the exception of Bermuda and the northern Bahamas, the Florida Keys represent the northernmost limit of coral reefs in the western Atlantic. These reefs, known as the Florida Reef Tract, are composed of bank reefs and patch reefs. The bank reefs occur near the shallow continental shelf break in relatively high energy environments and are dominated by elkhorn coral, the chief builder of the bank reefs. In less turbulent areas, staghorn and club-finger corals are found. Head corals, of which small star coral is predominant, tend to be found in shallow, sheltered parts of bank reefs and in the deeper areas in front of the reef slope. Behind the bank reefs, numerous patch reefs are found and may include star and fire corals.

Both types of reefs support algae, sponges, and numerous invertebrates, including the two most important commercial species in the keys, the spiny lobster and the stone crab. In addition, the reef habitat of the Florida Keys supports more than 500 species of fish, many of which, such as members of the snapper and grouper families, are of commercial and recreational importance.

The continental shelf along the Atlantic side of the Florida Keys is very narrow, approximately 24 kilometers (15 miles) wide, and the warm Florida and Gulf Stream currents approach close to shore. As a result, numerous open-water sport species, including swordfish, sailfish, blue and white marlin, and dolphin are avidly pursued fairly close to shore. Two endangered whales, the finback and sperm whale, also occur in these deep waters; the five marine turtles with special status are found throughout the coastal waters.

The shorelines and flats of the Florida Keys, especially along the Atlantic side, support the largest populations of bonefish in the United States. These warm water fish are a popular sport species, sought throughout the year but mainly in the spring and fall. The endangered West Indian manatee also is found in these areas.

#### Geographic Inventory

Three species of coral, elkhorn and two staghorn corals, are comparatively common in Key Largo Coral Reef Marine Sanctuary (grid reference NU80 to NT56) due to the protective status of this sanctuary. In other areas of the northern keys, these corals have been exterminated due to their high value as collector's items.

The queen conch occurs only in the shallow waters of the Florida Keys and is harvested in the lower keys (grid reference NT45 to LT91). Populations have declined in recent years due to overharvesting and, as a result, the commercial fishery is minor. Most conchs are taken as part of a popular recreational fishery.

Two areas known as the Humps (grid reference NT64 to NT41 and MT91 to MT79) harbor several snapper and grouper species and tilefish, all of which are recreationally and commercially harvested. These areas are characterized by high, rocky peaks, which rise 91 meters (300 feet) above the 182-meter (600-foot) deep bottom.

The key silverside, an endangered species in Florida, is known only from the shallow open bays surrounding the lower Florida Keys from Big Pine Key to Key West (grid reference MT72 to MT11). This species has one of the most restricted ranges of any North American marine fish.

The shallows and seagrass beds on the Gulf of Mexico side of the lower Florida Keys (grid reference MT64 to MT12) provide an important nursery for pink shrimp and spiny lobsters and a recreational fishery for seatrout, ladyfish, and bonefish.

Looe Key National Marine Sanctuary (grid reference MT61 to MT51) is a habitat area of particular concern. Within it are found important coral reef assemblages, including masses of elkhorn and staghorn coral. Also, the key blenny has been collected only from a single isolated coral formation within this sanctuary.

Rivulus, the only species of its genus found in North America, is a fish of special concern in Florida. It has been collected near Key West (grid reference MT32), one of only a few places that it has been found.

The flats surrounding Boca Grande Channel (grid reference MT11 to LT81) provide excellent shallow water and flats fishing for such sport species as permit, tarpon, and snook. Boca Grande Channel (grid reference LT91 to LT82) is a popular fishing area for bluefish, cobia, and mackerels.

Commercial bottom fishing for yellowtail, mutton, red snapper, and red grouper is the most common activity in winter and summer at grid reference LT41 to LT31.

Fort Jefferson National Monument (grid reference LT13 to LT01) encompasses major coral reef assemblages, including elkhorn and staghorn coral. Extensive, commercial grouper and spiny lobster fishing occurs immediately outside the monument boundary; however, commercial fishing within the monument is prohibited to protect the corals from damage caused by fishing nets and traps.

The Tortugas Banks (grid reference LT03 to KT93) support a popular commercial and recreational fishery for snappers and red grouper.

### 4.3.2 Terrestrial Resources

#### Widespread Species

Two species with special status, the Kirtland's warbler and white-crowned pigeon, are common throughout the Florida Keys, but typically are not found elsewhere in Florida. In addition, a number of common species are found on the keys, but not in other Florida regions: reddish egrets, roseate spoonbills,

great white herons, magnificent frigate-birds, scissor-tailed flycatchers, black-whiskered vireos, gray and western kingbirds, mangrove cuckoos, and smooth-billed anis.

A number of species with special status may be found throughout the Florida Keys as well as elsewhere in Florida and other parts of the United States. These include American crocodiles, American alligators, eastern indigo snakes, roseate terns, brown pelicans, and bald eagles. Peregrine falcons overwinter in the keys.

The keys also serve as temporary stopping sites for numerous migrating land birds; these tend to arrive between March 15 and May 1 in the spring and between September 15 and November 10 in the fall.

Geographic Inventory

Tropical hardwood hammocks (grid reference NU81 to NT79), which are unique in North America, contain both the Bahama and Schaus swallowtail butterflies.

The natural populations of Key Largo woodrat and Key Largo cotton mouse are restricted to Key Largo near grid reference NT68. This area is also important as a concentration point for American crocodiles, bald eagles, and white-crowned pigeons.

Small populations of the Key Largo woodrat and Key Largo cotton mouse have been established on Lignumvitae Key (grid reference NT35), which is an undisturbed tropical hammock, preserving natural communities once common to the keys.

Grid reference NT35 to NT24 is the farthest southern extent of the Schaus swallowtail butterfly.

The Key Vaca raccoon is known to occur only from grid reference MT93 to NT03.

Nearly the entire population of key deer inhabit the National Key Deer Refuge (grid reference MT43 to MT73). The current population numbers between 350 and 400 animals, but about 60 are lost annually to poachers, auto collisions, and dog attacks. The refuge also is probably the southernmost breeding location in North America for the American crocodile.

Big Pine Key (grid reference MT62 to MT63) and No Name Key (grid reference MT42) are the two keys preferred and extensively used by key deer. Also occurring on Big Pine Key are the white-crowned pigeon, eastern indigo snake, key mud turtle, and Big Pine Key ringneck snake, as well as many migrating songbirds, black-whiskered vireos, gray kingbirds, mangrove cuckoos, and an unusual, regular breeding occurrence for the Antillean nighthawk.

Within grid reference MT42 are found probably the last, largest, and most productive freshwater marshes remaining in the keys. The endangered mud turtle and silver rice rat are known only from this habitat type. Also in this area

are found the Florida brown snake, Florida ribbon snake, white-crowned pigeon, and the key deer.

The Great White Heron National Wildlife Refuge (grid reference MT12 to MT83) provides permanent protection to the great white heron, which is the largest North American wading bird. In the United States, this color phase of the great blue heron is found only here and in the southern part of the Florida mainland.

The key mud turtle, Stock Island tree snail, and white-crowned pigeon are found at grid reference MT21.

The only nesting place in the continental United States for the magnificent frigate-bird occurs at grid reference LT81 in the Marquesas Keys.

Bush Key in the Dry Tortugas (grid reference LT02 to LT12) is the only known nesting locality of sooty terns and brown noddies in North America. These islands are also one of the few places in the Gulf coast where roseate terns nest. Proximity to the West Indies results in frequent occurrences of unusual birds as accidentals on the islands when the birds are blown off course. In any season, there is a continuous procession of songbirds and other migrants as they fly over or nest on the islands. Peregrine falcons winter here and boobies regularly occur. However, the great spectacle between April and September is the assembly of sooty terns (approximately 100,000 breeding adults) for nesting.

## 4.4 FLORIDA BAY (GRID REFERENCE NT69 to MT88)

The Florida Bay section of the Southern Florida Zone extends from the south tip of Biscayne Bay (grid reference NT69) to Cape Sable (grid reference MT88) and represents a drowned lacustrine plain, a series of drowned lake basins divided by flats and interconnected by tidal channels. It is bounded on the south by the Florida Keys and on the north by the southern tip of the Everglades. It is a very shallow bay, typically less than 2 meters (6 feet) in depth, whose high rate of evaporation is not always offset by stream discharge from the Everglades. Hence, it is often hypersaline. Numerous mangrove-covered islands and hammocks within the bay impede tidal exchange, reducing the tidal range to approximately 0.1 meter (a few inches) in its northeastern end.

The biotic resources of this section are keyed geographically using north-south UTM grid swaths.

### 4.4.1 Aquatic Resources

#### Widespread Species

Shallow depressions in Florida Bay often are occupied by seagrasses or algal beds. Seagrasses in the bay are dominated by turtle grass, shoal grass, and manatee grass. These seagrass beds serve a major function as a nursery ground for many estuarine-dependent species including pink shrimp, stone crabs, spiny lobsters, mullets, drums, tarpons, and ladyfish. Juveniles of

other fish species, including snappers, groupers, and Spanish mackerel, also are found feeding in the seagrass beds.

In particular, Florida Bay serves as a major pink shrimp nursery area for the Tortugas Grounds, one of the prime commercial pink shrimp fishing areas in west Florida. This ground, west of Florida Bay beyond the 18-meter (60-foot) contour and just outside the study area, yields almost 50 percent of the west Florida pink shrimp fishery. To preserve the shrimp nursery and minimize gear conflicts with stone crab fishermen, Florida Bay and the Gulf of Mexico waters west of it have been proposed for designation as the Tortugas Shrimp Sanctuary, in which all fishing for shrimp would be prohibited.

The stone crab and spiny lobster are major commercial species within Monroe County, which includes Florida Bay and the Florida Keys. Almost 97 percent of the Florida west coast fishery for spiny lobster (90 percent of the total United States fishery) and 40 percent of the Florida west coast fishery for stone crab (35 percent of the total United States fishery) are landed in Monroe County. However, spiny lobster fishing is prohibited in the Everglades National Park portion of Florida Bay.

Florida Bay offers excellent sportfishing. Red drum are caught over flats; sand and spotted seatrout, crevalle jack, ladyfish, and tarpon are sought in depressions; and snapper, snook, and tarpon are sought in channels.

Several endangered species are found in Florida Bay including all five sea turtles and the West Indian manatee. Both the green sea turtle and the manatee use the extensive grass beds as a food source.

Geographic Inventory

Critical habitat for the West Indian manatee includes Card, Barnes, Blackwater, and Buttonwood Sounds (grid reference NU70 to NT57).

Rivulus, the only species of its genus found in North America, is a fish of special concern in Florida. Barnes Sound (grid reference NT69) is one of only a few places within the state that the fish has been collected.

Snapper, jewfish, red drum, and tarpon, all recreationally important species, are abundant from grid reference NT26 to NT15 in an area known as Key and Ninemile Banks.

Bluefish, seatrout, jacks, snapper, cobia, and Spanish, king, and cero mackerel are recreationally sought from grid reference NT05 to MT94 in areas known as Tripod Bank and Bamboo Bank.

Most sponges in Florida are harvested from the shallows of Florida Bay. Several areas of commercial concentration are found at the mouth of the bay (grid references MT93, MT83, MT95, and MT96).

Rivulus also has been collected in Florida Bay at grid reference NT48.

### 4.4.2 Terrestrial Resources

#### Widespread Species

Most of the terrestrial habitat within the Florida Bay section consists of numerous small keys and the extreme southern coast of the peninsula, which is nearly all wetland. Within this section lies much of the important North American range for the American crocodile, including its officially designated critical habitat. Other common and special status species of broad distribution include American alligators, numerous shorebird and wading birds, and orchids, bromeliads, and ferns.

#### Geographic Inventory

The Cape Sable seaside sparrow and least tern nest within grid reference NT08, as does the bald eagle. The brown pelican and shorebirds are also common here, along with white pelicans, wood storks, and mangrove cuckoos.

Probably the largest wading bird rookery in the Florida Bay section is found at grid reference NT07. In 1978, over 700 pairs nested representing six species, including 200 brown pelicans.

## 4.5 TEN THOUSAND ISLANDS (GRID REFERENCE MT88 to MU35).

The Ten Thousand Islands section of the Southern Florida Zone extends from Cape Sable (grid reference MT88) to Cape Romano (grid reference MU35). Inland portions of this section consist primarily of the Everglades, and thus are low-lying, freshwater wetlands. Mangrove swamps penetrate inland 1 to 9 kilometers (0.6 to 6 miles) along the entire coast of this section and inland 19 to 22 kilometers (12 to 14 miles) along rivers. The coastline is a very complex mosaic of mangrove islands, shallow embayments, and tidal channels, for which this section is named. The continental shelf is very broad and regular. Although reefal structures are more limited in both size and density than those in the Florida Keys, many reef-associated species, such as gorgonians, sponges, and some hard corals, abound on the shelf and form characteristic community types in some nearshore areas. Seagrass beds are poorly developed in this section relative to the Florida Bay and some northern Gulf of Mexico sections. Tidal range within this section is about 1.2 meters (4 feet), which is typical of an exposed coastline.

The biotic resources of this section are keyed geographically using east-west UTM grid swaths.

### 4.5.1 Aquatic Resources

#### Widespread Species

Mangrove swamps and the surrounding tidal marshes provide major nursery grounds for many estuarine-dependent species including pink shrimp, spotted seatrout, red drum, black drum, sheepshead, striped and white mullet, ladyfish, and snook. Other species use the area for feeding and shelter, including stone crab, spiny lobster, crevalle jack, snappers, groupers, bluefish, Florida pompano, cobia, mackerels, and tarpon.

Critical habitat for the West Indian manatee extends throughout the section, encompassing the mangrove swamps and tidal marshes as well as United States territorial waters adjoining the coast. This area is the focus of manatee abundance on the west coast of Florida and is also a winter concentration area.

Major coastal commercial fisheries include spiny lobster, pink shrimp, stone crab, striped and white mullet, bluefish, crevalle jack, Florida pompano, Spanish and king mackerel, groupers, and snappers. Sport species include the above as well as spotted seatrout, red drum, tarpon, and snook.

The southern quahog was historically a major commercial fishery in the Ten Thousand Islands area during the early to mid-1900's. However, a massive die-off resulted in the collapse of the fishery. Although there has been no recovery, a sport harvest still exists throughout the coastal portions of the section.

Freshwater sport fish, including catfish, sunfish, Florida largemouth bass, and Florida gar are sought, not only in the canals and rivers throughout the section, but also in the swamps which surround these water bodies.

Geographic Inventory

Loggerhead sea turtles nest along the southwest coast of Cape Sable (grid reference MT97 to MT98).

The proposed Tortugas Shrimp Sanctuary, described previously, continues within the Ten Thousand Islands section, encompassing waters inshore of grid reference MT18 to MU35. This area has been proposed to be closed to commercial shrimping to protect juvenile pink shrimp and minimize gear conflicts between stone crab and shrimp fishermen.

The Whitewater Bay system (grid reference NT09 to MU80) is a popular sportfishing area for spotted seatrout, red drum, tarpon, gray snapper, and snook. Jewfish are sought at the mouth of this system (grid reference MU80).

Loggerhead sea turtles nest on Pavilion Key (grid reference MU64).

### 4.5.2 Terrestrial Resources

Widespread Species

Mangrove swamps occupy the coastal areas of the Ten Thousand Islands section. Major mangrove species include red mangrove, black mangrove, and buttonwood. Inland, most of the undeveloped portions of this section consist of wetland habitats interspersed with upland hammocks.

Many species with special status are distributed throughout this section, including orchids, ferns, wood storks, everglade kites, Florida sandhill cranes, southeastern American kestrels, Cuban snowy plovers, and everglades minks. Other terrestrial species found throughout the area include mammals such as bobcats, whitetail deer, rabbits, squirrels, raccoons, opossums, and skunks, and numerous shorebirds, wading birds, waterfowl, raptors, amphibians,

and reptiles. A great many frogs, toads, snakes, and turtles are common in the many wetland areas of the section.

Geographic Inventory

Most of the southern portion of this section consists of the Everglades National Park (grid reference MT98 to MU74), which is the largest national park east of the Mississippi and largest tropical wilderness in the United States. It contains 566,580 hectares (1.4 million acres) of grassland with tree-covered hammocks, through which surface water slowly moves. Over 300 bird species have been recorded, 240 regularly. Eighty nesting species have been recorded. In addition to many widespread species, the park harbors the mangrove fox squirrel, Florida black bear, long-billed curlew, fulvous whistling-duck, and the smooth-billed ani, all of which tend to have restricted distributions.

The Taylor Slough drainage between grid reference NT18 and NU35 supports 90 percent of the American crocodile and Cape Sable seaside sparrows surviving in the United States, 50 percent of the reddish egrets and roseate spoonbills in Florida, and 50 percent of the Everglades National Park's wood storks.

The Big Cypress National Preserve has its southern boundary at grid reference NU03, but extends into the Gulf of Mexico Zone to grid reference MV70. It occupies more than 6,200 square kilometers (2,400 square miles) of slash pine, mixed hardwood hammocks, wet and dry prairies, marshes, and mangrove forests. About one-third is covered with cypress trees (mostly pond cypress). A few, giant bald cypresses, between 600 and 700 years old, remain. The area is wild and mostly roadless; it was established to protect the important source of water flowing to Everglades National Park. The preserve supports the largest confirmed population (about 12) of Florida panthers known.

The officially designated critical habitat, and a breeding area, for the everglade kite extends from grid reference NU11 to NU15 in this section.

Nine Mile Pond at grid reference NT29 is a good place to find bald eagles, osprey, herons, roseate spoonbills, limpkins, and mottled ducks. Swallow-tailed kites are present from late February through the fall.

At grid reference NU30, the stands of slash pine harbor flocks of wintering and migrant warblers such as yellow-rumped and pine warblers. Screech, barred, and barn owls also are found here.

The introduced spotted oriole has taken up residence in the vicinity of grid reference NU52.

## 4.6 LIST OF SOURCES FOR THE SOUTHERN FLORIDA ZONE

The List of Sources has been expanded into a matrix (Table 7), linking individual reference sources to the topics for which each reference was used in the preparation of the inventory maps and report.

Table 7. List of sources for the Southern Florida Zone.

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 7 (continued).

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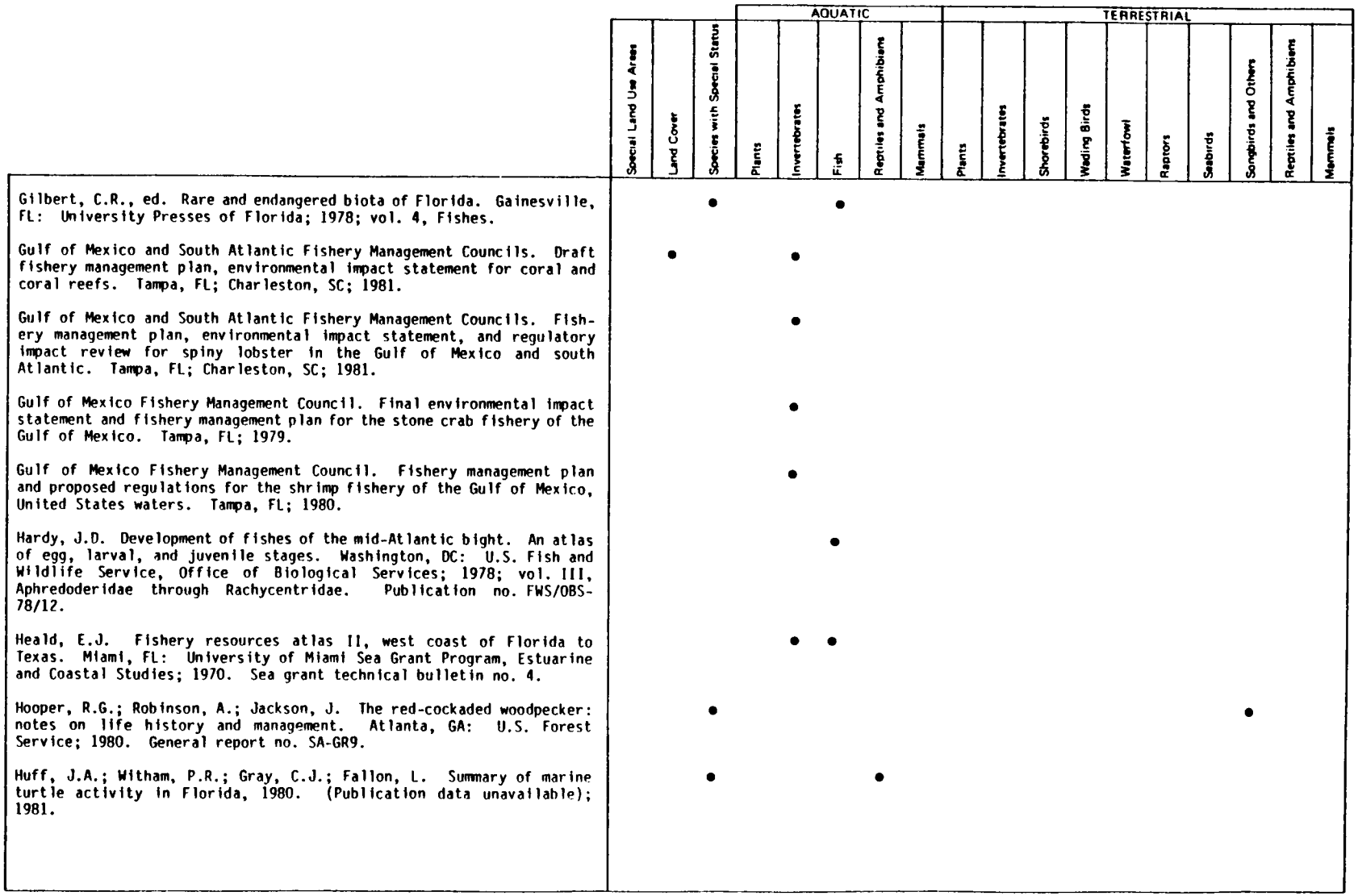
Table 7 (continued).



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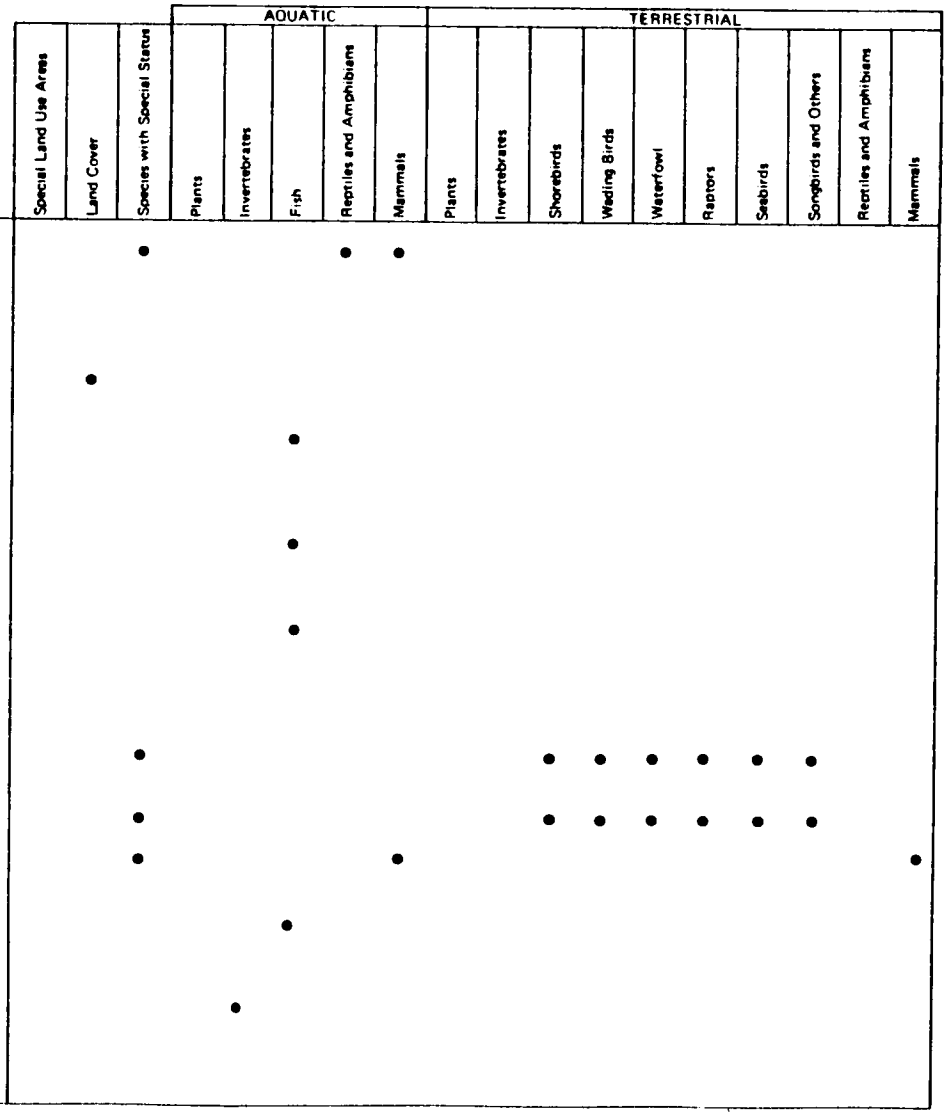



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Table 7 (continued).

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Table 7 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 7 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 7 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 7 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Table 7 (concluded).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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# PART 5

# GULF OF MEXICO ZONE
# (GRID REFERENCE MU35 to PD87)

## 5.1 INTRODUCTION

For best results, much of the preparatory information in parts 1, 2, and 3 should be read before using the maps or using the information in this part. This part presents some of the physiographic, land use, and geographic features of the Gulf of Mexico Zone and the characteristics and habits, not discussed in part 4, of some of the major biological resources.

### 5.1.1 Physical Description

The Gulf of Mexico Zone (Figure 6) constitutes approximately 90 percent of the study area and extends from Cape Romano, Florida, to the Texas-Mexico border (grid reference MU35 to PD87). A small branch of the Florida Current circulates in the Gulf of Mexico, affecting this zone.

The ecological inventory of the Gulf of Mexico Zone is covered by all or portions of the following USGS 1:250,000-scale maps:

- Miami, FL
- West Palm Beach, FL
- Charlotte Harbor, FL
- Saint Petersburg, FL
- Tarpon Springs, FL
- Gainesville, FL
- Valdosta, GA; FL
- Apalachicola, FL
- Tallahassee, FL; GA; AL
- Pensacola, FL; AL
- Mobile, AL; MS; LA
- Breton Sound, LA
- Baton Rouge, LA; MS
- New Orleans, LA
- Port Arthur, TX; LA
- Houston, TX
- Bay City, TX
- Beeville, TX
- Corpus Christi, TX
- Port Isabel, TX
- Brownsville, TX.

The climate and biota of the Gulf of Mexico Zone are primarily warm temperate. Terrestrial and avian species maintain some continuity with their

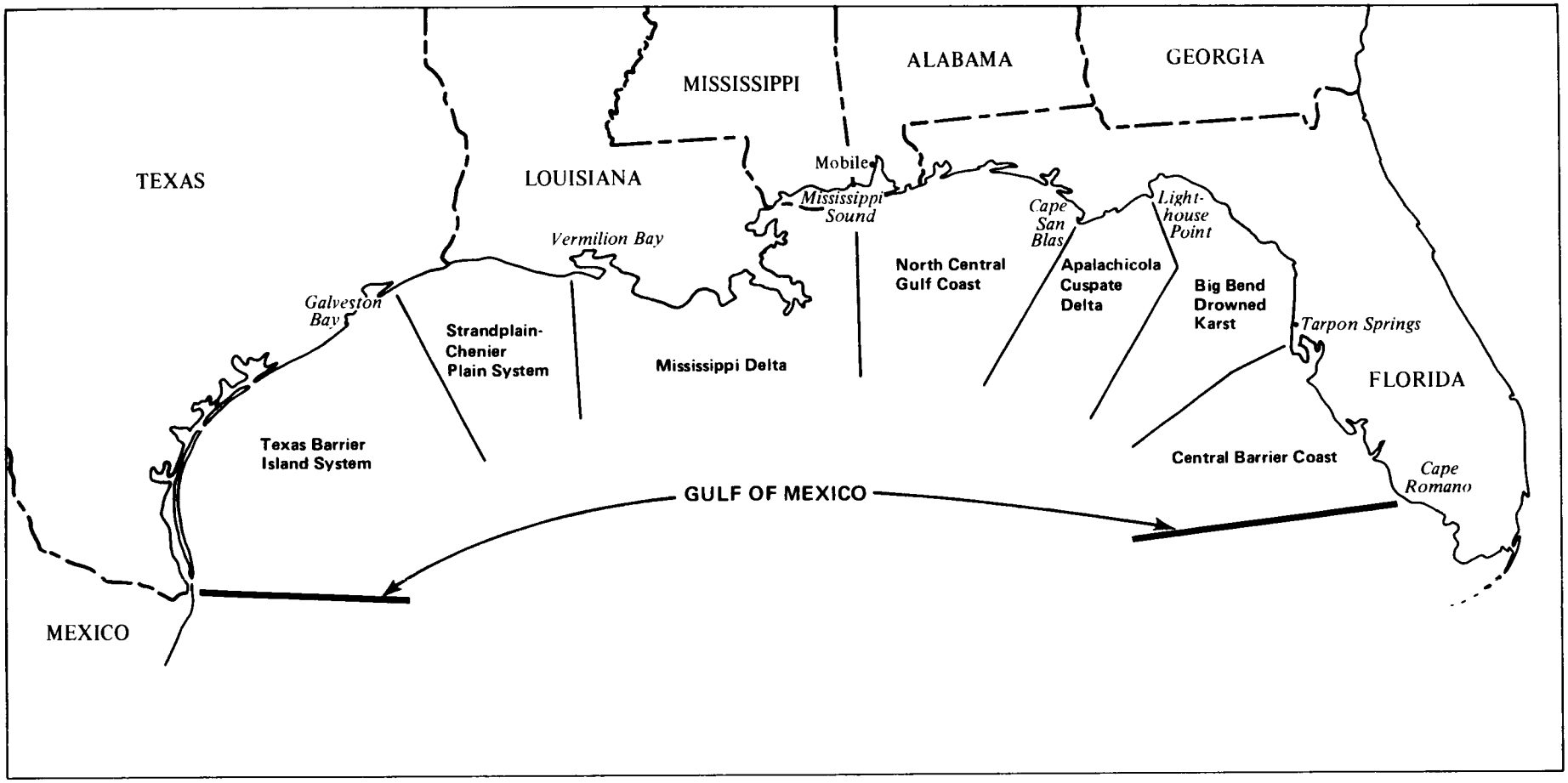


**Figure 6. Major sections of the Gulf of Mexico Zone.**

warm temperate counterparts on the eastern seaboard, but marine species have been effectively isolated since the uplift of the Florida peninsula. The Gulf of Mexico Zone contains seven subdivisions or sections: the Central Barrier Coast, the Big Bend Drowned Karst, the Apalachicola Cuspate Delta, the North Central Gulf Coast, the Mississippi Delta, the Strandplain-Chenier Plain System, and the Texas Barrier Island System.

The Central Barrier Coast section represents a transition from the mangrove-dominated coastline of south Florida to the sandy beaches and marshy bays characteristic of the northern Gulf of Mexico. Exposed sandy beaches, with scattered mangrove stands and rocky areas, are the predominant shoreline features along a series of barrier islands protecting shallow embayments. These embayments may be bounded by salt marshes, swamps, or mangrove stands, depending in part on latitude. The continental shelf is broad and regular, narrowing slightly to the north. Tidal range is approximately 0.6 meters (2 feet). Water temperature at St. Petersburg ranges from 11.3°C (52.3°F) to 32.3°C (90.1°F). Stream discharge is low: annual average discharge approximately 8 cubic meters per second (272 cubic feet per second) to Charlotte Harbor and 8.5 cubic meters per second (300 cubic feet per second) to Tampa Bay.

The Big Bend Drowned Karst section is characterized by wide shallow areas bounded by rugged shorelines. The sea floor is often rocky and covered with seagrass beds or oyster reefs in shallow areas. The continental shelf is very broad and high in fish production. Swamps are common along riverbanks near the coast. Tidal range is approximately 1.1 meter (3.4 to 3.5 feet). Water temperature at Cedar Key ranges from 5.0°C (41.0°F) to 33.4°C (92.1°F). Stream discharge is high; the Suwannee River alone is responsible for 15 percent of the total flow to the west coast of Florida.

The Apalachicola Cuspate Delta section has an exposed coastline that is partially protected by barrier islands with smooth sandy beaches. Protected bays have turbid water and muddy bottoms, due largely to a very high stream discharge from the Apalachicola River. This river accounts for about 35 percent of the total flow to the west coast of Florida. Oyster beds are relatively common, but seagrass beds are rare in this section. Tidal range is approximately 0.6 meters (2 feet).

The North Central Gulf Coast section has an exposed coastline; bays and sounds are protected by barrier islands and separated by stretches of relatively straight shoreline with high energy beaches and well-developed dune systems. Bays are typically lined with marshes and pine savannahs. Stream discharge is high, resulting in variation in water clarity from very turbid, in areas directly influenced by rivers, to clear. Seagrass systems exist, but are not extensive. Tidal range is approximately 0.5 meters (1.5 feet).

The Mississippi Delta section is influenced greatly by the Mississippi River, although historical effects of the Pearl River and recent effects of other large rivers, such as the Atchafalaya River, are evident. Due to the tremendous terrigenous silt load carried by the Mississippi River, nearshore water is typically turbid and the bottom is muddy. Extensive marsh systems occur along the coast, often protected by barrier islands. Drainage within the

marshes has been altered by manmade channels. Anoxic conditions frequently develop in offshore waters during the summer.

The Strandplain-Chenier Plain System section is influenced directly by discharges of several small rivers and indirectly by the Mississippi and Atchafalaya Rivers. The coastline is exposed, without substantial barrier islands. Low-lying inland areas contain extensive brackish and freshwater marshes. These marshes often are partitioned by stranded beach ridges (cheniers) or by spoil banks produced during dredging in the marsh. Tidal range is modest, approximately 0.5 to 0.7 meters (1.5 to 2 feet).

The Texas Barrier Island System section has a coastline consisting largely of bays and lagoons that are protected by barrier islands. Stream discharge from several small rivers contributes sufficient silt to nearshore waters that water clarity is generally poor, particularly in northern parts of the section. Continuous protection by barrier islands, low runoff, and high evaporation along the south Texas coast occasionally produce hypersaline conditions in the Laguna Madre. Water temperatures are quite variable, especially in winter; high temperatures over 32°C (90°F) occur in south Texas in summer, and ice formation in the bays has been recorded during periodic winter storms ("northers"). Marsh systems are common along the upper coast; seagrass beds are common and mangroves occur sporadically along the south coast.

### 5.1.2 Special Land Use Areas

The Gulf of Mexico Zone includes the highly urbanized areas of New Orleans and Houston in addition to the forests of northwest Florida and the rangeland of southeast Texas. Vast areas of the zone are held as public lands and a total of 245 special land use areas have been identified (Table 8).

Federal ownership has been identified for 51 of the special land use areas, ranging from the tiny Shell Keys National Wildlife Refuge to the vast Apalachicola National Forest. Five of these areas also have been designated as Class I air quality areas: Chassahowitzka Wilderness, Saint Marks Wilderness, Okefenokee Wilderness, Bradwell Bay Wilderness, and Breton Wilderness. State ownership has been identified for 181 areas, while private ownership is identified for the remaining 13 special land use areas. Approximately 20 percent of the areas have historical significance, while a little more than 50 percent are recreationally significant and 60 percent are significant for their natural and ecological values. Due to scale limitations, some historic sites in the urban areas of the Gulf of Mexico Zone have not been shown on the maps.

## 5.2 RESOURCES OVERVIEW

The following paragraphs summarize the locations and habits, not discussed in part 4, of various species in the Gulf of Mexico Zone. Only the more important species of the zone have been shown on the inventory maps due to scale limitations.

Table 8. Designated land use areas for the Gulf of Mexico Zone.

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA | | | | | | |
| Loxahatchee National Wildlife Refuge | X | | | X | | |
| J. W. Corbett Wildlife Management Area | | X | | X | | X |
| Pahokee State Recreation Area | | X | | | | X |
| Everglades Reclamation State Historic Site | | X | | | X | |
| Brown's Farm Wildlife Management Area | | X | | X | | X |
| Holey Land Wildlife Management Area | | X | | X | | X |
| Rotenberger Wildlife Management Area | | X | | X | | X |
| Rookery Bay Aquatic Preserve | | X | | X | | |
| Delnor-Wiggins Pass State Recreation Area | | X | | | | X |
| Estero Bay Aquatic Preserve | | X | | X | | |
| Koreshan State Historic Site | | X | | | X | |
| Caloosahatchee National Wildlife Refuge | X | | | X | | |
| Lykes Brothers Incorporated-Fisheating Creek Wildlife Management Area | | X | | X | | X |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Cecil M. Webb Wildlife Management Area | | X | | X | | X |
| J. N. "Ding" Darling National Wildlife Refuge | X | | | X | | |
| J. N. "Ding" Darling Wilderness | X | | | X | | |
| Pine Island Sound Aquatic Preserve | | X | | X | | |
| Pine Island National Wildlife Refuge | X | | | X | | |
| Matlacha Pass National Wildlife Refuge | X | | | X | | |
| Matlacha Pass Aquatic Preserve | | X | | X | | |
| Cape Haze-Gasparilla Sound Aquatic Preserve | | X | | X | | |
| Island Bay National Wildlife Refuge | X | | | X | | |
| Island Bay Wilderness | X | | | X | | |
| Oscar Scherer State Recreation Area | | X | | | | X |
| Myakka River State Park | | X | | | | X |
| Lake Manatee State Recreation Area | | X | | | | X |
| De Soto National Memorial | X | | | | X | |
| Judah P. Benjamin Confederate Memorial at Gamble Plantation State Historic Site | | X | | | X | |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Madira Bickel Mound State Archaeological Site | | X | | | X | |
| Passage Key National Wildlife Refuge | X | | | X | | |
| Passage Key Wilderness | X | | | X | | |
| Egmont Key National Wildlife Refuge | X | | | X | | |
| Pinellas County Aquatic Preserve | | X | | X | | |
| Boca Ciega Bay Aquatic Preserve | | X | | X | | |
| Pinellas National Wildlife Refuge | X | | | X | | |
| Cockroach Bay Aquatic Preserve | | X | | X | | |
| Ybor City State Museum | | X | | | X | |
| Caladesi Island Aquatic Preserve | | X | | X | | |
| Caladesi Island State Park | | X | | | | X |
| Lower Hillsborough Wildlife Management Area | | X | | X | | X |
| Hillsborough River State Park | | X | | | | X |
| Upper Hillsborough Wildlife Management Area | | X | | X | | X |
| Green Swamp Wildlife Management Area | | X | | X | | X |
| Withlacoochee State Forest | | X | | X | | X |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Richloam Wildlife Management Area | | X | | X | | X |
| Croom Wildlife Management Area | | X | | X | | X |
| Chassahowitzka National Wildlife Refuge | X | | | X | | |
| Chassahowitzka Wilderness* | X | | | X | | |
| Dade Battlefield State Historic Site | | X | | | X | |
| Saint Martins Marsh Aquatic Preserve | | X | | X | | X |
| Yulee Sugar Mill Ruins State Historic Site | | X | | | X | |
| Citrus Wildlife Management Area | | X | | X | | X |
| Fort Cooper State Park | | X | | | X | X |
| Crystal River State Archaeological Site | | X | | | X | |
| Lake Rousseau State Recreation Area | | X | | | | X |
| Gulf Hammock Wildlife Management Area | | X | | X | | X |
| Waccasassa Bay State Preserve | | X | | X | | X |

*Class I air quality area.

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Cedar Keys National Wildlife Refuge | X | | | X | | |
| Cedar Keys Wilderness | X | | | X | | |
| Cedar Key State Museum | | X | | | X | |
| Lower Suwannee National Wildlife Refuge | X | | | X | | |
| Steinhatchee Wildlife Management Area | | X | | X | | X |
| Fort McCoy Wildlife Management Area | | X | | X | | X |
| Marjorie Kinnan Rawlings State Historic Site | | X | | | X | |
| Lochloosa Wildlife Management Area | | X | | X | | X |
| Paynes Prairie State Preserve | | X | | X | | X |
| Devil's Millhopper State Geological Site | | X | | X | | |
| San Felasco Hammock State Preserve | | X | | X | | X |
| Manatee Springs State Park | | X | | | | X |
| River Rise State Preserve | | X | | X | | X |
| O'Leno State Park | | X | | | X | X |
| Ichetucknee Springs State Park | | X | | | | X |
| Tide Swamp Wildlife Management Area | | X | | X | | X |
| Camp Blanding Wildlife Management Area | | X | | X | | X |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Lake Butler Wildlife Management Area | | X | | X | | X |
| Osceola National Forest | X | | | X | | X |
| Osceola Wildlife Management Area | | X | | X | | X |
| Olustee Battlefield State Historic Site | | X | | | X | |
| Cypress Creek Wildlife Management Area | | X | | X | | X |
| Occidental Wildlife Management Area | | X | | X | | X |
| Stephen Foster State Folk Culture Center | | X | | | X | |
| Suwannee River State Park | | X | | | X | X |
| Forest Capital State Museum | | X | | | X | |
| Aucilla Wildlife Management Area | | X | | X | | X |
| Saint Marks National Wildlife Refuge | X | | | X | | |
| Saint Marks Wilderness* | X | | | X | | |

*Class I air quality area.

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA-GEORGIA | | | | | | |
| Okefenokee National Wildlife Refuge | X | | | X | | |
| Okefenokee Wilderness* | X | | | X | | |
| GEORGIA | | | | | | |
| Stephen C. Foster State Park | | X | | | | X |
| Grand Bay Wildlife Management Area | | X | | X | | X |
| Lapham-Patterson House State Historic Site | | X | | | X | |
| Lake Seminole Waterfowl Management Area | | X | | X | | X |
| Seminole State Park | | X | | | | X |
| FLORIDA | | | | | | |
| Alfred B. Maclay State Gardens | | X | | X | | |
| Lake Jackson Aquatic Preserve | | X | | X | | |
| Lake Jackson Mounds State Archaeological Site | | X | | | X | |
| Tallahassee Cascades State Historic Site | | X | | | X | |

*Class I air quality area.

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Ochlockonee River Wildlife Management Area | | X | | X | | X |
| Joe Budd Wildlife Management Area | | X | | X | | X |
| Talquin Wildlife Management Area | | X | | X | | X |
| Lake Talquin State Recreation Area | | X | | | | X |
| Apalachicola National Forest | X | | | X | | X |
| Apalachicola Wildlife Management Area | | X | | X | | X |
| Natural Bridge Battlefield State Historic Site | | X | | X | X | |
| San Marcos de Apalache State Historic Site | | X | | | X | |
| Bradwell Bay Wilderness* | X | | | X | | |
| Ochlockonee River State Park | | X | | | X | X |
| Alligator Harbor Aquatic Preserve | | X | | X | | |
| Apalachicola River and Bay Estuarine Sanctuary | | X | | X | | |
| Apalachicola Bay Aquatic Preserve | | X | | X | | |
| Dr. Julian G. Bruce Saint George Island State Park | | X | | | | X |

*Class I air quality area.

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| John Gorrie State Museum | | X | | | X | |
| Saint Vincent National Wildlife Refuge | X | | | X | | |
| Saint Joseph Bay Aquatic Preserve | | X | | X | | |
| T. H. Stone Memorial Saint Joseph Peninsula State Park | | X | | | | X |
| Constitution Convention State Museum | | X | | | X | |
| Edward Ball Wildlife Management Area | | X | | X | | X |
| Fort Gadsden State Historic Site | | X | | | X | |
| Dead Lake State Recreation Area | | X | | | | X |
| G. U. Parker Wildlife Management Area | | X | | X | | X |
| Robert Brent Wildlife Management Area | | X | | X | | X |
| Torreya State Park | | X | | | X | X |
| Three Rivers State Recreation Area | | X | | | | X |
| Apalachee Wildlife Management Area | | X | | X | | X |
| Florida Caverns State Park | | X | | X | | X |
| Falling Waters State Recreation Area | | X | | | | X |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Ponce de Leon Springs State Recreation Area | | X | | | | X |
| Pine Log State Forest | | X | | X | | X |
| Point Washington Wildlife Management Area | | X | | X | | X |
| Saint Andrews State Park Aquatic Preserve | | X | | X | | |
| Saint Andrews State Recreation Area | | X | | | | X |
| Eden State Gardens | | X | | X | | |
| Grayton Beach State Recreation Area | | X | | | | X |
| Basin Bayou State Recreation Area | | X | | | | X |
| Fred Gannon Rocky Bayou State Recreation Area | | X | | | | X |
| Rocky Bayou State Park Aquatic Preserve | | X | | X | | |
| Blackwater River State Forest | | X | | X | | X |
| Blackwater Wildlife Management Area | | X | | X | | X |
| Blackwater River State Park | | X | | | X | X |
| Yellow River Marsh Aquatic Preserve | | X | | X | | |
| Fort Pickens State Park Aquatic Preserve | | X | | X | | |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| FLORIDA (cont'd) | | | | | | |
| Big Lagoon State Recreation Area | | X | | | | X |
| Saint Regis Wildlife Management Area | | X | | X | | X |
| La Floresta Perdida Wildlife Management Area | | X | | X | | X |
| FLORIDA-MISSISSIPPI | | | | | | |
| Gulf Islands National Seashore | X | | | X | X | X |
| ALABAMA | | | | | | |
| Conecuh National Forest | X | | | X | | X |
| Baldwin Forest | | X | | X | | |
| Gulf State Park | | X | | | | X |
| Alabama Department of Conservation Fish Hatchery | | X | | X | | |
| Bon Secour National Wildlife Refuge | X | | | X | | |
| Meaher State Park | | X | | | | X |
| Mobile Forest | | X | | X | | |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| MISSISSIPPI | | | | | | |
| Pascagoula River Wildlife Management Area | | X | | X | | X |
| Shepard State Park | | X | | | | X |
| Mississippi Sandhill Crane National Wildlife Refuge | X | | | X | | |
| Gulf Marine State Park | | X | | | | X |
| Red Creek Wildlife Management Area | | X | | X | | X |
| Leaf River Wildlife Management Area | | X | | X | | X |
| De Soto National Forest | X | | | X | | X |
| Little Biloxi Wildlife Management Area | | X | | X | | X |
| Wolf River Wildlife Management Area | | X | | X | | X |
| Buccaneer State Park | | X | | | | X |
| MISSISSIPPI-LOUISIANA | | | | | | |
| Bogue Chitto National Wildlife Refuge | X | | | X | | |
| LOUISIANA | | | | | | |
| Pearl River Wildlife Management Area | | X | | X | | X |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| LOUISIANA (cont'd) | | | | | | |
| Fort Pike State Commemorative Area | | X | | | X | |
| Jean Lafitte National Historical Park | X | | | | X | |
| Biloxi Wildlife Management Area | | X | | X | | X |
| Breton National Wildlife Refuge | X | | | X | | |
| Breton Wilderness* | X | | | X | | |
| Pass a Loutre Wildlife Management Area | | X | | X | | X |
| Delta National Wildlife Refuge | X | | | X | | |
| Bohemia Wildlife Management Area | | X | | X | | X |
| Grand Isle State Park | | X | | | | X |
| Saint Bernard State Park | | X | | | | X |
| Fontainebleau State Park | | X | | | | X |
| Fairview Riverside State Park | | X | | | | X |
| Manchac Wildlife Management Area | | X | | X | | X |
| Camp Moore State Commemorative Area | | X | | | X | |
| Salvador Wildlife Management Area | | X | | X | | X |
| Wisner Wildlife Management Area | | X | | X | | X |
| Pointe au Chien Wildlife Management Area | | X | | X | | X |

*Class I air quality area.

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| LOUISIANA (cont'd) | | | | | | |
| Edward Douglass White State Commemorative Area | | X | | | X | |
| Old State Capitol State Commemorative Area | | X | | | X | |
| Old Arsenal State Commemorative Area | | X | | | X | |
| Audubon State Commemorative Area | | X | | | X | |
| Locust Grove State Commemorative Area | | X | | | X | |
| Three Rivers Wildlife Management Area | | X | | X | | X |
| Thistlethwaite Wildlife Management Area | | X | | X | | X |
| Longfellow-Evangeline State Commemorative Area | | X | | | X | |
| Attakapas Island Wildlife Management Area | | X | | X | | X |
| Atchafalaya Delta Wildlife Management Area | | X | | X | | X |
| Shell Keys National Wildlife Refuge | X | | | X | | |
| Russell Sage Foundation--Marsh Island State Wildlife Refuge | | X | | X | | |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| LOUISIANA (cont'd) | | | | | | |
| Cypremort Point State Park | | X | | | | X |
| Palmetto Island State Park | | X | | | | X |
| State Wildlife Refuge | | X | | X | | |
| Paul J. Rainey Wildlife Refuge and Game Preserve | | | X | X | | |
| Rockefeller Wildlife Refuge | | X | | X | | |
| Lacassine National Wildlife Refuge | X | | | X | | |
| Lacassine Wilderness | X | | | X | | |
| Sabine National Wildlife Refuge | X | | | X | | |
| TEXAS | | | | | | |
| Sabine Pass Battleground State Historical Park | | X | | | X | |
| Texas Point National Wildlife Refuge | X | | | X | | |
| Sea Rim State Park | | X | | | | X |
| J. D. Murphree Wildlife Management Area | | X | | X | | X |
| McFaddin National Wildlife Refuge | X | | | X | | |
| Anahuac National Wildlife Refuge | X | | | X | | |
| Vingt-et-un Islands Sanctuary | | | X | X | | |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| TEXAS (cont'd) | | | | | | |
| Sheldon Reservoir Wildlife Management Area | | X | | X | | X |
| San Jacinto Battleground State Historical Park | | X | | | X | |
| Addicks Reservoir | | X | | X | | |
| Barker Reservoir | | X | | X | | |
| University of Houston at Clear Lake Preserve | | | X | X | | |
| Armand Bayou Nature Center | | | X | X | | |
| North Deer Island Sanctuary | | | X | X | | |
| South Deer Island Sanctuary | | | X | X | | |
| Galveston Island State Park | | X | | | | X |
| Snake Island Sanctuary | | | X | X | | |
| Bird Island Sanctuary | | | X | X | | |
| Brazoria National Wildlife Refuge | X | | | X | | |
| Varner-Hogg Plantation State Historical Park | | X | | | X | |
| Bryan Beach State Recreation Area | | X | | | | X |
| San Bernard National Wildlife Refuge | X | | | X | | |
| Palmetto Bend State Recreation Area | | X | | | | X |
| Port Lavaca State Fishing Pier | | X | | | | X |
| Fannin Battleground State Historic Site | | X | | | X | |

continued

Table 8 (concluded).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| TEXAS (cont'd) | | | | | | |
| Goliad State Historical Park | | X | | | X | |
| Matagorda Island State Lands | | X | | X | | |
| Aransas National Wildlife Refuge | X | | | X | | |
| Goose Island State Recreation Area | | X | | | | X |
| Copano Bay State Fishing Pier | | X | | | | X |
| Connie Hager Bird Sanctuary | | | X | X | | |
| Rob and Bessie Welder Wildlife Foundation Refuge | | | X | X | | |
| Lake Corpus Christi State Recreation Area | | X | | | | X |
| Lydia Ann Island Sanctuary | | | X | X | | |
| Mustang Island State Park | | X | | | | X |
| South Bird Island Sanctuary | | | X | X | | |
| Padre Island National Seashore | X | | | X | | X |
| Green Island Sanctuary | | | X | X | | |
| Laguna Atascosa National Wildlife Refuge | X | | | X | | |
| Santa Ana National Wildlife Refuge | X | | | X | | |
| Palo Alto Battlefield National Historic Site | X | | | | X | |
| Port Isabel Lighthouse State Historic Structure | | X | | | X | |
| Queen Isabella State Fishing Pier | | X | | | | X |
| Brazos Island State Recreation Area | | X | | | | X |

### 5.2.1 Species with Special Status

Species with special status shown on the accompanying inventory maps include only those known to occur in the Gulf of Mexico Zone which are designated as either threatened or endangered on published Federal and state lists (Table 9) and for which supporting data were available. Species proposed for consideration as endangered, threatened, or other classification are discussed only when appropriate in the applicable aquatic or terrestrial sections of this report.

Species with special status that are known to occur in the Gulf of Mexico Zone include 1 aquatic invertebrate, 8 fish, 5 marine reptiles, 2 marine mammals, 40 terrestrial plants and plant groups, 27 birds, 18 terrestrial reptiles and amphibians, and 13 terrestrial mammals. In accordance with the Florida list of threatened plants, several plant groups have been included in the species with special status; with specific exceptions, all members of these plant groups are listed as threatened in the State of Florida and specific plant species are not identified in this study. Plants that are members of one of these groups, but that also are included on Florida's list of endangered plant species, have been identified as individual species in the inventory.

The unicolor mussel (67) is found in the main stem of the Pascagoula River and some of its lower tributaries. This freshwater mussel lives in river shallows, mainly on stable sand substrates. Pollution and silting of rivers probably have led to reductions in the numbers of this species.

The Gulf of Mexico subspecies of the Atlantic sturgeon (209) is found in the northeastern Gulf of Mexico. This anadromous species historically supported an important commercial fishery. However, because of overfishing, dam construction, and river pollution, its numbers have declined to the point where it is considered endangered in Mississippi. A limited fishery still exists on the Suwannee River in Florida. In the spring, adults migrate upstream from their wintering grounds over the continental shelf to spawning areas in shallow water; postspawning emigration occurs in the fall. Juveniles may remain in fresh or brackish water for 3 to 5 years, although they may participate in prespawning runs as early as age one.

The bluestripe shiner (219) is endemic to the Apalachicola River system (including the Flint and Chattahoochee Rivers) in Florida, Georgia, and Alabama. It is restricted to the large rivers and usually is found over sand and above the Fall Line. Little is known of its life history, but it is considered threatened in Florida because of its limited range within the state.

The blackmouth shiner (221) is currently an undescribed species of which little is known. It has been collected only twice over a period of 37 years, both times in the same locality: Pond Creek in Santa Rosa County, Florida. It was collected in shallow, mud-bottomed, weedy backwaters, although it is possible that it inhabits deeper water. Its habitat seems to be stable and not subject to environmental stress.

The crystal darter (223), one of the larger darter species, is found in the large rivers of the Gulf coast, especially the Escambia, Alabama, and Pearl River systems, and the Mississippi River Valley. Little is known of its life

Table 9. Species with special status in the Gulf of Mexico Zone.

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | AQUATIC INVERTEBRATES | | | | |
| 67 | Unicolor mussel | | | | MS |
| | FISH | | | | |
| 209 | Atlantic sturgeon | | | MS | |
| 219 | Bluestripe shiner | | | | FL |
| 221 | Blackmouth shiner | | | | FL |
| 223 | Crystal darter | | | MS | |
| 225 | Okaloosa darter | X | | FL | |
| 231 | Frecklebelly madtom | | | MS | |
| 241 | Paddlefish | | | TX | |
| 244 | River darter | | | | TX* |
| | AQUATIC REPTILES AND AMPHIBIANS | | | | |
| 300 | Green sea turtle | X | X | FL | |
| 301 | Loggerhead sea turtle | | X | | FL |
| 302 | Hawksbill sea turtle | X | | FL | |
| 303 | Kemp's Ridley sea turtle | X | | FL | |
| 304 | Leatherback sea turtle | X | | FL | |
| | MARINE MAMMALS | | | | |
| 350 | West Indian manatee | X | | FL | |
| 354 | Sperm whale | X | | FL | |

continued

Table 9 (continued).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | TERRESTRIAL PLANTS | | | | |
| 400 | Lance-leaved wake-robin | | | FL | |
| 401 | Florida royal palm | | | FL | |
| 402 | Orchids | | | | FL |
| 403 | Bromeliads | | | | FL |
| 405 | Ferns | | | | FL |
| 408 | Palms | | | | FL |
| 409 | Chapman's rhododendron | X | | FL | |
| 410 | Hollies | | | | FL |
| 412 | Coonties | | | | FL |
| 413 | Four-petal pawpaw | | | FL | |
| 414 | Sandhill milkweed | | | | FL |
| 416 | Catopsis | | | FL | |
| 417 | Giant dewflower | | | | FL |
| 418 | Pagoda dogwood | | | | FL |
| 419 | Okeechobee gourd | | | FL | |
| 421 | Fall-flowering ixia | | | | FL |
| 423 | Ashe magnolia | | | FL | |
| 426 | White-top pitcher plant | | | FL | GA |
| 427 | Grass of parnassus | | | FL | |
| 428 | Florida yew | | | FL | |
| 437 | Prickly-apple cactus | | | FL | |
| 439 | Hidden orchid | | | FL | |
| 440 | Hand fern | | | FL | |
| 441 | Auricled spleenwort | | | FL | |

continued

Table 9 (continued).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | TERRESTRIAL PLANTS (cont'd) | | | | |
| 442 | Sinkhole fern | | | FL | |
| 443 | Trailing arbutus | | | FL | |
| 444 | Orange azalea | | | FL | |
| 445 | Miccosukee gooseberry | | | FL | |
| 446 | Red-flowered pitcher plant | | | FL | |
| 447 | Florida torreya | | | FL, GA | |
| 448 | Mountain laurel | | | | FL |
| 449 | Bartram's ixia | | | | FL |
| 450 | Harper's beauty | X | | | |
| 452 | Hartwrightia | | | | GA |
| 453 | Pond-spice | | | | GA |
| 454 | Trumpets | | | | GA |
| 455 | Hooded pitcher plant | | | | GA |
| 456 | Parrot pitcher plant | | | | GA |
| 457 | Riparian autumngrass | | | | GA |
| 477 | Black lace cactus | X | | | |
| | BIRDS | | | | |
| 556 | Cuban snowy plover | | | FL | |
| 557 | Least tern | | X | | FL, TX* |
| 603 | Wood stork | | X | FL | TX* |
| 605 | Reddish egret | | | | TX* |

continued

Table 9 (continued).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | BIRDS (cont'd) | | | | |
| 606 | White-faced ibis | | | | TX* |
| 620 | Florida sandhill crane | | | | FL |
| 624 | Mississippi sandhill crane | X | | MS | |
| 625 | Whooping crane | X | | MS | |
| 702 | Swallow-tailed kite | | | | TX* |
| 704 | Everglade kite | X | | FL | |
| 707 | Bald eagle | X | | GA, AL, MS, LA, TX | FL |
| 708 | Audubon's caracara | | | | FL |
| 709 | Peregrine falcon | X | | FL, GA, AL, MS, LA, TX | |
| 712 | Osprey | | | | TX* |
| 713 | Southeastern American kestrel | | | | FL |
| 717 | White-tailed hawk | | | | TX* |
| 719 | Zone-tailed hawk | | | | TX* |
| 720 | Gray hawk | | | | TX* |
| 721 | Black hawk | | | | TX* |
| 760 | Brown pelican | X | | GA, AL, MS, LA, TX | FL |
| 804 | Attwater's greater prairie chicken | X | | TX | |
| 808 | Kirtland's warbler | X | | FL, GA | |
| 809 | Red-cockaded woodpecker | X | | GA, AL, MS, LA, TX | FL |

continued

Table 9 (continued).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | BIRDS (cont'd) | | | | |
| 816 | White-crowned pigeon | | | | FL |
| 818 | Cape Sable seaside sparrow | X | | FL | |
| 820 | Florida grasshopper sparrow | | | FL | |
| 823 | Florida scrub jay | | | | FL |
| | TERRESTRIAL REPTILES AND AMPHIBIANS | | | | |
| 851 | American alligator | X | X | GA, AL, MS, TX | LA |
| 853 | Eastern indigo snake | | X | AL, MS | FL, GA, |
| 857 | Gopher tortoise | | | | MS |
| 863 | Short-tailed snake | | | | FL |
| 864 | Sand skink | | | | FL |
| 871 | Pine barrens treefrog | X | | | |
| 873 | Black pine snake | | | MS | |
| 874 | Rainbow snake | | | MS | |
| 875 | Yellow-blotched sawback turtle | | | | MS |
| 876 | Ringed sawback turtle | | | | MS |
| 877 | Southern hognose snake | | | MS | |
| 878 | Texas indigo snake | | | | TX* |
| 880 | Mexican treefrog | | | | TX* |
| 881 | Rio Grande frog | | | | TX* |
| 882 | Giant toad | | | | TX* |
| 883 | Texas tortoise | | | | TX* |

continued

Table 9 (concluded).

| Map number | Species | Federal | | State | |
|---|---|---|---|---|---|
| | | Endangered | Threatened | Endangered | Threatened |
| | TERRESTRIAL REPTILES AND AMPHIBIANS (cont'd) | | | | |
| 884 | Texas horned lizard | | | | TX* |
| 885 | White-lipped frog | | | | TX* |
| | TERRESTRIAL MAMMALS | | | | |
| 900 | Red wolf | X | | AL, MS, LA, TX | |
| 901 | Black bear | | | | MS |
| 904 | Ocelot | | | TX | |
| 905 | Jaguarundi | X | | TX | |
| 925 | Florida mouse | | | | FL |
| 927 | Gray bat | X | | FL, GA, AL, MS | |
| 928 | Indiana bat | X | | FL, GA, AL, MS | |
| 932 | Mangrove fox squirrel | | | | FL |
| 933 | Florida black bear | | | | FL |
| 934 | Everglades mink | | | | FL |
| 935 | Florida panther | X | | FL, GA, AL, MS, LA | |
| 940 | Perdido Bay beach mouse | | | | FL |
| 941 | Choctawhatchee beach mouse | | | | FL |

*Designated "protected non-game species" under Texas law; equivalent to "threatened."

history, although it occupies large sand or gravel bars and riffles as well as flowing pools of large rivers. Its numbers have been depleted due to habitat destruction.

The Okaloosa darter (225) is the only fish species in the study area on the Federal endangered list. This darter occupies small to medium-sized streams with clear water, moderate to swift currents, and clean, sandy bottoms. It is restricted to a series of small streams that empty into Rocky and Boggy Bayous near the western end of Choctawhatchee Bay in Okaloosa and Walton Counties, Florida. Little is known of its life history, although it has been observed spawning in early spring. Populations are estimated between 1,500 and 10,000 individuals. Its numbers have probably declined only slightly in the past 17 years, mainly in areas where a closely related allopatric species, the brown darter, has been introduced, but also where there has been temporary disruption of its limited habitat.

The frecklebelly madtom (231) is found chiefly in riffles and rapids of major rivers and their larger tributaries. The species is taken in large numbers in the lower Pearl River and was formerly common in parts of the Mobile Bay drainage. Nothing is known of its life history.

The paddlefish (241) prefers large, free-flowing rivers rich in zooplankton. It is distributed throughout the Mississippi Valley and adjacent Gulf drainages from the Mobile River basin in Alabama to the San Jacinto River in Texas. Spawning occurs from March through June in fast-flowing water over gravel or sand bars; males and females gather in schools and the eggs are broadcast. Paddlefish commonly reach a size of 18 to 27 kilograms (40 to 60 pounds). Since large quantities of water flow are required for reproduction, dam construction and the flooding of habitat are major concerns.

The river darter (244) usually is found in deep chutes and riffles of large rivers and lower tributaries, where there is swift current and coarse gravel or rock bottom. This species appears to be more tolerant of turbid water than other darters. Little is known of its life history; however, spawning seems to occur in the spring.

The five sea turtles with special status, discussed previously in part 4 of this report, also occur throughout the Gulf of Mexico Zone. These include the green (300), loggerhead (301), hawksbill (302), Kemp's Ridley (303), and leatherback (304) sea turtles. The threatened loggerhead sea turtle is known to nest on Florida Gulf coast beaches and on the Chandeleur Islands in Louisiana. The endangered hawksbill turtle infrequently nests on Florida Gulf coast beaches. The other three species do not nest in the Gulf of Mexico Zone.

Two endangered marine mammals are found in the Gulf of Mexico Zone: the West Indian manatee (350) and the sperm whale (354). Both have been described previously in part 4 of this report. Within the Gulf of Mexico Zone, the manatee is found mainly along the west coast of peninsular Florida. However, during the winter, its range becomes restricted to the southern portion of the peninsula as well as isolated warm water springs and powerplant outfalls in other portions of the peninsula. The manatee has been sited peripherally in all states of the Gulf coast, and in particular off the Rio Grande in Texas.

The sperm whale is found uncommonly throughout the Gulf of Mexico, mainly along the edge of the continental shelf.

Two shorebirds, previously discussed in part 4 of this report, also may be found in the Gulf of Mexico Zone. The Cuban snowy plover (556) is a rare, summer breeder throughout the Gulf of Mexico Zone on outer beaches and sand bars. The least tern (557) is a summer resident throughout the Gulf coast, where it breeds in small colonies.

As discussed in part 4 of this report, the wood stork (603) breeds only in peninsular Florida; however, post-breeding dispersal carries individuals throughout wetland habitats in the Gulf of Mexico Zone.

The reddish egret (605) breeds only in southern Florida and along the Texas coast in this zone in significant numbers. After the summer breeding season, however, wanderers occur all along the northern Gulf coast. The species prefers coastal tidal flats, salt marshes, shores, and lagoons.

The white-faced ibis (606) is found primarily from southern Louisiana to southern Texas in marshes, rice fields, and swamps, where it breeds in summer. Most birds remain year-round; however, some individuals wander throughout the Gulf coast region, and some occasionally inhabit Florida.

The Florida sandhill crane (620) is a permanent resident only in the Florida portion of the Gulf of Mexico Zone. Breeding may begin a little later in this zone than in the Southern Florida Zone.

The Mississippi sandhill crane (624) inhabits semi-open and wet pine savanna. All known breeding, summer feeding, and roosting sites are included within the legally designated critical habitat in Jackson County, Mississippi. These cranes are permanent residents, although they may move locally within this zone. Nesting territories often are used year after year; hatching occurs from early April to late June. There are an estimated 40 to 50 birds in the wild population, with about 12 to 15 breeding pairs. Another 19 or so are held by the FWS as part of a captive breeding program.

The tallest North American bird, and one of the rarest, is the whooping crane (625). Although it breeds in Canada, it winters in coastal Texas in prairie pools and marshes. The birds begin to display ritual premigration behavior in December or January, and leave Texas between the end of March and the middle of April.

The swallow-tailed kite (702) has special status only in Texas, where it is rare and is found only locally. It spends most of its time in the air; hunting, feeding and drinking are all done on the wing. Summer nesting takes place in the tops of very tall trees, generally pines or cypress.

The distribution of the everglade kite (704), discussed previously in part 4 of this report, is restricted to the southernmost Florida portion of the Gulf of Mexico Zone.

While the bald eagle (707) winters throughout the Gulf coast, its breeding is primarily restricted to Florida. As discussed in part 4 of this report, a few scattered nesting locations occur in Louisiana and Texas.

The Audubon's caracara (708) is an open country bird, and prefers dry prairies with scattered cabbage palms. The species is non-migratory; in the Gulf of Mexico Zone, it is restricted to mid-peninsular Florida and southern Texas. However, it only has special status in Florida, where about 35 to 44 of the birds remain. Peak breeding occurs from January to March.

As in the Southern Florida Zone (part 4), peregrine falcons (709) winter throughout Gulf coastal areas.

While ospreys (712) occur all year east of Louisiana in this zone, they are found in coastal areas of Louisiana and Texas only in winter.

Southeastern American kestrels (713) are found in this zone only in Florida and Georgia. They are permanent residents, as discussed previously in part 4 of this report.

The white-tailed hawk (717) occurs in this zone only in extreme southern Texas in grasslands and dry scrub areas, where it feeds on small animals. It is a year-round resident here, breeding in summer.

Another threatened hawk, the zone-tailed hawk (719), is similarly restricted to wooded canyons and rivers just north of the Texas-Mexico border, where it is more common during the summer. The species hunts small mammals, reptiles, and birds.

The gray hawk (720) is a small buteo found mostly south of the Mexican border, although it occasionally can be found somewhat north of this area any time of year. It occurs locally in woods along streams, where it hunts for lizards.

The black hawk (721) is rare in the United States. In this zone, it is restricted to the Texas-Mexico border during summer. It frequents woodlands near water, where it searches for crabs, toads and crayfish.

The brown pelican (760) is common along the Gulf coast from Florida to Louisiana. Most breeding occurs in Florida, as described in part 4 of this report. By 1962, pollutants had extirpated the species west of Florida, but it was reintroduced to Louisiana in 1968.

The Attwater's greater prairie chicken (804) is restricted to the central Texas coast, where it is a permanent breeding resident. Breeding behavior is exhibited from late February or early March through May. These birds require tall grass prairie for roosting, cover, and nesting, and short grass for their very elaborate and spectacular courtship performance. Overhunting and destruction of habitat have been the major factors in the species' decline in numbers.

The Kirtland's warbler (808), as previously described in part 4 of this report, occurs as a migrant in the Florida portion of the Gulf of Mexico Zone.

The red-cockaded woodpecker (809) is semi-colonial and a very local resident in mature southern pine forests of the Gulf coast states. Trees used for nesting and roosting almost always are infected with red heart disease. Thus, the species generally is considered to require mature diseased pines for its existence--a situation usually contrary to timber management policies. These woodpeckers usually occur in small groups of from one pair to 8 or 10 birds and occupy a home range of 14 to 20 hectares (35 to 50 acres). Nesting takes place in April and May; at least 10 to 11 months is required for excavation of a cavity suitable for nesting.

The white-crowned pigeon (816) and the Cape Sable seaside sparrow (818), both previously described in part 4 of this report, occur only in the extreme southern Florida portion of the Gulf of Mexico Zone.

Florida grasshopper sparrows (820) are restricted to the south-central Florida peninsula, where they nest on the ground during spring. The population is not very large, but the birds seem to be adapting to cattle pastures. They feed largely on grasshoppers, crickets, and other insects, as well as seeds.

Florida scrub jays (823) have extremely specific habitat requirements. They reside permanently in scrub growth containing particular species of oak, such as chapman oak, live oak, and myrtle oak. They avoid wet habitats and forests, including canopied sand-pine stands. They defend a permanent territory and breed within a short season, from early March to mid-June.

Two terrestrial reptiles, the American alligator (851) and the eastern indigo snake (853), occur in the Gulf of Mexico Zone as well as in the Southern Florida Zone (part 4). The American alligator is found in suitable, wetland habitat throughout the Gulf of Mexico Zone. Although it is protected in all states, it has threatened "similarity of appearance" status in Louisiana, and is hunted under regulations. The eastern indigo snake occurs in scattered areas throughout Florida and Georgia west to Mississippi.

Dry, well-drained soils seem to be a prime requisite for the gopher tortoise (857). The species is one of only two tortoises in the Gulf coast. It is an excellent burrower, constructing tunnels from 3 to 11 meters (10 to 35 feet) long. These tunnels are very important because they are occupied by both the tortoise and a host of other animal species, some of which require these burrows for survival. Tortoise populations occur in scattered, resident groups. Because many peripheral populations have disappeared, the species is listed as threatened in Mississippi.

The short-tailed snake (863) is restricted chiefly to longleaf pine/turkey oak plant associations. It is endemic to Florida, but little is known of its life history. It is threatened by habitat destruction.

The sand skink (864) is distributed only in central Florida and no other closely related species are known. The primary habitat is sand-pine scrub forests, where it lives just below the surface of the sand. Hatchlings emerge in July; the normal life span is about 3 years.

The pine barrens treefrog (871) occurs in this zone only in several small sites in the Florida panhandle. These populations appear to be isolated by 930 kilometers (580 miles) from the only other confirmed populations in North Carolina. The species is highly sensitive to its environment; it prefers hillside seepage bogs of upland stream valleys. Eggs are laid from June to August.

Confined largely to Mississippi, the black pine snake (873) is a melanistic pine snake with a loud hiss. It is found chiefly in sandy areas of longleaf pine.

The rainbow snake (874) burrows in a variety of habitats, including swamps and sandy fields. It readily enters water to catch eels and other aquatic animals, but is inoffensive when handled.

Yellow-blotched sawback turtles (875) are limited to the Pascagoula River system in Mississippi. They are one of eastern North America's spiniest turtles, with very conspicuous dorsal spines. Similarly, the ringed sawback turtle (876) has large dorsal spines and inhabits rivers of the Pearl River system of southern Mississippi and adjacent Louisiana. Insects and mollusks constitute the principal food for both turtles.

Smallest of the hognose snakes, the southern hognose (877) inhabits sandy woods, fields, and groves, dry river floodplains, and hardwood hammocks. It is a harmless species; when threatened, it flattens its head and neck, hisses loudly, and inflates its body with air to frighten the intruder. If its show of hostility fails, it will roll over and play dead.

The Texas indigo snake (878) is similar to the eastern indigo snake in general appearance and habits. Both are subspecies, but the Texas race is found in arid portions of southern Texas.

A tropical species, the Mexican treefrog (880) enters the United States only in the lower Rio Grande Valley of extreme southern Texas. It finds shelter in damp tree holes, beneath debris, or in the ground during dry weather.

Likewise, the Rio Grande frog (881) is restricted to the lower Rio Grande Valley in the Gulf of Mexico Zone, where it is common. Natural habitats include areas of palm groves, thickets, and ditches, although it also frequents lawns and flowerbeds. It breeds in spring, but may call during any warm month when irrigation is in progress.

Another southern Texas threatened amphibian is the giant toad (882). It is a large brown toad inhabiting pools and arroyos in the Rio Grande Valley. Its skin gland secretions are highly toxic to dogs and other animals. Breeding depends upon arrival of rains and may occur from early spring to autumn.

The Texas tortoise (883) is an arid-land counterpart of the gopher tortoise. It constructs long burrows in sandy soil, but where digging is difficult, it may barely cover itself. It also may find shelter under rocks or stumps. Texas tortoises are active in hot weather. Foods include prickly-pear cactus, young shoots, and other vegetation.

Texas horned lizards (884) are inhabitants of dry, flat, open terrain with sparse plant cover. They are fast runners and are usually active on very warm days.

The white-lipped frog (885) is one of the several Mexican amphibians and reptiles that barely enter the United States in extreme southern Texas. It is found in a variety of habitats containing moisture. The breeding season begins in spring or summer, after the arrival of heavy rains.

Recent, confirmed sightings of the red wolf (900) have been made only in extreme southeast Texas and in southwest Louisiana, although unconfirmed reports have been made in a few other locations. Red wolves have interbred extensively with coyotes and currently inhabit coastal prairie and marsh habitat, although many large areas in the southeast could support them. Breeding occurs in January and February, and the pups are born in March and April. The best population estimate in 1977 was that not more than 50 purebred wolves were left in the wild; at the time of this writing, the number is probably much lower.

The black bear (901) is threatened in Mississippi. It probably has similar habits to the Florida subspecies, described in part 4 of this report.

In the Gulf of Mexico Zone, the ocelot (904) is largely restricted to the lower Rio Grande Valley of southern Texas. Ocelots occupy dense chaparral thickets, second-growth forests, and partially cleared lands, where they hunt small to medium-sized animals; they often are found in trees. Breeding takes place in late summer; young are born in the fall. Population size is uncertain, but may range from 12 to 60 individuals in the United States.

The jaguarundi (905) inhabits thick, dense, thorny brushlands in the lower Rio Grande Valley. It readily climbs trees and consumes mostly birds. Mating occurs in November and December; it is thought that young are born in either March or August. Population estimates for the United States are uncertain, but only about 20 individuals may remain.

Confined to Florida, the Florida mouse (925) has one of the narrowest habitat ranges of any Florida mammal. It inhabits open tree stands containing dry, well-drained sandy soils, and clumps of shrubs with patches of bare ground. It lives in burrows and breeds in fall and early winter.

Gray bat (927) colonies roost only in caves and cave-like habitats, and the population has experienced a marked decline in numbers. They have very specific requirements for the caves they inhabit, and they utilize different caves in summer and winter. Mating occurs in the fall; the young are born in June, when the colonies have migrated to their summer range. In the Gulf of Mexico Zone, most caves are suitable for summer use, but are too warm for winter hibernation.

The Indiana bat (928) is apparently absent in this zone during the summer, but uses certain caves for winter hibernation. Breeding seems to occur only during the first 10 days of October. Hibernating colonies disperse in late March; migration to the wintering caves usually begins in August.

Four mammals previously discussed in the Southern Florida Zone (part 4) also occur in parts of the Gulf of Mexico Zone. The mangrove fox squirrel (932) and the everglades mink (934) are restricted to the southern Florida portion of the Gulf of Mexico Zone. The Florida black bear (933) occurs in small, widely scattered populations in the eastern third of this zone. A few recent sightings confirm the presence of the Florida panther (935) within Florida; although unconfirmed, it still may exist in very small numbers west to Louisiana.

The Perdido Bay beach mouse (940) inhabits the dry, sandy, sparsely vegetated coastal dune environment. Little is known about its life history or ecology.

The Choctawhatchee beach mouse (941) inhabits high, primary and secondary Gulf coast dunes and certain smaller, older interior dunes. Little is known concerning its life history or ecology. The race is experiencing rapid declines in population due to habitat destruction.

### 5.2.2 Aquatic Resources

The aquatic organisms in the Gulf of Mexico Zone are both abundant and diverse. The Gulf of Mexico has yielded the most valuable fishery (shrimp) and the largest fishery by weight (menhaden) in the United States. Ninety percent of the commercial catch and 10 percent of the recreational catch in the Gulf of Mexico depend on its vast estuaries, tidal marshes, and seagrass beds as major breeding, nursery, and feeding grounds.

Brief descriptions of the life histories of the major commercially, recreationally, and ecologically important aquatic organisms which occur in this zone are provided below. This summary concentrates on those species which were not covered previously in the Resources Overview of the Southern Florida Zone (part 4).

#### Plants

Seagrasses, three of which have been described previously in part 4, are widespread throughout the Gulf of Mexico Zone in intertidal and subtidal areas. The major species, turtle grass, manatee grass, shoal grass, and widgeon grass, are particularly abundant along peninsular Florida, landward of the Mississippi and Louisiana barrier islands, and in Laguna Madre, Texas. They serve a major function in providing nursery areas for many of the important recreational and commercial finfish and shellfish species in the Gulf of Mexico.

Widgeon grass, the only species not described previously, is found from fresh water to salinities of 45 parts per thousand, although optimum conditions are less than 25 parts per thousand. It is distributed in the deeper portions of the intertidal zone and is especially abundant in areas of extreme salinity.

#### Invertebrates

Several invertebrates, previously discussed in part 4 of this report, are also important within the Gulf of Mexico Zone. Pink shrimp are a major part of

the Gulf of Mexico shrimp fishery in the Gulf of Mexico Zone from Cape Romano to the Apalachicola Delta in Florida. West of that, their proportion of the fishery diminishes until, beyond the Mississippi Delta, they are an incidental catch. Similarly, the stone crab, although distributed throughout the Gulf of Mexico, is commercially important only along the coast of Florida to the Apalachicola Delta. Spiny lobsters are restricted in range to the southern half of peninsular Florida, and most commercial lobster fishing occurs in the Southern Florida Zone. Sponges and corals form scattered offshore reef communities throughout the Gulf of Mexico Zone.

In the northern and western portions of the Gulf of Mexico Zone, two species of shrimp, the white and brown, dominate the shrimp fishery and represent most of the value of the total Gulf of Mexico commercial fishery. The yield of brown shrimp is about twice that of white shrimp; they are second and third in yield, respectively, behind menhaden in the Gulf. Shrimp also provide an important recreational resource.

Brown shrimp spawn in 30 to 120 meters (100 to 400 feet) of water from November to April. Most postlarvae move into estuaries from February to April, where they show a preference for soft bottom, shallow areas in or near marshes. Adults seem to burrow during the day and move into the water column at night. Migration of juveniles from shallow estuarine areas and of adults from deeper estuarine areas to offshore occurs from May to July. Most of the estuarine fishery for brown shrimp occurs at this time. Brown shrimp are caught mainly between the shoreline and depths of 73 meters (240 feet).

The white shrimp is more of an inshore species than the brown shrimp. Spawning occurs from March to October at depths between 8 and 34 meters (26 and 110 feet) and postlarvae move into the estuaries from May through October. Postlarvae and juveniles are found in shallow, muddy estuarine areas near marshes. The maturing shrimp move into deeper portions of the estuary and offshore from July through November and become susceptible to the fishery. Adult shrimp in offshore waters live mostly on the bottom and are caught mainly between the shoreline and depths of 27 meters (90 feet).

The blue crab is the third largest fishery by yield in the Gulf of Mexico Zone, behind the menhaden and the three shrimp species. It is also the basis of a major recreational fishery. The blue crab mates only once, during the final molt, and the sperm remain viable for over a year for use in multiple spawns. Mating and spawning occur from March through November with peak spawning May through September. Spawning takes place offshore and in high salinity estuaries, while juveniles are found throughout estuaries in and around marshes. Adult males tend to remain in the estuaries throughout the year. Females are found in estuaries with salinity generally above 20 parts per thousand, but migrate into coastal waters during the winter.

The eastern oyster is distributed throughout the Gulf of Mexico Zone, but is most abundant from Apalachicola Bay, Florida, to Aransas Bay, Texas. It is the third most valuable fishery in the zone, behind the three shrimp species and the menhaden, and it also provides for a major sport harvest. Oysters prefer salinities between 5 and 15 parts per thousand and water depths of 2.5 to 8 meters (8 to 25 feet). They spawn during the summer and the eggs hatch after 6 to 14 days. The free-swimming larvae settle where they can

attach to a suitable hard substrate (known as cultch), such as oyster shells. As a result, oyster and clam shells often are deposited artificially as a management tool to increase the available cultch material for seed oysters.

Crayfish form the fourth most valuable fishery in Louisiana (18.6 million pounds worth $5.7 million in 1978). The harvest is taken primarily from the Atchafalaya River basin. The red swamp crayfish and the white river crayfish compose the bulk of the crop. The former species inhabits the shallows of lakes, bayous, ponds, ditches, and marshes of fresh and slightly brackish water, while the latter is an upland species found in piney-wooded, sandy-bottomed, swift-flowing streams and hillside ponds. Both species are ecologically important as food for many fish and furbearing mammals. Mating occurs in May or June and the adults burrow into the mud shortly thereafter. Crayfish stay in these burrows during summer low water levels, at which time the eggs are laid and fertilized by stored sperm. The eggs of the red crayfish hatch in 14 to 21 days. Growth of the red crayfish occurs rapidly in shallow water, and by the following spring, the individuals migrate to open water to mate.

Callico scallops occur in large beds offshore. Because the adults are mobile and the larvae planktonic, commercial bed locations shift; however, harvestable beds frequently occur off Cape San Blas, Florida. Callico scallops spawn in spring and early summer offshore. The larvae pass through two planktonic forms in 1 to 2 weeks, then attach to large shells and hard substrates in 18 to 73 meters (60 to 240 feet) of water prior to becoming mobile juveniles. They reach maturity and are harvested within a year.

Fish

Commercially important fish in the Gulf of Mexico Zone include members of the drum, jack, snapper, grouper, billfish, and catfish families, striped mullet, Spanish and king mackerel, menhaden, sheepshead, ladyfish, southern and Gulf flounder, Florida pompano, bluefish, buffalo, gar, and Atlantic thread herring. Important sport species include some of the above as well as members of the sunfish and herring families, striped bass, tarpon, and snook. The life histories of several of these species were described previously in part 4.

a. Freshwater species.

Gars are represented by five species within the Gulf of Mexico Zone: the alligator and spotted gar are distributed from the Florida panhandle west, the longnose gar is found throughout the zone, the shortnose gar is limited to the Mississippi River drainage, and the Florida gar is found throughout peninsular Florida north to the Ocklocknee River drainage. In many places, gar are considered nuisance fish, although they are sought for sport throughout the zone and form a commercial fishery in Louisiana. Gar are common in slow-moving streams and rivers, lakes, and bayous; the alligator gar can tolerate brackish water. Spawning occurs in the spring and the adhesive eggs are deposited in weeds or debris. The alligator gar is by far the largest member of the gar family, often exceeding 68 kilograms (150 pounds).

Two important freshwater herrings are found within the Gulf of Mexico Zone. The gizzard shad, found throughout the zone, is ecologically important as a major forage fish, which is preyed upon by several game fish species. It is found in many freshwater habitats and occasionally enters estuaries and nearshore areas. Spawning occurs from spring through mid-summer, near the surface, in all freshwater habitats. Juveniles are found well upstream from brackish water, usually in the shallows.

The skipjack herring is a highly migratory, freshwater sport species that occasionally moves into estuarine and marine water; it prefers clear deep water. It is most common from the Apalachicola River drainage (Florida) to the Mississippi River drainage. Spawning occurs in the spring in the depths of main channels over coarse sand and gravel bars.

Three buffalofish, the smallmouth, largemouth, and black buffalo, occur in the zone, mainly west of the Lake Pontchartrain drainage in Louisiana, in a wide variety of large rivers and lakes. Spawning occurs in the spring and the eggs are deposited randomly over weed beds or mud bottoms. The fish are sought for sport and compose a commercial fishery in Louisiana and Texas.

The flathead and blue catfish are important sport and commercial species along with the previously described channel catfish. They are found from the Mobile River drainage west, in the deep areas of medium-size and large rivers. The flathead catfish spawns from late May through August. Males select hollow logs, underwater caves, or crevices as nesting sites and, after the eggs are laid, guard the nests. The young seek shelter under rocks or brush, preferably in fast-moving water. Flathead catfish grow to an average of 9 to 11 kilograms (20 to 25 pounds). The blue catfish spawns in May and June in nests which the male guards. They commonly grow to 9 to 18 kilograms (20 to 40 pounds).

The white and yellow bass are popular sport species whose ranges have been expanded due to introductions. The white bass occurs from the Mississippi Delta west, in rivers, clear lakes, and reservoirs. During the spring, the white bass migrates upstream in unisexual schools, to join and spawn in running water over gravel or other hard bottom shoals. Growth is rapid and adults always are found in schools in open water. The yellow bass is distributed from the Mobile to the Trinity River basin, in quiet pools and backwaters of large streams, lakes, and reservoirs. It moves into tributary streams in April and May to spawn over gravel bottoms. As adults, they often are found in schools.

The sunshine bass, a hybrid between the striped bass and the white bass, has been introduced extensively in Florida lakes and now is being introduced in lakes of other Gulf coast states. The fish originally was developed with striped bass females and white bass males, but recently the reciprocal hybrid has been bred. Both hybrids are excellent fighting fish. Their primary food is shad, so they also function to control forage fish species.

Several members of the sunfish family, including sunfishes, white crappie, and basses, provide a substantial sport fishery throughout the Gulf of Mexico Zone. The green sunfish, longear sunfish, redbreast sunfish, and spotted sunfish, along with the warmouth, bluegill, and redear sunfish described in part 4, are known collectively as bream and serve as excellent panfish species.

They thrive in a variety of freshwater habitats; for example, the redbreast sunfish is found most commonly in clear, flowing streams and the spotted sunfish is found most commonly in quiet waters with heavy vegetation. They spawn during the spring and summer; males build nests and guard the eggs subsequent to spawning.

The white crappie appears with the black crappie (part 4) from the Florida panhandle west, in the Gulf of Mexico Zone. The white crappie is present in a wide variety of freshwater habitats including ponds, lakes, streams, and slow-moving areas of large rivers. This species usually builds nests in large colonies on gravel or other hard bottoms. Spawning occurs in the spring and the males guard the nests. Both young and adults usually are found in schools.

In addition to the popular largemouth bass (part 4), the spotted bass and Suwannee bass are important sport species in the Gulf of Mexico Zone. The spotted bass is found from the Florida panhandle west to the Nueces River basin in Texas, preferring larger streams and rivers. It is a nest builder and there is evidence that it migrates upstream in the spring to spawn in small tributaries.

The Suwannee bass is a unique species, found only in the lower parts of the Suwannee and Ochlockonee River systems in Florida and Georgia. The species occurs most commonly in shoal areas with moderate to swift current, limestone bottom, and high pH and hardness. Spawning occurs from February or March to June in the adult habitat. The fish is a popular sport species, and although its distribution is very limited, its populations are healthy and seem to be stable.

The freshwater drum is distributed from the Mobile River basin west to the Rio Grande basin. It is the only North American representative of the generally marine and estuarine drum family. It prefers large, silty lakes and rivers, but occurs in a wide variety of freshwater habitats. Freshwater drum spawn in large groups, with the eggs broadcast over gravel or clay bottoms; they generally grow to 0.5 to 1 kilogram (1 to 2 pounds). Drum support a commercial fishery in Louisiana and a sport fishery in all states in which they occur.

b. Anadromous species. In addition to the Gulf subspecies of the Atlantic sturgeon, which is endangered in Mississippi and therefore described previously in part 5, the Alabama shad and striped bass are important anadromous species in the Gulf of Mexico Zone.

The Alabama shad ascends major Gulf coast rivers, from the Suwannee River (Florida) to the Mississippi River, from January to April. The fish is sought for sport during this time. Spawning occurs in moderate current over coarse sand and gravel bottoms; juveniles emigrate in the late fall. Adult populations are small and their coastal distribution is limited.

The striped bass is native in the Gulf of Mexico Zone from the Suwannee River, Florida, to Lake Pontchartrain, Louisiana; however, it has been widely introduced for sport into reservoirs, lakes, and streams throughout the zone. The only known reproducing population of the Gulf coast striped bass occurs in

the Apalachicola River, Florida; most other populations are being maintained by stocking of the Atlantic coast race. Spawning migrations begin in February and continue through April. Certain landlocked populations are capable of reproduction and also migrate upstream during this time. Males arrive on the spawning grounds before the females. Spawning occurs in flowing water in upper tidal reaches and freshwater areas of rivers, in turbulent, silt-ladened riffle areas. Larvae remain at the spawning grounds awhile before beginning to drift downstream. Juveniles continue this downstream movement and by the second summer are in lower river reaches. Currently, most Gulf coast striped bass are primarily riverine, rarely entering estuarine and coastal waters.

c. Estuarine-dependent species. The vast estuaries, tidal marshes, and seagrass beds of the Gulf of Mexico Zone are major breeding, nursery, and feeding grounds for many recreationally and commercially important species. Estuarine-dependent finfish of importance in this zone include members of the drum family, sheepshead, flounders, striped mullet, sea catfish, and anchovy, some of which have been discussed in part 4 of this report.

Gulf menhaden are distributed throughout the Gulf of Mexico Zone, although the major commercial fishery occurs from Mississippi Sound to Galveston Bay, from April through October. Gulf menhaden form the largest fishery by weight in the United States. The fish are processed into meal for animal feed; oil for lubricants, cosmetics, margarine, paints, varnishes, and industrial uses; and solubles for additives to plant food, fertilizer, and poultry feed. The species spawns offshore from mid-October through March in 40 to 140 meters (130 to 460 feet) of water. The larvae migrate into the low salinity, shallow portions of estuaries from February to May. Metamorphosis to the juvenile stage during May to July is accompanied by schooling and movement to more open, deeper parts of estuaries. Juveniles and sub-adults migrate into offshore waters from December through February. Adults migrate into estuaries during the spring and summer and offshore from September through November.

The bay anchovy is distributed throughout the zone and is the most abundant fish species in many estuaries of the northern Gulf of Mexico. This species is ecologically important as a forage fish, which is preyed upon by most carnivorous aquatic species and birds. Spawning occurs from February to October in the high salinity estuaries and nearshore Gulf to depths of 20 meters (66 feet). Larvae use estuaries and nearshore areas for nursery grounds. Juveniles and adults are found in the estuaries from spring through fall, but move to deeper water in the winter.

Two species of marine catfish are common throughout the Gulf of Mexico Zone, the sea catfish and gafftopsail catfish, and their life histories are similar. Spawning occurs in shallow waters of brackish rivers and estuaries from May to August. The eggs and larvae are retained in the mouth of the male for a total period of 6 to 8 weeks. Released juveniles develop in the low salinity portions of the estuaries and move to deeper water in the fall. Adults overwinter in the Gulf and return to the estuaries in the spring. The marine catfish provide for a minor recreational and commercial fishery in all Gulf states.

Drums, including the spotted and sand seatrout and red drum discussed in part 4, and the Atlantic croaker, black drum, spot, and southern and Gulf

kingfish, form one of the most recreationally and commercially important finfish families in the Gulf of Mexico Zone.

The Atlantic croaker is distributed throughout the Gulf of Mexico Zone from low salinity estuaries offshore to depths of 90 meters (295 feet). Spawning occurs offshore at depths of 15 to 81 meters (50 to 265 feet), but is concentrated near deep passes during late fall to early spring. Larvae begin to appear in shallow, low salinity estuaries in October and remain through the winter. During the late spring and early summer, juveniles migrate into deeper estuarine and nearshore Gulf areas, and adults move into the estuaries. In the fall, both adults and juveniles move offshore. Most commercial and sport catches are made from spring through fall, when the fish are inshore; most fishing activity occurs from Mobile Bay, Alabama, to Sabine Lake, on the Texas-Louisiana border.

The black drum is common in nearshore and estuarine waters throughout the zone. Spawning occurs from February to April in or near tidal passes and in open estuaries. The larvae are transported to shallow estuarine marshes, but as large juveniles, may move to deeper estuarine waters or shallow waters off sandy beaches. Adults move inshore during the spring and to coastal areas in the fall. This species is of moderate recreational and commercial importance; the fishery is concentrated mainly in Louisiana and Texas.

The spot is found throughout the zone and is widely distributed from freshwater rivers offshore to depths of 132 meters (433 feet). Adults tend to be found in higher salinities than juveniles. Spawning occurs offshore in the winter; larvae and juveniles appear in low salinity estuarine nursery grounds in the winter and juveniles move to open estuarine areas in the spring. By the following winter, spot move offshore and apparently never return to the estuaries. Spot compose a minor industrial bottomfish fishery in the zone, with most of the yield used for pet foods.

Two species of kingfish, southern and Gulf, are both found throughout the zone and compose a minor commercial and recreational fishery. They occur on the bottom, mainly in shallow, open surf offshore to 36 meters (118 feet) water depth, and less often in high salinity estuaries during the summer. Southern kingfish are believed to spawn between April and October offshore in 9 to 26 meters (30 to 85 feet) of water. Larvae and juveniles are found along outer beaches, estuaries, and tidal rivers, but as they mature they move seaward. Gulf kingfish also spawn offshore, probably between April and August, and juveniles are found only in the open surf.

Two species of flounder, the southern and Gulf, are sought recreationally and commercially, although the southern flounder, which is distributed throughout the zone, is by far the more popular. The Gulf flounder is mainly distributed east of Atchafalaya Bay in Louisiana.

The southern flounder is found from shallow estuaries offshore to depths of 110 meters (360 feet), depending on season. Spawning occurs in late fall and winter on the inner and central continental shelf from 20 to 60 meters (66 to 197 feet) water depth. The larvae and early juveniles move into the estuaries along with the adults in the spring. Juveniles are most abundant in

shallow vegetated areas, and adults also seem to prefer vegetated habitats. Most adults and older juveniles migrate offshore in October and November.

The Gulf flounder is found on the continental shelf out to 50 meters (164 feet) deep and in high salinity areas of larger estuaries. Spawning occurs on the inner continental shelf from November to February and larvae and juveniles move into estuarine nursery grounds. In the fall, the species moves offshore to deeper water.

d. Oceanic species. Important oceanic fish species in the Gulf of Mexico Zone include members of the jack, snapper, grouper, and billfish families, mackerels, Florida pompano, bluefish, and cobia, as described in part 4, as well as the species described below.

The Atlantic thread herring is a pelagic, surface schooling fish, distributed in waters less than 50 meters (164 feet) deep and concentrated in the eastern Gulf of Mexico. This species is sought off the Florida panhandle and to a lesser extent off Alabama and Mississippi, but currently is an underutilized commercial resource, with potential value as a source of fish meal. It is important as a forage fish and is a source of food for many commercial and recreational fish. The Atlantic thread herring spawns in waters less than 30 meters (98 feet) deep, from February to September. Larvae and juveniles develop in the open-water adult grounds, although some juveniles also are found in estuaries in July and August. During the late fall, large schools migrate farther offshore and possibly to more southerly waters.

The blue runner is a pelagic, schooling species found over the continental shelf and nearshore, concentrating around reefs and jetties. Spawning occurs offshore, possibly throughout the year, but with a peak during the summer. Development also occurs offshore, although some older juveniles move into the surf zone. Adults move southward and offshore during the late fall. The fish is a minor sport species throughout the zone. The commerical fishery, which occurs mainly in late spring, is restricted to the Florida panhandle west of Apalachicola Bay.

The silver seatrout is one of the few drum species in the Gulf of Mexico not normally associated with the estuaries. It is found throughout the zone, in water depths of 10 to 65 meters (33 to 213 feet). Spawning occurs offshore, extending from spring to fall, with peaks in the spring and fall. The larvae and juveniles are found on the bottom in the adult grounds, although juveniles appear to approach and enter bays in fall and winter. The silver seatrout contributes to the Gulf industrial bottomfish fishery throughout the year and is sought as a sport species mainly during spring and summer.

### 5.2.3 Terrestrial Resources

The Gulf of Mexico Zone contains a wealth of terrestrial resources, reflecting its vast extent and diversity of habitats: fresh water and salt water, coastal islands, beaches, dunes, marshes, swamps, prairies, lowland and upland forests, grasslands, brushlands, and tropical hammocks. While development and increasing urbanization are causing a decline in population size and range of many species, virtually the entire zone serves as a huge concentration area for others. This is particularly true for migrating waterfowl and small

land birds. In some portions of this zone, particularly in the southern regions of Florida and Texas, a number of tropical species have extended their range, making them unique to North America there.

Plants

Most of the plants mapped in the Gulf of Mexico Zone are species with special status, which are listed as threatened or endangered by the Federal Government, by Florida, or by Georgia. Although there are no official state lists of threatened or endangered plants in the other states of this zone, a number of plant species were included on the maps because they were ecologically unique in distribution or association. In some cases, exceptionally large and original growth trees were mapped, as were a few commercial timber lands.

Invertebrates

No terrestrial invertebrates were mapped in this zone.

Birds

A great diversity of bird species occupy nearly every habitat type within the Gulf of Mexico Zone, often with different species present in various seasons. Birds are generally one of the more conspicuous and important terrestrial groups throughout the zone. The large avian population consists of shorebirds, wading birds, waterfowl, raptors, seabirds, and songbirds and others.

Areas mapped for bird species were selected based on an area's importance to a species within the geographic interval. Thus, no absolute population boundaries were used throughout the inventory. The selection of mapped areas was based on published information and objective, unpublished data from knowledgeable individuals concerning areas and species of importance.

a. Shorebirds. Shorebirds, including gulls, terns, sandpipers, plovers, stilts, and skimmers, make extensive use of salt marshes and adjacent coastal beaches in the Gulf of Mexico Zone for nesting and feeding. They nest in colonies from April to August and have very restrictive nesting requirements. They are very vulnerable to disturbance during the nesting season. Principal migratory flights occur from March 15 to May 15 and August 15 to October 20, although some shorebirds remain in the zone year-round. The most widely distributed shorebirds are least terns, black skimmers, and Forster's terns; the most abundant shorebirds are laughing gulls and sandwich terns. Shorebirds of special interest due to their rarity include American oystercatchers and Cuban snowy plovers.

b. Wading birds. The coastal habitats in this zone support an abundance of wading birds of many species. These birds nest in a wide range of habitats, including cypress swamps, fresh, brackish, and salt marshes, on mangrove islands, and along inland lake and river margins. They often form large rookeries and are very susceptible to nesting disturbance. Usage of nesting colonies may vary considerably from one year to the next. Wading bird nesting is most intense from February through July. The most abundant species include

Louisiana herons, snowy egrets, cattle egrets, white ibises, little blue herons, and great egrets.

c. Waterfowl. Within the Gulf of Mexico Zone, the marshes, swamps, lakes, and bays constitute the largest, and one of the most important, waterfowl wintering areas in the United States. The area is at the southern terminus of several flyways and normally provides wintering ground for millions of ducks and geese annually. Additional millions of ducks use the marshes for staging, resting, and feeding before continuing across the Gulf of Mexico to wintering grounds in Central and South America.

Over 30 species of ducks have been recorded in this zone and several of these nest here in summer. The mottled duck, black-bellied whistling-duck, fulvous whistling-duck, and wood duck breed in significant numbers, with teals in lesser numbers. Waterfowl hunting is very popular.

Waterfowl distribution is not uniform throughout the zone. Definite concentration areas exist that attract high populations of wintering waterfowl every year, especially in fresh and brackish marshes. The most common dabbling ducks are gadwall, American wigeon, pintail, blue- and green-winged teal, mallard, northern shoveler, and mottled duck. Common diving ducks are lesser scaup, redhead, and canvasback. Though not all species were individually mapped, it may be assumed that, unless otherwise noted, most waterfowl areas mapped contain combinations of these common species.

d. Raptors. Raptors include hawks, falcons, eagles, and owls. Owls are generally residents of wooded areas, although several species are found in coastal areas or open fields and meadows. Many hawks, eagles, and falcons are residents, although some are winter visitors.

Ospreys breed in eastern portions of this zone, but are winter visitors in the western portion. The swallow-tailed kite is common only in summer in eastern areas. The short-tailed hawk is a rare and localized, permanent resident of Florida. A number of hawks, most with special status, enter this zone only in extreme southern Texas.

e. Seabirds. For the purposes of this study, seabirds include pelicans, gannets, scoters, cormorants, and some grebes. Some are pelagic, normally coming to land only to breed. Most of the mapped species nest within the Gulf of Mexico Zone; gannets are winter visitors. Brown pelicans, the only seabird with special status, are common east of Louisiana. Although courtship may begin as early as March, nesting usually does not occur until May or June. Offshore islands and islets are the major breeding areas for this group.

f. Songbirds and others. This category includes all of the passerines (perching birds) and a variety of other birds such as woodpeckers, doves, and grouse. Some species are important as recreational and economic resources, especially the gallinaceous species such as quail and turkey. Others are aesthetically and recreationally important and are sought out by birdwatchers and photographers. Many species are resident, breeding in the spring and early summer. Many other species pass through the Gulf of Mexico Zone as they migrate along several flyways; these are generally fall and spring transients or visitors during summer or winter. Principal migrations occur from March 15

to May 1 and September 15 to November 10. Many species are of special interest because of their rarity or restricted distribution, but very few have special status. A number of such species have been mapped where their regular occurrence is unusual.

Mammals

Most of the mammalian species in the Gulf of Mexico Zone are more likely to be found in the undeveloped areas, but some species are either indifferent to or actively seek out urbanized areas. Most are year-round residents, generally found in pairs or small family groups, which breed from late winter to spring.

Hunting and trapping are popular sports. The whitetail deer is the most important big game species in the Gulf of Mexico Zone, but many other mammals are hunted or trapped, also. The most abundant furbearing mammals in the zone's wetlands are muskrat and nutria. Although several other species are common, these two are the most important economically to the commercial fur industry. Nutria have been the most abundant furbearers trapped; muskrat populations have been declining since 1970. Other furbearers include river otter, raccoon, opossum, mink, beaver, red and gray fox, and bobcat.

## 5.3 CENTRAL BARRIER COAST (GRID REFERENCE MU35 to LB21)

The Central Barrier Coast section, from Cape Romano (grid reference MU35) to Tarpon Springs, Florida (grid reference LB21), has a coastline consisting of mixed exposed sandy beaches, mangrove stands, and rocky areas. A series of barrier islands protects shallow embayments containing salt marshes, mangrove stands, and swamps. Tidal range is modest, about 0.6 meters (2 feet). Stream discharge is low; consequently, water clarity is high. The continental shelf is broad and contains scattered reefal structures, but few hard corals.

The biotic resources of this section are keyed geographically using east-west UTM grid swaths.

### 5.3.1 Aquatic Resources

Widespread Species

The extensive mangrove swamps, tidal marshes, seagrass beds, and estuaries support numerous estuarine-dependent recreational and commercial species including pink shrimp, blue crab, several drum species, sheepshead, mullet, snook, ladyfish, and Gulf flounder. Offshore species, which occasionally are found in the estuaries, include various groupers (especially red grouper and gag), snappers (especially red snapper) and grunts, king and Spanish mackerel, bluefish, Florida pompano, cobia, tarpon, and crevalle jack.

Inland freshwater species, including Florida largemouth bass, black crappie, sunfish, catfish, and bullheads are sought for sport in the creeks, canals, and surrounding swamps. The channel and white catfish and brown bullhead also compose a commercial fishery in these areas.

Several species with special status occur in coastal waters throughout this section, including the five sea turtles and the West Indian manatee. The focus of abundance of manatees on the west coast of Florida extends from the Ten Thousand Islands area to Charlotte Harbor.

Geographic Inventory

Critical habitat for the West Indian manatee includes the coastal mangrove swamps and adjoining United States territorial waters from the southern border of this section to Gordon Pass (grid reference MU35 to MU28).

An active sport fishery for Spanish and king mackerel during spring and fall migrations occurs between grid reference MU35 and MU19.

Loggerhead sea turtles nest on sandy beaches between grid reference MU26 and MV11.

Major offshore commercial and recreational grouper and snapper grounds are located in the areas surrounding grid references KU99 and KV31. Dominant species include red grouper, gag, and red snapper.

Critical habitat for the West Indian manatee includes the United States territorial waters adjoining Lee County (grid reference MV11 to LV76).

Lake Trafford (grid reference MV52) is one of the best lakes in Florida for large Florida largemouth bass.

The lower portion of the Caloosahatchee River (grid reference LV93 to MV25) is designated as critical habitat for West Indian manatees. During the winter, manatees concentrate on portions of the Caloosahatchee and Orange Rivers near grid reference MV15 and MV25, where river waters are warmed by discharge from the Fort Myers Power Plant in Tice (grid reference MV25). West Indian manatees also are found upstream on the Caloosahatchee River (grid reference MV25 to MV98) and throughout Lake Okeechobee (grid reference NV17).

Lake Okeechobee (grid reference NV17) is the largest natural freshwater lake in the United States entirely within one state. Commercial harvests include channel and white catfish, black crappie, sunfish, Florida gar, gizzard shad, and soft-shelled turtle. Sport fish include most of the above as well as largemouth bass; black crappie is the major creel species.

The sandy beaches from Sanibel Island to Longboat Key (grid reference LV92 to LA33) provide extensive nesting habitat for the loggerhead sea turtle.

The beaches of Sanibel Island and Captiva Island (grid reference LV92 to LV83) also are widely acknowledged to possess some of the finest seashell collection beaches in the world. These shells wash ashore from nearby offshore beds.

The Charlotte Harbor estuarine complex, including Pine Island Sound, Matlacha Pass, Garparilla Sound, and Lemon Bay (grid reference LV92 to LV59), contains numerous marshes and seagrass beds which serve as important nursery grounds for estuarine-dependent species, especially pink shrimp.

Boca Grande, at the entrance to Charlotte Harbor (grid reference LV75), offers some of the best tarpon sportfishing in Florida. Scattered oyster beds (grid references LV93, LV94, LV86, and LV98) and southern quahog beds (grid references LV97 and LV78) occur within Charlotte Harbor. The oyster beds were historically commercial, but have not been productive recently. The commercial clam harvest is intermittent and short term.

Charlotte Harbor within Charlotte County (grid reference LV86 to LV97), the Peace River (grid reference LV98 to NV08), and the lower Myakka River (grid reference LV88 to LA60) are designated critical habitats for West Indian manatees. The manatees concentrate in these areas during the winter.

From Sanibel Island to Anclote Key (grid reference LV92 to LB12), the shoreline of the central Florida west coast curves outward on the continental shelf and deep water occurs relatively close to shore. Hard rocky bottoms, which support reef-associated species, occur frequently in this area. The most common reef configuration is a limited area of rock outcrops that project 0.6 to 2.4 meters (2 to 8 feet) above the surrounding shell bottom. These outcrops support algae, tunicates, hard and soft coral, and sponges, and attract many sport fish species including red grouper, grunts, gag, and red snapper. Several species of primary reef fish occur around these outcrops including squirrelfish, angelfish, butterflyfish, damselfish, and wrasses.

The Sanibel shrimp grounds are located off Charlotte and Lee County in 9 to 27 meters (30 to 90 feet) of water (grid reference LV25) and yield almost 30 percent of west Florida's commercial pink shrimp catch. Many of the shrimp in this fishery were nurtured in the Charlotte Harbor system nursery grounds.

Major offshore commercial and recreational snapper and grouper grounds occur in the area surrounding grid reference KV38.

King and Spanish mackerel are actively pursued for sport during spring and fall migrations in waters off Siesta Key (grid reference LA31).

Hawksbill sea turtles have been observed nesting on Longboat Key (grid reference LA33) and loggerhead sea turtles nest on islands at the mouth of Tampa Bay (grid references LA24 and LA25).

The lower portions of the Manatee River (grid reference LA34 to LA64) and the Little Manatee River (grid reference LA56 to LA66) are critical habitats for the West Indian manatee.

The Tampa Bay system, including Sarasota Bay, Boca Ciega Bay, Tampa Bay, Old Tampa Bay, and Hillsborough Bay (grid reference LA42 to LB30), provides major nursery areas for estuarine-dependent fish and shellfish. In particular, pink shrimp from these nurseries are recruited into the adult population found on the Sanibal shrimp grounds. Commercial harvests of pink shrimp also are taken within the Tampa Bay system.

Several mollusks are sought commercially in lower Tampa Bay (grid reference LA25 to LA57), including bay scallop, southern and northern quahog, and sunray venus clam. The quahog fishery is short term and intermittent. Northern quahogs have been introduced recently to Tampa Bay and are not found

elsewhere on the Florida west coast; they have been established successfully and are replacing the southern quahog.

The warm water effluents from the Big Bend Generating Plant (grid reference LA57) and the Gibsonton Phosphate Plant (grid reference LA68), within the Tampa Bay complex, provide winter refuges for the manatee.

Lake Tarpon (grid reference LB30 to LB31) holds the record for the largest largemouth bass ever caught in Florida: 8.6 kilograms (19 pounds even).

Tarpon Springs (grid reference LB21) was historically the major center for sponge landings along the Florida west coast, although most sponges were harvested to the north. The industry has been declining in this area due to the introduction of artificial sponges, and changes in social patterns.

The warm water discharge of the Anclote Power Plant (grid reference LB21) provides a warm water refuge for West Indian manatees during the winter.

### 5.3.2 Terrestrial Resources

#### Widespread Species

The Central Barrier Coast serves as a migratory route and overwintering area for a wide variety of shorebirds, wading birds, waterfowl, seabirds, and songbirds. Shore and beach areas contain numerous terns, gulls, and other shorebirds; coastal mangrove swamps, marshes and interior wetlands provide habitat for herons, egrets, and the like, as well as eagles. Undeveloped portions of the interior contain numerous resident and migratory songbirds, as well as a wide variety of amphibians and reptiles. Common mammals include bobcats, whitetail deer, rabbits, squirrels, raccoons, opossums, and skunks.

A large number of species with special status may be found throughout the Central Barrier Coast section. Many plants, including orchids, bromeliads, palms, coonties, sandhill milkweed, and prickly-apple cactus, are distributed widely in the section. The diverse habitats also harbor Cuban snowy plovers, wood storks, Florida scrub jays, Florida sandhill cranes, everglade kites, bald eagles, Audubon's caracaras, peregrine falcons, southeastern American kestrels, brown pelicans, Kirtland's warblers, red-cockaded woodpeckers, American alligators, eastern indigo snakes, Florida mice, Florida black bears, mangrove fox squirrels, and everglades mink.

#### Geographic Inventory

Collier Seminole State Park (grid reference MU47) contains many plant species characteristic of coastal forests of the West Indies and Yucatan. The Florida royal palm is here, as are the least tern, bald eagle, brown pelican, American alligator, and Florida black bear. In addition, there are numerous other shorebirds, waders, ducks, raptors, songbirds, reptiles, amphibians, and mammals.

The Fakahatchee Strand State Preserve between grid reference MU56 and MU76 is an elongated swamp, seasonally flooded, and almost entirely roadless and undeveloped. It is noted for diverse and abundant fauna and flora,

including the world's largest stand of Florida royal palm; this is only one of about three Florida locations where this species occurs. The strand also contains the world's only royal palm-bald cypress forest, and North America's largest and greatest variety (44 species) of native orchids. This is the only area where consistent evidence for the presence of Florida panthers has been found. In 1981, two male panthers were captured here, equipped with radio transmitters, and released in order to study home range movements.

Big Cypress National Preserve (grid reference NU03 to MV70) extends into this section. The preserve and the related wildlife management area are home to everglade kites, wintering marsh hawks, numerous amphibians and reptiles including the American alligator, Florida black bears, Florida panthers, bobcats, whitetail deer, and raccoons.

A concentration area for the gopher tortoise occurs at grid reference MV20.

The least tern nests between grid reference MV11 and MV25, along with a number of other shorebirds, waders, and bald eagles.

The largest remaining stand of virgin bald cypress in Florida is found within a 4,450-hectare (11,000-acre) area of Corkscrew Swamp (grid reference MV31). Trees over 700 years old and 40 meters (130 feet) tall, some of the oldest trees in eastern North America, reside here. Up to 6,000 pairs of wood storks have nested in this swamp--one of the largest rookeries in the United States for this species. Over 60 other species of birds also nest here, and apparently one little blue heron named George has been a resident for at least 15 years.

Large concentrations of marsh rabbit and round-tailed muskrat occur south of Lake Okeechobee (grid reference NV15 to NV24). To the south and east (grid reference NV13 to NV53), the fields are flooded from July until early September to prevent erosion and pest outbreaks. During this period, migrant shorebirds concentrate by the thousands to take advantage of created habitat.

Over 245 bird species have been recorded on the 58,924 hectares (145,600 acres) of the Loxahatchee National Wildlife Refuge (grid reference NV71 to NV64). This is one of the last undrained areas of the northern Everglades, and is protected from hunting and excessive human disturbances. Among the many animals found here are numerous wintering waterfowl, including the uncommon fulvous whistling-duck.

The Florida grasshopper sparrow, as well as bald eagles and wintering peregrine falcons, can be found from grid reference MV94 to MV88.

The 60,705-hectare (150,000-acre) Fisheating Creek Wildlife Management Area (grid reference MV48 to MV68) is noted especially for its tremendous diversity of bird life; many habitat types in the area have remained in a fairly pristine state. Notable species with limited distributions found here include the Florida grasshopper sparrow, sand skink, Florida panther (unconfirmed), short-tailed hawk, and gopher tortoise.

A ranch at grid reference MV38 to MV48 contains 21,000 hectares (52,000 acres) of undisturbed prairie, which is probably the best remaining undisturbed habitat in the east for Audubon's caracara, but also provides prime habitat for many other wildlife species.

The 1,956-hectare (4,833-acre) J. N. "Ding" Darling National Wildlife Refuge (grid reference LV82 to LV92) has a wide variety of accessible plants and animals of both subtropical and temperate climatic zones. Numerous wading birds congregate here, occasionally including one-third of the United States population of roseate spoonbills. Shorebirds and warblers may appear by the thousands in April. Over 200 species of birds are found here, including great white herons, mottled ducks, wood storks, white ibises, mangrove cuckoos, and gray kingbirds. The refuge provides some of the best birdwatching in the United States; on the auto tour, one may come within 3 meters (10 feet) of some wading birds.

Pine Island (grid reference LV93 to LV85) is famous for its bald eagles. Between 6 and 12 pairs nest regularly on the island, and many more use the area for feeding.

Populations of the Florida scrub jay are found between grid references LV76 and LA50, and also at grid reference LA43.

The 13,200 hectares (32,600 acres) around grid reference LA70 are an important part of the corridor used by the Florida panther and contain mostly pine flatwoods and saw palmetto interspersed with hardwood hammock forests.

One of the largest Florida state parks is Myakka River State Park at grid reference LA71. It is little disturbed, containing lakes, a river, marshes, hammocks, and prairies, with abundant wildlife. There are over 200 species of birds and many snakes; unconfirmed sightings of Florida panthers have been made here.

The least tern and many other shorebirds nest on Passage Key at grid reference LA24. Brown pelicans also may be found on this island wildlife refuge.

The southern tip of the peninsular island chain, north of the entrance to Tampa Bay (grid reference LA25), is one of Florida's most important birding areas. Many shorebirds and an abundance of warblers and other songbirds migrate through or overwinter in the area. The best birding is during the spring migration from late March to late May.

The Toy Town sanitary landfill at grid reference LA38 is among the best places in Florida to observe gulls. Up to a half million gulls, representing several species, may be seen here in winter. Nearby is a small population of the exotic ringed turtle dove, which has escaped from captivity.

The small spoil islands owned by the National Audubon Society (grid reference LA58) are among the finest waterbird colonies along the Florida coast. Up to 13,000 nesting pairs, mostly white ibises, have been recorded.

At grid reference LA29, a number of exotic species of parrots and parakeets have escaped captivity and established breeding populations.

Caladesi Island State Park (grid reference LB20) contains one of the few remaining undisturbed barrier beaches in Florida. The bay side is mangrove swamp and much of the interior is virgin pine flatwoods. About 161 bird species have been recorded here and rattlesnakes are said to be large and numerous. The island's isolation limits mammal abundance and variety.

The Hillsborough River flows over limestone outcrops and meanders through swamps and hammocks with bald cypress, magnolia, live oak, and palms. Many kinds of wildlife occur in the Lower Hillsborough Wildlife Management Area (grid reference LB60 to LB71).

## 5.4 BIG BEND DROWNED KARST (GRID REFERENCE LB21 to GJ51)

The Big Bend Drowned Karst section extends from Tarpon Springs (grid reference LB21) to Lighthouse Point, Florida (grid reference GJ51). The coastline is typically rugged; nearshore areas often have rocky bottoms. Wide, shallow areas, supporting seagrass beds and oyster reefs are common. Tidal range is high for the Gulf of Mexico: about 1.2 meters (4 feet). Stream discharge is also high due to the influence of several moderate-size rivers, the largest being the Suwannee River.

The biotic resources of this section are keyed geographically using east-west UTM grid swaths.

### 5.4.1 Aquatic Resources

#### Widespread Species

Seagrasses are a dominant feature of the coastal areas of the Big Bend Drowned Karst section. Major species include manatee grass, turtle grass, and shoal grass. They perform an important ecological function by providing a nursery ground for both estuarine-dependent and marine species.

Temperate species begin to dominate in the estuarine and marine waters of this section. Widespread species include the blue crab, stone crab, pink, brown, and white shrimp, several drum species, sheepshead, striped mullet, Gulf menhaden, Gulf and southern flounder, bluefish, cobia, Spanish and king mackerel, snappers, groupers, grunts, sea bass, blue runner, Atlantic thread herring, Alabama shad, and Spanish sardine. These species are both recreationally and commercially important. In particular, the blue crab supports the major fishery in this section.

Lakes are abundant inland, and along with several major river systems and reservoirs, support catfish and bullheads, sunfish, black crappie, largemouth bass, spotted bass, Florida gar, and pickerel.

The five marine turtles with special status occur throughout the coastal waters of this section. This section is, however, the northern end of the West Indian manatee's range and, with a few exceptions, manatees are seen here only in the warmer months.

Geographic Inventory

Several spring-fed rivers, which have clear, fresh water and constant temperatures, flow into the Gulf of Mexico, providing winter refuges for the West Indian manatee; these include the Weeki Wachee River (grid reference LB35 to LB45), Chassahowitzka River (grid reference LB37 to LB47), Homosassa River (grid reference LB38 to LB48), and the Crystal River (grid reference LC30 to LB49). The Crystal River itself is a designated critical habitat for the West Indian manatee; the warm water discharge from the Crystal River Power Plant (grid reference LC30) also provides a winter refuge for the manatee.

Lake Tsala Apopka (grid reference LB78 to LC60) is a chain of numerous lakes connected to the Withlacoochee River (Florida). Although it is becoming hypereutrophic due to urban and agricultural runoff, it provides good sport-fishing opportunities for largemouth bass, black crappie, and sunfish.

Lake Panasoffkee (grid reference LB88 to LB98) is renowned for its redear sunfish, although it also yields largemouth bass, other sunfish, and chain pickerel.

The Withlacoochee River (Florida) from Lake Panasoffkee to near its mouth (grid reference LB88 to LC31) and especially Lake Rousseau (grid reference LC51 to LC41) offer excellent largemouth bass sportfishing.

Orange and Lochloosa Lakes (grid reference LC85 to LC96), both state fish management areas, are two of the best lakes in Florida for big largemouth bass fishing; they also have a healthy black crappie fishery. Nearby Newnans Lake (grid reference LC77 to LC88), a state fish management area, and Santa Fe Lake (grid reference LC98 to LC99) are also popular largemouth bass and black crappie lakes.

The loose coiled snail, a small, slender, brown snail, is found only in Magnesia Spring (grid reference LC87 to LC97). The snail shows a strong preference for mats of filamentous algae floating in the spring pool and overflow pool.

The Suwannee River (grid reference KC94 to LE60), including the Santa Fe, New, Withlacoochee (Georgia), and Alapaha Rivers, is one of the most unique river systems in Florida. It is born in the Okefenokee Swamp in Georgia, and throughout its length, remains unpolluted and undammed. The river system offers very good sportfishing for such species as largemouth bass, channel catfish, and spotted, redear, and redbreast sunfish, and supports several unusual species including the West Indian manatee, Suwannee bass, and the Gulf subspecies of the Atlantic sturgeon. The many creeks, sloughs, swamps, and springs provide spawning habitats for freshwater fish species.

The lower Suwannee River has a small, but active, Atlantic sturgeon commercial fishery, the only one of its kind on the west coast of Florida and perhaps the entire Gulf of Mexico. Most commercial sturgeon fishing is pursued at the mouth in East Pass (grid reference KC94) and to a lesser extent on the Suwannee River from the mouth to Ellaville (grid reference KC94 to KD96). Although this anadromous fish is a species of special concern in Florida, the population has remained stable in the Suwannee River over the past 20 years.

West Indian manatees occur in the lower Suwannee River (grid reference KC94 to LC06) during the warmer months of the year. During the winter months, they concentrate at Manatee Springs (grid reference LC06), one of six natural warm water refuges within the state for this endangered species.

Fannin Springs, near the town of Suwannee River (grid reference LC17), attracts numerous sport fish species including largemouth bass.

The lower portion of the Santa Fe River (grid reference LD10 to LD40) appears to harbor a larger percentage of harvestable-size game fish, including redear, redbreast, and spotted sunfish, and largemouth and Suwannee bass, than most other areas within the Suwannee River system.

The Suwannee bass is most abundant in the lower Santa Fe River (grid reference LD10 to LD40), although it occurs throughout the Suwannee River. It is a species of special concern in Florida, because it is endemic to only the Suwannee and Ochlockonee River systems. It is a popular game fish and its populations have remained healthy.

The spawning grounds of the anadromous Atlantic sturgeon in the Suwannee River probably occur between Ellaville and White Springs (grid reference KD96 to LD35). The river in this stretch is characterized by steep banks, numerous shoals, and swift currents.

Apalachee Bay (inshore of grid reference KC49 to GJ51) is a major blue crab spawning area. Female crabs from Florida west coast estuaries migrate northward into this area to release their eggs. An extensive commercial sponge bed is located offshore between grid reference KD21 and KD12.

### 5.4.2 Terrestrial Resources

#### Widespread Species

Many bird species migrate through or winter in this part of Florida, including shorebirds, wading birds, waterfowl, raptors, and songbirds and others. Common species in the marshes and swamps are gulls, terns, herons, egrets, dabbling ducks, osprey, amphibians, turtles, snakes, mink, river otter, and raccoon. Sandhill areas support bobwhite, gopher tortoise, and tree squirrels (eastern fox, eastern gray, and southern flying squirrels). Forested areas contain owls, numerous songbirds, woodpeckers, bobcat, white-tail deer, gray fox, tree squirrels, raccoon, opossum, and skunks.

A number of species with special status occur in this section with broad distributions. Those which occur throughout the section in suitable habitat include: southeastern American kestrel, red-cockaded woodpecker, American alligator, eastern indigo snake, and Florida mouse. Special status species widely distributed in restricted areas or habitats include: Cuban snowy plover, Florida sandhill crane, bald eagle, peregrine falcon, brown pelican, and Florida black bear. The Florida panther is very rare, and its distribution is largely uncertain.

Geographic Inventory

At Green Swamp Wildlife Management Area (grid reference LB93 to LB94), it is legal to hunt bobwhite, deer, gray fox, boar, squirrel, raccoon, opossum, and cottontail. The same species may be hunted at Withlacoochee State Forest, as well as Croom, Citrus, and Richloam Wildlife Management Areas (grid reference LB94 to LB69). Bobcat also may be taken at most of these areas.

Chassahowitzka National Wildlife Refuge and Wilderness (grid reference LB36 to LB39) contains 12,141 hectares (30,000 acres) of unspoiled estuarine habitat, providing wintering grounds for ducks and other waterfowl, especially coots. Peak winter populations number over 20,000 ducks and 19,000 coots. It also harbors the most southern flock of pintails. A large flock of white pelicans winters here, which is unusual for this western species. Wading birds nest by the thousands on offshore refuge islands.

Florida panther sightings have been reported from grid reference LB79 to LC70. Other sightings have been reported from grid reference LB67 to LB69.

The short-tailed snake is known to inhabit the area of grid reference LC51. Nearby, from grid reference LC62 to LC93, this snake and the Florida scrub jay are residents.

A unique vegetation community exists at grid reference LC31 to LC32; about one-fourth of the area is upland hammock, a remnant of the original Gulf hammock association and a vast hardwood forest of this region.

Cedar Keys National Wildlife Refuge (grid reference KC92 to LC02) supports one of the largest nesting colonies of herons, egrets, brown pelicans, and other waterbirds in the South; sometimes 200,000 birds, including 60,000 white ibises, nest here. The area also probably has the largest population, estimated at over 700, of poisonous cottonmouth snakes of any place its size in the world. The northernmost significant nesting colony on the Gulf coast for brown pelicans occurs here; more than 1,200 birds have been recorded.

The Florida scrub jay regularly inhabits the area between grid reference LC03 and LC15.

During winter, American oystercatchers tend to concentrate at the mouth of the Suwannee River around grid reference KC93 to KC84.

The short-tailed hawk, a rare species, regularly breeds in the lower Suwannee River basin at grid reference KC94.

Extensive wildlife management areas extend from grid reference KC94 to KD91, and offer good hunting opportunities for many game species. Largely undisturbed since logging activities in the early 1900's, the nearby 8,000-hectare (20,000-acre) Tide Swamp Wildlife Management Area (grid reference KC68 to KC59) contains prime wildlife habitat and hunting opportunities.

Populations of the short-tailed snake can be found at grid reference LC16.

Bird Island in Orange Lake (grid reference LC85) contains a large heron rookery of 10,000 birds, as well as numerous cottonmouths, which wait under the trees for eggs or young to fall from the nests.

The Paynes Prairie State Preserve (grid reference LC67 to LC77) occupies 5,560 hectares (13,735 acres) on an old lake basin. It is considered one of the most significant natural areas in Florida and is composed of wet prairie, marsh, open water, uplands of hardwood hammocks, pine flatwoods, swamps, old fields, and ponds. This mosaic of habitats effectively supports a diversity of wildlife, and concentrates some, such as herons, sandhill cranes, many dabbling ducks, and many amphibians and reptiles.

Newnans Lake at grid reference LC88 is a good place to observe a variety of warblers during spring and fall migrations.

Devil's Millhopper State Geological Site (grid reference LC68) provides a suitable habitat for many reptiles and amphibians, as well as hawks, owls, songbirds, river otter, and other mammals.

O'Leno State Park (grid reference LD41) is interesting because the river disappears underground for 4.8 kilometers (3 miles) inside the park. The area harbors many nesting wading birds. Unusual species include Mississippi kite, Bachman's sparrow, and hooded warbler; the latter breeds here in spring. Bird-watching is good, especially for songbird migrants.

A population of the Florida sandhill crane occurs at grid reference KD64 to KD66, a rather disjunct distribution for this more southern species. It is probably the most sizeable western location for this crane.

The Suwannee River State Park at grid reference KD96 is a good location to observe many songbird migrants, especially in fall. Beaver also are seen here occasionally.

Despite management for commercial timber production, the extensive forests from grid reference LD72 to LD66 are home to many red-cockaded woodpeckers and other wildlife, including Florida black bear.

The Okefenokee National Wildlife Refuge (grid reference LD78 to LE72) covers 152,000 hectares (376,000 acres), and is one of the oldest, largest, and most primitive swamps in America. It is a true wilderness, with over 230 species of birds, 32 amphibians, 58 reptiles, and 42 mammals. One of the largest American alligator populations anywhere exists here, with 12,000 to 15,000 individuals. All duck species native to the Atlantic Flyway are seen here, and over 75,000 pairs of wading birds nest in the refuge. The habitat is a mixture of freshwater marsh, pine uplands and islands, lakes, dense forest, and swamps.

Saint Marks National Wildlife Refuge (grid reference GJ83 to GJ63) is an important wintering ground for many kinds of waterfowl. It is also the only major wintering area for Canada geese in Florida. Largest waterfowl concentrations occur from mid-November to mid-April. Over 300 species of birds have been recorded here. This is also an important concentration area for shorebirds, waders, and songbirds, especially during migrations and in winter.

Unusual elsewhere in this section, groove-billed anis and yellow-headed blackbirds are sighted regularly; both species normally occur much farther west.

An important wildlife area at Wakulla Springs (grid reference GJ64) is privately owned. Trips are conducted on the Wakulla River, which flows through some of the most beautiful stretches of wilderness in northern Florida. Birdlife is highly diverse and abundant in any season, and is easily observed at close range.

A number of American Forestry Association champion trees, including a spruce pine, silverbell, flowering dogwood, hawthorn, Tallahassee haw, horsesugar, and sweetbay, occur near grid reference GJ67.

A stand of original growth trees at grid reference GJ69 contains magnolia, beech, sweetgum, tupelo, and spruce pine.

## 5.5 APALACHICOLA CUSPATE DELTA (GRID REFERENCE GJ51 to FH58)

The Apalachicola Cuspate Delta section extends from Lighthouse Point (grid reference GJ51) to Cape San Blas, Florida (grid reference FH58). As its name suggests, the coastline morphology is due largely to the effects of the Apalachicola River, which accounts for about 35 percent of the total runoff to the west coast of Florida. This discharge is responsible for turbid water and muddy bottoms in the bays, which are enclosed partially by barrier islands. The Gulf of Mexico within this section is relatively shallow and sandy bottomed with scattered areas of low rock relief. Tidal range in this area is modest, about 0.6 meters (2 feet).

The biotic resources of this section are keyed geographically using north-south UTM grid swaths.

### 5.5.1 Aquatic Resources

#### Widespread Species

Species of commercial and recreational importance in the Apalachicola Cuspate Delta section include groupers (mainly red, gag, yellowmouth, and warsaw), snappers (mainly red), sea bass, grunts, bluefish, king and Spanish mackerel, and pink, brown, and white shrimp.

Seagrass beds are limited by turbid water in this section; however, there are extensive estuaries and several estuarine-dependent species are of importance in nearshore waters and estuaries. These include the three shrimp species, blue crab, eastern oyster, bay scallop, bay anchovy, spotted and sand seatrout, Atlantic croaker, red and black drum, spot, southern kingfish, sheepshead, southern and Gulf flounder, and Gulf menhaden. The five sea turtles of special status also occur in this section.

The numerous rivers, lakes, and reservoirs in the section harbor white and channel catfish, yellow and brown bullheads, black crappie, largemouth bass, sunfish, and pickerel. The migratory Alabama shad and skipjack herring are found in rivers throughout the zone.

Geographic Inventory

Southwest Cape (grid reference GJ51) represents the northern end of recreational and commercial stone crab harvests.

The Ochlockonee River (grid reference GJ51 to KE23) supports populations of the Suwannee bass, a fish which occurs only in this river system and the Suwannee River system. The Ochlockonee River is one of the easternmost rivers in the Gulf of Mexico which support striped bass; many of these fish were probably stocked in Lake Talquin (grid reference GJ26 to GJ47) and subsequently released across the Jackson Bluff Dam.

Lake Talquin (grid reference GJ26 to GJ47) is a state fish management area and, in addition to striped bass, yields largemouth bass, black crappie, bluegill, redear sunfish, redbreast sunfish, warmouth, and spotted sunfish. Catfish and bullheads provide both a significant commercial and recreational fishery.

Lake Jackson (grid reference GJ69), a natural lake near the shores of the Ochlockonee River, has a nationwide reputation for the large number of trophy largemouth bass caught by sport fishermen. From 1964 through 1974, it is estimated that 1,350 bass of 4.5 kilograms (10 pounds) and over were caught here; the lake record is 8.3 kilograms (18.25 pounds). Trophy bass are taken primarily during the spring. Black crappie sportfishing is also good within Lake Jackson, primarily during fall and winter.

Suwannee bass have recently been found in Barnetts Creek (grid reference GK71 to GK73), a tributary of the Ochlockonee River.

Major commercial callico scallop beds occur offshore of the Apalachicola Delta in the vicinity of grid reference FH95. Population densities vary greatly from year to year, because the species is mobile and conditions for growth change annually.

Loggerhead sea turtles nest on the barrier islands fronting the Apalachicola Bay system (grid reference GJ30 to FH97). Loggerhead and leatherback sea turtles have been observed nesting on the beaches of Saint Vincent Island (grid reference FH87 to FH78).

The Apalachicola Bay system, including Saint George and Saint Vincent Sounds (grid reference GJ51 to FH68), is one of the most biologically productive estuaries along the west Florida coast. It is the primary blue crab spawning ground in west Florida, having the greatest concentration of egg-bearing females. It appears that female blue crabs collected in coastal west Florida waters are either migrating to or terminating in the Apalachicola Bay system.

The oyster beds of Apalachicola Bay (grid references GH19 to GH08 and FH98 to FH78) provide over 90 percent of Florida's oyster production. This fishery has benefitted from spring shell plantings, which increase the available cultch area, and from the damming of the Apalachicola River, which has stabilized the water flow.

Several anadromous species pass through the Apalachicola Bay system on their way to spawning grounds in the Apalachicola River. These include the Alabama shad and the Atlantic sturgeon.

The Apalachicola River system (grid reference FH99 to GK13) is the largest Florida river system emptying into the Gulf of Mexico. The system includes several major tributaries including the Chipola River (grid reference FJ82 to FK63), Chattahoochee River (grid reference FK92 to FK93), and Flint River (grid reference GK32 to GK33). It supports three endemic fish species or varieties within the study area (bluestripe shiner, shoal bass, and "handpaint" bluegill) and several migratory species (Atlantic sturgeon, striped bass, Alabama shad, and skipjack herring). Striped bass is harvested commercially on the river. This river also represents the eastern end of the range of the spotted bass and white crappie.

The Atlantic sturgeon is believed to spawn in the Three Brothers River (grid reference FJ80 to FJ81) and the Florida River (grid reference FJ83 to FJ84), both small tributaries to the Apalachicola River. Population levels of the Atlantic sturgeon on the Apalachicola River appear to be stable.

The bluestripe shiner, endemic to the Apalachicola River system and found from grid reference FJ73 to the Jim Woodruff Dam (grid reference GJ09) and upstream on the Chattahoochee River (grid reference FK92 to FK93), is threatened in Florida. Although the range of this species is limited, it is common in the Apalachicola River below Jim Woodruff Dam.

The reach of river below the Jim Woodruff Dam (grid reference FJ96 to GJ09) is an important spawning, concentration, and recreational fishing area for migrating fish species, including Atlantic sturgeon, Alabama shad, skipjack herring, and striped bass, since the dam acts as a migration barrier. The striped bass may be residents of the lower river, but move up to this area to spawn. This river reach may be the only location in which the Gulf coast race of the striped bass spawns. The shoal bass, a species of concern in Florida, is endemic to the Apalachicola River system, preferring large, riverine shoals and main channels. It is sought as a game fish, where it occurs in large numbers, and is taken in small numbers in the reach below the dam.

Lake Seminole (grid reference GK00) provides excellent sportfishing opportunities for striped bass, largemouth bass, black crappie, sunfish, and chain pickerel. Hybrid sunshine bass also have been stocked in this lake.

The lower reach of the Chipola River (grid reference FJ82 to FJ73) is a popular sportfishing area for Alabama shad.

The shoal bass is fairly common in the rapids of the Chipola River surrounding Marianna (grid reference FK70 to FK61).

### 5.5.2 Terrestrial Resources

#### Widespread Species

A number of terrestrial plant species with special status, such as ferns, occur in the Apalachicola Cuspate Delta section. Other species with special

status that occur throughout this section in suitable habitat include: bald eagles, Cuban snowy plovers, southeastern American kestrels, red-cockaded woodpeckers, American alligators, eastern indigo snakes, and Florida black bears.

Coastal beaches receive concentrations of shorebirds, such as gulls and terns, especially during migrations and in winter. Inland wetlands provide resting and wintering habitat for many waterfowl. Other areas support migrating and wintering songbirds.

Geographic Inventory

Saint Marks National Wildlife Refuge (grid reference GJ41 to GJ43) is an important waterfowl concentration area, and the only major Canada goose wintering area in Florida. More than 300 bird species have been found here; 98 species nest in the refuge. The largest concentrations of waterfowl occur from mid-November to mid-January.

At grid reference GJ41 and GJ51, bald eagles nest, and peregrine falcons and scoters spend the winter.

The Apalachicola National Forest (grid reference GJ15 to FI91) is a second growth pine forest with hardwood swamps. It contains several large limestone sinks, many lakes, ponds and streams, and is managed for commercial timber production. It also has a substantial red-cockaded woodpecker population. Several areas of unique vegetation occur within the national forest. A preservation area for unusual vegetation occurs at grid reference GJ32, consisting of spruce pine and southern magnolia; this represents the southern limit for spruce pine. A unique stand of 100-year-old dwarf cypress, 1.5 to 3 meters (5 to 10 feet) tall, and an exceptionally large black titi tree, 12 meters (40 feet) tall, in an unusual titi swamp occur at grid references GJ11 and GJ12. A stand of virgin slash pine about 85 years old, 30 to 36 meters (98 to 118 feet) tall, and 32 to 69 centimeters (13 to 27 inches) in diameter occurs at grid reference GJ43. An unusual distribution of a relic vegetation association is found at grid reference GJ44; the stand of turkey oak, sand liveoak, myrtle, chapman oak, and longleaf pine almost always is found on the coast, and its present location suggests that during the Pleistocene, the coast was farther inland.

Least tern nesting has been found at grid reference GJ47.

A number of wildlife management areas are located between grid reference GJ57 and FJ97, which offer good recreational hunting for bobwhite, turkey, and many mammals, including whitetail deer.

Ireland's Woods at grid reference GJ58 is a stand of original growth hardwoods containing beech, sweetgum, black gum, spruce pine, and magnolia.

Saint Vincent National Wildlife Refuge (grid reference FH88 to FH78) is a wild, beautiful, uninhabited, tropical island of forest and marsh. Until 1968, it was privately owned as a hunting and fishing preserve, and a number of exotic game species were introduced; a small herd of sambar deer remain. Over 200 species of birds have been identified, and the area is a concentration

point for migrating warblers. It also contains an American Forestry Association champion ogeeche tupelo.

The Apalachicola River floodplain extends from grid reference FH99 to GJ09, and its forests have some of the highest wildlife value in northern Florida. With 81,000 hectares (200,000 acres), it is the largest forested tract in the state. It also contains a large number of endemic, disjunct, or rare species of plants and animals. Although unconfirmed, this area may be the last area for the possibly extinct ivory-billed woodpecker and Bachman's warbler. Neither has been seen since the 1950's. The Florida panther also may inhabit this region. It supports as many as 344 species of vertebrates, including breeding birds, amphibians, reptiles, and mammals. The highest species density of amphibians and reptiles in North America north of Mexico has been reported from this area.

Normally a coastal dune and beach community, an unusual stand of slash pine-sand liveoak occurs 40 kilometers (25 miles) inland at grid reference FJ82. Unusual in northwest Florida, the grass species Andropogon gerardii grows in this same area.

Torreya State Park, at grid reference FJ98, contains the rare Florida torreya tree and several American Forestry Association champion trees, including an ashe magnolia, and a Florida yew. Nearby is a champion water hickory.

A unique plant community of stewartia, mountain laurel, fly poison, false solomon's seal, and several trillium species occurs at grid reference GJ09. In the same area is an American Forestry Association champion planer-tree, over 3.7 meters (12 feet) in circumference and 28.3 meters (93 feet) in height.

One of the only locations in Florida for the Indiana bat is in Florida Caverns State Park (grid reference FK61). It contains limestone caves with exceptional formations, the Chipola River floodplain, hardwood hammocks, and a river swamp. The river flows underground for several tens of meters (several hundred feet) here.

The Indiana bat and the gray bat also are found in caves from grid reference FK52 to FK71. This area contains more air-filled cave ecosystems than anywhere else in Florida or the entire coastal plain of the United States. In addition to the bats mentioned, a number of other bat species inhabit these caves, as do endemic cave-adapted fauna, including the Georgia blind salamander.

## 5.6 NORTH CENTRAL GULF COAST (GRID REFERENCE FH58 to CJ65)

The North Central Gulf Coast section extends from Cape San Blas, Florida (grid reference FH58) to Petit Bois Pass on the Alabama-Mississippi border (grid reference CJ65). The coastline consists of alternating sections of straight shoreline, with high energy beaches and well-developed dune systems, and bays partially enclosed by barrier islands. Water clarity is variable, and is adversely affected locally by the discharges of several rivers, the largest of which is the discharge from the Mobile Bay system. Extensive oyster beds are found in Mobile Bay and Mississippi Sound, but seagrass systems are uncommon.

The biotic resources of this section are keyed geographically using north-south UTM grid swaths.

## 5.6.1 Aquatic Resources

### Widespread Species

To the west of Cape San Blas, the continental shelf is relatively narrow and there are numerous rock and coral outcrops. Popular sport and commercial species associated with these habitats include red snapper, vermilion snapper, red grouper, gag, yellowmouth grouper, and red porgy. Other important commercial and recreational species in the Gulf of Mexico include brown, white, and pink shrimp, Atlantic bonito, amberjack, crevalle jack, blue runner, sharks, spot, Atlantic croaker, sand seatrout, southern and Gulf flounder, Gulf menhaden, bluefish, Spanish and king mackerel, Atlantic thread herring, and Spanish sardine. These latter two species are fished commercially in the Gulf of Mexico mainly within this section. The five marine turtles with special status also are found in the North Central Gulf Coast section.

Nearshore and estuarine waters harbor numerous species of commercial and recreational importance, including the three shrimp species, blue crab, ladyfish, spotted and sand seatrout, black and red drum, silver perch, Atlantic croaker, spot, southern kingfish, southern and Gulf flounder, Gulf menhaden, striped mullet, sheepshead, and Florida pompano. The estuaries serve as important nursery grounds for estuarine-dependent species. The anadromous Atlantic sturgeon and Alabama shad pass through these waters on their upstream and downstream spawning migrations.

The freshwater rivers and lakes of this section harbor white and channel catfish, black crappie, largemouth bass, numerous sunfish, gars, bowfin, chain pickerel, and redfin pickerel. Migratory species, including Atlantic sturgeon, skipjack herring, and Alabama shad, occur in the major rivers.

### Geographic Inventory

The waters in and around Saint Joseph Bay (grid reference FH68 to FJ50) contain important commercial shellfish beds. Within Saint Joseph Bay, sunray venus clams and bay scallops are harvested. The scallop beds within Saint Joseph Bay are some of the largest in Florida. A major sunray venus clam bed existed off Saint Joseph Point at grid reference FJ50 to FJ41, although the populations have been depleted.

Saint Andrew Sound (grid reference FJ41 to FJ32) and lower Saint Andrew Bay (grid reference FJ32 to FJ23) contain commercial quantities of bay scallops.

Numerous commercially important oyster beds are found in the upper portions of the Saint Andrew Bay system, including East Bay (grid reference FJ52 to FJ43), North Bay (grid reference FJ34), and West Bay (grid reference FJ14 to FJ15). Deer Point Lake (grid reference FJ34 to FJ35), which has been dammed off from North Bay, offers excellent largemouth bass sportfishing.

The area surrounding grid reference FJ27, known as the Sandhill Lakes, is remote and undeveloped. The lakes, of which the larger ones include Porter Lake, Gap Lake, Big Blue Lake, Deadening Lake, and Gully Lake, are cypress-lined, clear, cold, and deep. They offer excellent sportfishing for largemouth bass and sunfish.

The inshore trolling grounds off Panama City (grid reference FJ22 to EJ94) provide summer sportfishing opportunities for Spanish and king mackerel, Atlantic bonito, and dolphin; red snapper and gag are sought around reefs, rocks, and buoys.

Farther offshore, the irregular bottom and rocky areas provide some of the most important commercial and recreational fishing grounds in Florida. These include the areas around grid reference EJ82 and the Southeast Grounds (grid reference EJ52). The major species sought is the red snapper, although vermilion snapper, red grouper, gag, and red porgy also commonly are taken.

The area just off Destin Inlet (grid reference EJ55 to EJ35) contains numerous artificial reefs and is a popular nearshore fishing ground for king mackerel, red snapper, gag, and cobia. Mackerel are caught mainly during their spring and fall migrations.

Striped mullet and spotted seatrout are the most important recreational and commercial species in Choctawhatchee Bay, with fishing activity centered around the grass flats at the mouth of the bay (grid reference EJ46) and at the mouth of the Choctawhatchee River (grid reference EJ86).

The Okaloose darter, the only fish on the Federal list of endangered species that occurs in the Gulf of Mexico coastal area, is endemic to a series of five small creek systems in an area surrounding grid reference EJ58. It is found in clear streams with moderate to swift currents and clean sand substrate.

The Choctawhatchee River (grid reference EJ86 to FK12) offers good sportfishing opportunities for largemouth bass and sunfish; however, it is most known for its alligator gar, some of which weigh up to 91 kilograms (200 pounds). The river also supports migratory Atlantic sturgeon and striped bass populations.

Athearns villosa, a small clam, is restricted to the Choctawhatchee River and is found mainly above Westville (grid reference FK10 to FK12), where it lives in moderate to swift currents over sandy bottom.

Juniper Lake (grid reference EK80) is an artificial impoundment within the Choctawhatchee River drainage. This state fish management area yields big largemouth bass and excellent catches of bluegill.

The area of the Gulf of Mexico from grid reference EJ33 to DJ92, known as the Timberholes, 29 Edges, and 27 Edges, has a rugged relief bottom and is an important recreational and commercial red snapper ground. Vermilion snapper, red and yellowmouth grouper, gag, and red porgy also are taken. These grounds represent the inshore edge of De Soto Canyon (grid reference EJ12 to EJ02), a submarine canyon over which lies open Gulf waters. De Soto Canyon is one of

the major billfish sportfishing areas in the Gulf of Mexico. Major species sought include blue marlin, white marlin, and sailfish.

The area off the entrance to Pensacola Bay (grid reference DJ85 to DJ64) is a popular summer sportfishing area for Spanish and king mackerel, bluefish, and cobia. The wreck of the battleship Massachusetts, and other artificial reefs in this area, aid in attracting sport fish species.

The Atlantic sturgeon is known to migrate into Pensacola Bay and East Bay (grid reference DJ75 to EJ06), Escambia Bay (grid reference DJ87), and Blackwater Bay (grid reference DJ97 to DJ98).

The saltmarsh topminnow, a species of special concern in Florida, is found in Escambia Bay (grid reference DJ86 to DJ87) and East and Blackwater Bays (grid reference DJ96 to DJ98). It has been recorded only a few times from Florida, and the above mentioned bays may be the species' easternmost occurrence.

The blackmouth shiner, a threatened species in Florida, is known only from Pond Creek at the U.S. 90 highway bridge (grid reference DJ98). Its habitat appears to be stable and not subject to environmental stress.

The Escambia River above grid reference DK71 harbors two fish species of special concern, the crystal darter and harlequin darter. Both species are at the periphery of their range.

A series of artificial reefs, offshore of Mobile Bay (grid reference CJ92), attract several sport species including red snapper, cobia, gag, and red grouper.

Mobile Bay, including Bon Secour Bay (area surrounding grid reference DJ06), is an important estuary for the production of estuarine-dependent species, including blue crab, brown and white shrimp, spotted and sand seatrout, red drum, spot, Atlantic croaker, striped mullet, Gulf menhaden, and southern flounder. These species are harvested commercially and recreationally from Mobile Bay. The Atlantic sturgeon also migrates through this bay during its seasonal spawning runs.

Cedar Point Reef (grid reference CJ95 and CJ85) is the major oyster-producing reef in Mobile Bay, yielding 90 percent of all oysters harvested in Alabama waters. However, overharvesting and removal of cultch material have resulted in reduced yields and intermittent closures for stock management purposes. As a result, most Alabama oyster landings are harvested from Mississippi Sound (grid reference CJ85 to CJ65).

The Mobile Delta (grid reference DJ09 to DJ02) is the second largest river delta in the United States, extending 64 kilometers (40 miles) upriver and 16 kilometers (10 miles) wide. The delta provides important spawning and nursery habitat for freshwater fish species and supports a high, standing crop of fish. The primary use of the delta is recreational fishing for sunfish, largemouth bass, spotted bass, yellow bass, black and white crappie, striped bass, chain pickerel, channel, blue, and flathead catfish, alligator gar, and bowfin. During the autumn, when salinity is elevated, spotted seatrout, red

drum, and southern flounder are sought in the lower delta. Commercial species include channel and blue catfish, freshwater drum, and buffalo. In addition, several unique species occur in the Mobile Delta, including the Atlantic sturgeon, crystal darter, and blue sucker. These species have unofficial special status in Alabama. The flathead catfish, yellow bass, and white bass, common throughout the fresh waters of the central Gulf of Mexico, are at the eastern limit of their range in the Mobile Delta.

### 5.6.2 Terrestrial Resources

#### Widespread Species

A number of terrestrial plant species with special status or of special concern in Florida, Georgia, and Alabama occur in the North Central Gulf Coast section, including ferns, several pitcher plants, ashe magnolia, and mountain laurel. Other species with special status found throughout this section include: Cuban snowy plover, peregrine falcon, southeastern American kestrel, red-cockaded woodpecker, American alligator, and eastern indigo snake; bald eagles, wood storks, and brown pelicans are widespread in portions of this section.

Throughout this section, many common species occur as migrants and residents, including all bird categories and many mammal species such as bobcat, whitetail deer, mink, river otter, nutria, muskrat, swamp rabbit, marsh rabbit, opossum, and skunk. Waterfowl form concentrations in winter and are hunted. A number of species have restricted distributions: American oystercatcher, gray kingbird, reddish egret, Stoddard's yellow-throated warbler, and mourning dove.

#### Geographic Inventory

The lands surrounding Saint Joseph Bay (grid reference FH68 to FJ50) provide a unique cross section of coastal strand and bayshore physiography and associated vegetation, from a high energy Gulf beach and dune system to a bayshore estuarine saltmarsh system. Least terns nest here, bald eagles feed, peregrine falcons winter, magnificent frigate-birds summer, and other shorebirds reside year-round. The coastal area of T. H. Stone Memorial-Saint Joseph Peninsula Park (grid reference FH59 to FJ50) provides 1,000 hectares (2,500 acres) of white sand beaches and dunes, a heavily forested interior, small fresh and salt marshes, and freshwater ponds. It is an excellent bird-watching area, with over 200 species recorded. An active bald eagle nest was sighted recently on the mainland side of the bay, several kilometers (miles) inland in the vicinity of grid reference FJ70.

Marsh hawks, songbirds, and many sparrow species inhabit the open lands at grid reference FJ68.

Saint Andrews State Recreation Area (grid reference FJ23) has high dunes of white sand with dense stands of sea oats, fresh and salt marshes, and over 219 bird species recorded, many of which concentrate here seasonally.

The Choctawhatchee beach mouse is restricted to this section and is found from grid reference FJ23 to EJ46.

Unique distributions for the one-toed amphiuma and four-toed salamander are found at grid reference EJ86. This amphiuma is very rare and requires specialized conditions for its habitat--muck soils of a particular quality. This location for the four-toed salamander represents a disjunct, southern limit in its range.

One of the only locations in the entire study area where the pine barrens treefrog and eastern chipmunk may be found is between grid reference EK80 and EK31. This is the southern limit for both species. Several small areas in the region have been designated legally as critical habitat for the pine barrens treefrog.

Least terns nest at grid reference EJ16, and Cuban snowy plovers nest between grid reference EJ06 and DJ95.

Blackwater River State Forest (grid reference EK01 to EK31) is Florida's largest state forest and represents a transition zone of vegetation from tropical to temperate species. The pine barrens treefrog occurs here, as do red-cockaded woodpeckers, Florida black bears, many warblers, and game animals.

The Perdido Bay beach mouse is restricted to the beaches between grid reference DJ65 and DJ44.

Within the entire Gulf coast study area, the sea salamander is found only at grid reference DK62, the southernmost extent of its geographic range and a disjunct location from the major center of distribution in the Appalachians.

There is a possibility, based on unconfirmed sightings, that the Florida panther occurs in the vicinity of grid reference DJ38.

Waterfowl winter in great numbers in the lower Mobile estuary from grid reference DJ29 to DK12. Over 104,000 birds have been recorded in a single season; duck populations average 26,000 annually, with 16,000 coot. This area has one of the largest wintering canvasback populations outside of Louisiana. Hunting is an important activity here; coots are the most important game bird in the area.

Dauphin Island (grid reference CJ74 to CJ94) contains the only coastal colony of common terns in Mississippi, Alabama, or Louisiana, and it is a concentration area for migrating land birds and warblers. Peregrine falcons occasionally winter here or stop during migration.

## 5.7 MISSISSIPPI DELTA (GRID REFERENCE CJ65 to WC76)

The Mississippi Delta section extends from Petit Bois Pass at the Alabama-Mississippi border (grid reference CJ65) to the western end of Vermilion Bay, Louisiana (grid reference WC76). This section is influenced greatly by the discharge of the Mississippi River, which contributes to coastal morphology, poor water clarity, shallow muddy bottoms, extensive marsh-covered lowlands near the coast, and very high biological productivity nearshore. A series of barrier islands protects the marshes from the sea, but an extensive mosaic of dredged canals and spoil banks has altered drainage patterns behind these

islands. Anoxic conditions develop over a large portion of the nearshore shelf in central and western Louisiana in summer, apparently due to a combination of nutrient input from river discharges and the stabilizing effect of the encroachment of offshore water.

The biotic resources of this section are keyed geographically using north-south UTM grid swaths.

### 5.7.1 Aquatic Resources

#### Widespread Species

The Mississippi Delta section is known as the "Fertile Fisheries Crescent," because it is one of the most productive fisheries in the world. The area heads the nation in volume of commercial fishery landings, with Gulf menhaden and brown and white shrimp being the major fisheries; this section produces by far the greatest shrimp harvest in the Gulf of Mexico. Over 98 percent of the species commercially caught in this section are estuarine-dependent; these include the blue crab, eastern oyster, brown and white shrimp, Gulf menhaden, Atlantic croaker, red and black drum, spotted and sand seatrout, southern and Gulf kingfish, southern and Gulf flounder, spot, striped mullet, and sheepshead. The seagrass beds, numerous estuaries, and vast tidal marshes, especially immediately around the Mississippi River Delta from Chandeleur Sound through Atchafalaya Bay, provide prime nursery grounds for these species. There is a large sport fishery for many of these species as well, especially spotted seatrout and red drum. Other marine and estuarine-dependent, recreational and commercial species of importance include sea catfish, tarpon, Florida pompano, red snapper, and Spanish mackerel.

The five marine turtles with special status are found in high salinity estuarine and Gulf of Mexico waters throughout the section.

Freshwater species also form an important fishery in the rivers, bayous, oxbows, and lakes of this section. Blue, flathead, and channel catfish, buffalo, gars, freshwater drum, bowfin, carp, and crayfish compose a recreational and commercial fishery, while white and black crappie, largemouth, white, and yellow bass, and several sunfish species provide for recreational fishing.

#### Geographic Inventory

Mississippi Sound (grid reference CJ64 to BJ63) is an important nursery area and commercial and recreational fishing ground for estuarine-dependent species. In particular, the seagrass beds on the inshore side of the barrier islands (grid reference CJ64 to BJ94) are primary shelter areas for juvenile as well as adult finfish and shellfish. Grass species composing these beds are dominated by widgeon grass and secondarily shoal grass, manatee grass, and turtle grass. The green sea turtle is attracted to the seagrass beds as a source of food.

Loggerhead sea turtles have been reported to nest on the Mississippi barrier islands (grid reference CJ64 to BJ94), although the reports are unconfirmed.

The passes leading into Mississippi Sound, including Petit Bois Pass, Horn Island Pass, Dog Keys Pass, Ship Island Pass, and South Pass (grid references CJ74, CJ54, CJ24, CJ04, and BJ94, respectively), are important conduits for the inshore and offshore movement of estuarine-dependent species to and from estuarine nursery and feeding grounds.

A commercial "sponge" blue crab sanctuary has been designated in Mississippi waters surrounding the barrier islands from grid reference CJ64 to CJ04. This area is a major blue crab spawning ground and, therefore, female blue crabs in the egg-carrying (sponge) condition are protected from harvesting.

A commercial shrimp management sanctuary has been designated in Mississippi waters within 0.8 kilometers (0.5 miles) of the mainland and in all bayous and bays in the coastal area (grid reference CJ65 to BJ54) with the exception of two pipeline ditches in Hancock County. These shallow, sanctuary areas are critical for the development of young brown and white shrimp and as a result are closed to commercial shrimping.

The Atlantic sturgeon, an endangered species in Mississippi, migrates up the Pascagoula River (grid reference CJ45 to CK33). The unicolor mussel, a threatened mussel in Mississippi, is found farther up the Pascagoula River (grid reference CJ49 to CK33) and within the Red Creek Wildlife Management Area (grid reference CJ29).

The Atlantic sturgeon has also been found in Biloxi Bay and the lower Biloxi River (grid reference CJ26 to CJ07).

Peripheral sightings of the West Indian manatee have been made at grid references CJ24 and BJ86, in Dog Keys Pass and the Wolf River, respectively.

Mississippi's largest productive oyster reefs, known as Pass Christian Tonging Reef and Pass Christian Dredging Reef, lie off Pass Christian at grid reference BJ85. These reefs constitute one of the largest, nearly continuous oyster reefs in the world.

The waters in Louisiana from South Pass through Grand Island Pass (grid reference BJ84 to BJ53) are State Red Line oyster areas. Oyster reefs in Red Line areas are natural seed grounds in which private leases are prohibited; however, 80 percent of oysters planted on private leases are transplanted from Red Line seed grounds.

The Pearl River (grid reference BJ53 to BK33) is a migration route for the Atlantic sturgeon. The non-tidal, freshwater portions of the Pearl River (grid reference BJ45 to BK33) support another Mississippi endangered fish species, the frecklebelly madtom, as well as three species of unusual distribution, the bluenose shiner, river redhorse, and freckled darter.

The neighboring West Pearl and Bogue Chitto Rivers (grid reference BJ44 to YE63) support several of these unique species, including the Atlantic sturgeon, river redhorse, and freckled darter.

Rigolets Pass (grid reference BJ43 to BJ34), connecting Mississippi Sound with Lake Pontchartrain, is an important corridor for the movement of

estuarine-dependent species between these two nursery grounds. The brackish-water clam is harvested from the nursery grounds in Lake Pontchartrain and Lake Maurepas (grid reference BJ34 to YD34), and the shells are used for road construction.

The rivers draining into Lake Pontchartrain and Lake Maurepas are known as the Florida Parish rivers and include the Tchefuncta River (grid reference YD76 to YE52), Tangipahoa River (grid reference YD65 to YE43), Tickfaw River (grid reference YD45 to YE23), and Amite and Comite Rivers (grid reference YD35 to XE83); portions of all five rivers have been designated by Louisiana as Natural and Scenic Rivers. They are spring-fed, swift, clear, and shallow and, as a result, support rock bass, a popular sport species which is not common in other Gulf coast streams. Other important species include catfish, spotted bass, warmouth, and crappies. The anadromous Atlantic sturgeon and Alabama shad migrate into these rivers.

The Chandeleur Islands (grid reference CJ12 to CH19) are unique to this area, in that they resemble the coast of southern Florida with sand beaches, clear water, and black mangroves. Extensive seagrass beds, consisting of turtle grass, manatee grass, and shoal grass, border the inshore side of the island chain and serve as a nursery for estuarine-dependent fish and shellfish species. Loggerhead sea turtles nest on the seaward side of the islands.

The western border of Chandeleur Sound, from the Mississippi-Louisiana border to Point Paulina (grid reference BJ94 to BH89), and the western border of Breton Sound, from Eloi Bay to Raccoon Pass (grid reference BH79 to BH65), are State Red Line oyster areas, that is, natural seed areas where private leases are prohibited. These areas, along with the other oyster reefs on the east side of the Mississippi River represent 80 to 90 percent of the state's oyster reefs. The most productive oyster grounds are between Mozambique Point and California Point (grid reference BH57 and BH56).

The continental shelf becomes quite narrow near the mouth of the Mississippi Delta, and the 183-meter (600-foot) contour (grid reference DH04 to CH20) approaches close to shore. Beyond this contour is a major sportfishing area for sailfish, blue and white marlin, and blackfin tuna. The endangered finback and sperm whales also are found in these deep waters.

The lower Mississippi Delta (grid reference BH84 to BH62) provides sportfishing opportunities for marine and freshwater species. Spotted seatrout, Atlantic croaker, red drum, and tarpon are caught throughout the area, often in association with oil and gas platforms, such as at grid references BH94 to CH03, BH80 to BH71, and BH61, which act as artificial reefs. Freshwater species, such as blue catfish, white and black crappie, largemouth bass, sunfish, freshwater drum, and yellow bass, are sought in impoundments and distributaries, such as in Delta National Wildlife Refuge (grid reference BH83). Blue catfish is the most important commercial species in the lower delta.

Thompson Creek (grid reference XD69 to XE73) and Bayou Sara (grid reference XE50 to XE53), tributaries to the Mississippi River, are typical Florida Parish rivers and support rock bass, as well as the bluntnose minnow, which is at the southern end of its range. The former creek also supports bluntface shiner and rainbow darter, both of which are at the southern end of their

ranges and disjunct from most of the other populations. A portion of Bayou Sara has been designated by Louisiana as a Natural and Scenic River.

False River (grid reference XD58 to XD59) and Raccourci Old River (grid reference XE31 to XE21), both oxbow lakes of the Mississippi River, offer excellent sportfishing opportunities for black and white crappie, largemouth bass, and sunfish. Catfish are commercially and recreationally sought in Raccourci Old River. The oxbows also serve as spawning and nursery areas for these freshwater species during the spring floods.

Quatre Bayoux Pass, Grand Terre Island Pass, and Barataria Pass (grid reference BH24 to BH14) are important deep tidal passes for the movement of estuarine-dependent fish and shellfish into and out of the feeding and nursery grounds of Barataria Bay (grid reference BH15). The Barataria Bay basin (grid reference BH24 to YD31), including Little Lake (grid reference YC86), Lake Salvador (grid reference YC96), and Lac des Allemands (grid reference YD31), is the most productive of the Louisiana estuaries. It is responsible for nearly half of the fish harvest on the Louisiana coast and produces more Atlantic croaker, black and red drum, sand and spotted seatrout, gars, blue crab, shrimp, and oysters than any other Louisiana estuary. The nutrient input from the Mississippi River, subtropical climate, abundant rainfall, marshes, and the nutrient (organic and mineral) cycling by tidal flushing are responsible for the great productivity.

Caminada Pass, Belle Pass, Little Pass Timbalier, Cat Island Pass, Wine Island Pass, Whiskey Pass, Grand Pass de Ilettes, Bayou Grand Caillou, and Oyster Bayou (grid references YC83, YC72, YC51, YC32, YC31, YC11, YCO2, YCO2 to YCO3, and XC83, respectively) are major deep tidal passes through which estuarine-dependent finfish and shellfish move to and from estuarine feeding and nursery grounds. The estuaries and marshes behind these passes (grid reference YC83 to XC64), like those of the Barataria Bay basin, are important nurseries, feeding grounds, and commercial and recreational harvest areas for estuarine-dependent species, including brown and white shrimp, blue crab, flounder, and the major drum species, especially spotted seatrout.

The Atchafalaya River basin (grid reference XC79 to XD26) is one of the prime freshwater commercial fishing areas in Louisiana. Over half of the state's yield of crayfish comes from this basin. Other species of commercial importance include frogs, blue and channel catfish, gars, buffalo, freshwater drum, bowfin, and carp. Recreational species include the above, as well as largemouth, spotted, yellow, and white bass, black and white crappie, and sunfish.

Brackish-water clams are harvested from Atchafalaya Bay, East and West Cote Blanche Bays, and Vermilion Bay (grid reference XC65 to WC88). These bays, and the surrounding marshes, are also nursery areas for estuarine-dependent species. The relict oyster reefs at the mouth of Atchafalaya Bay (grid reference XC64 to XC26) attract sport fish species, including spotted and sand seatrout and black and red drum.

The shoals off Atchafalaya Bay (grid references XC33 to XC12 and XC32 to XC11) are important fishing grounds for brown and white shrimp and industrial bottomfish, such as Atlantic croaker, spot, and silver seatrout. This area is

one of the most productive nearshore shrimping grounds, especially for white shrimp, in the Gulf of Mexico. The freshwater influence of the Atchafalaya River over the shoals appears to be particularly conducive to shrimp production.

The oyster reefs along Marsh Island (grid reference XC25 to WC97) attract such sport fish as spotted and sand seatrout, Atlantic croaker, and red drum.

Trinity Shoal and Tiger Shoal (grid reference XC05 to WC63) form another major commercial shoal area for the harvesting of white and brown shrimp, Atlantic croaker, spot, and silver seatrout.

Southwest Pass (grid reference WC97) is a deep tidal pass through which estuarine-dependent finfish and shellfish move on their way to and from the estuarine nursery and feeding grounds of Vermilion Bay (grid reference XC08 to WC88).

### 5.7.2 Terrestrial Resources

#### Widespread Species

A number of terrestrial plants of special concern in Mississippi occur in the Mississippi Delta section, including false-leaved false-foxglove, false-coco, Juneberry holly, Carolina lilaeopsis, naked-stemmed panic-grass, Chapman's butterwort, yellow fringeless orchid, American chaffseed, and Drummond's yellow-eyed grass. Black mangroves have an unusual northern distribution within this section.

Bald eagles and peregrine falcons winter and American alligators are permanent residents throughout the section. Wood storks, brown pelicans, gopher tortoises, red-cockaded woodpeckers, and eastern indigo snakes have more limited distributions.

The extensive wetlands throughout this section provide habitat for many breeding, migrating, and wintering shorebirds and waterfowl, as well as furbearers like muskrat and nutria. Other abundant mammals include bobcat, whitetail deer, mink, river otter, and raccoon, many of which are hunted throughout the section.

Louisiana has for many years led the nation in production of wild fur. In the coastal marshes, muskrat, nutria, raccoon, and mink compose the bulk of the fur harvest of the state. Nutria has been the most abundant furbearer taken since 1962, usually one to two million pelts annually, constituting 70 to 80 percent of the furbearers trapped. Approximately 400 to 500 thousand muskrat pelts are taken annually.

#### Geographic Inventory

The Pascagoula River marshes from grid reference CJ46 to CJ47 are important wetlands for waterfowl. They contain 6,000 hectares (15,000 acres) of some of the most unspoiled brackish marsh on the Mississippi coast, and provide wintering habitat for about 2,500 wood ducks and other dabblers, as well as a few diving ducks.

The only population of Mississippi sandhill cranes in the world occurs as a resident species of Jackson County, Mississippi, around the area of grid reference CJ46 to CJ28. There are probably only 40 to 50 individuals left in the wild; most occupy the national wildlife refuge at grid reference CJ27 to CJ46.

Peregrine falcons winter on islands from grid reference CJ64 to BJ94, and on Deer Island at grid reference CJ26. Deer Island is also an excellent location to observe transient and wintering birdlife, especially following storms in April or early May. The stands of large live oaks and other vegetation teem with great numbers of migrating small land birds, such as flycatchers, vireos, and warblers.

The rainbow snake and yellow-blotched sawback turtle inhabit grid reference CJ37 to CJ47. This turtle along with the endangered southern hognose snake occur from grid reference CJ38 to CK20. The yellow-blotched sawback turtle also can be found from grid reference CJ48 to CK31, along with the possible occurrence of the Florida panther.

The black bear is threatened in Mississippi and has been documented from grid references CK30 and CK11, as well as in De Soto National Forest (grid reference CJ18 to CK12).

Bald eagles have been found consistently at grid reference CJ07.

The yellow-blotched sawback turtle occurs at grid reference CJ18 to CK10, and the southern hognose snake has been found at grid reference CK10, both in the Red Creek Wildlife Management Area.

The black pine snake and the black bear occur from grid reference BK72 to BK22, in the De Soto National Forest.

An important breeding location for the brown pelican occurs at grid reference BJ83. This area and the area around grid reference BJ82 are major nesting areas for shorebirds and terns, and winter concentration areas for geese.

Grid reference BJ75 contains habitat for the southern hognose snake.

Among the numerous plants of special concern and widely distributed animals occupying the area of the Mississippi Test Facility (grid reference BJ65 to BJ48) is the more localized rainbow snake and possibly the Florida panther.

Bald eagles are known to use the area at grid reference BK51; the black pine snake inhabits this area and the Wolf River Wildlife Management Area at grid reference BJ69 to BK53.

The Pearl River Delta (grid reference BJ44) contains some of the best waterfowl habitat in Louisiana as well as a bald eagle nest. The area is composed of bottom land hardwoods like bald cypress and tupelo, swamps, and marshes.

The Pearl River Wildlife Management Area (grid reference BJ45 to BJ49) contains a unique vegetation association of dense stands of spruce pine and palmetto, unusual in Louisiana. The Florida panther may inhabit the area, but this is unconfirmed. Stands of the rare saw palmetto also occur along the northeast shore of Lake Pontchartrain at grid reference BJ33 and BJ15.

Although not mapped because no recent documentation has been made, the Bachman's warbler was once plentiful in the woods near Mandeville (grid reference YD76 to YD86), and possibly still may occur there.

A large area for the red-cockaded woodpecker extends from grid reference YD46 to YE53.

The largest white ibis nesting colony in coastal Louisiana, Mississippi, or Alabama is found at grid reference YD46. Over 60,000 of these birds nest here annually.

Original growth trees occur in a virgin swamp community at grid reference YD25, and the largest living specimen of the laurel oak exists at grid reference YD35.

At grid reference YD05 is an American Forestry Association national and state champion coast pignut hickory tree with a height of 38.4 meters (126 feet), circumference of 4.4 meters (14 feet, 5 inches), and spread of 27.7 meters (91 feet).

Nearby, at grid reference YD34, high wintering concentrations of dabbling ducks occur.

The islands from grid reference CH19 to CJ22 are important for migrating peregrine falcons and small land birds, breeding shorebirds, wading birds, and brown pelicans, and wintering waterfowl.

Curlew Island (grid reference CH07) has been the site of one of the largest nesting colonies of sandwich and royal terns in the north Gulf of Mexico.

The marshes from grid reference BH19 to BJ80 are concentration areas for numerous ducks and geese in winter, as well as for shorebird breeding.

The wetlands of the Mississippi River mouth (grid reference BH92 to BH54) contain a unique population of marsh deer. Approximately 150 to 200 individuals live on the alluvial ridges in the delta. Marsh deer are smaller, darker, and have smaller in-turned antlers and bigger hooves than other whitetail deer; these are adaptations for survival in the marsh environment. This entire area is also important for wintering ducks and geese.

Queen Bess Island (grid reference BH14) is one of the few nesting locations in Louisiana for the brown pelican. This species has been reintroduced after becoming extinct in the state in the 1960's.

Two important bald eagle nesting areas occur at grid references YC88 and YD50.

The Isles Dernieres (grid reference YC21 to XC91) are the only large islands relatively free of development left in Louisiana. They are remote, nearly wild, and heavily used by shorebirds, seabirds, and wading birds for feeding, resting, and nesting.

Bald eagles nest within grid references YC05, YC07, XC87, and XD85. This represents the greatest nesting concentration of eagles on the northern Gulf coast.

The few native black bears that remain in Louisiana today are confined largely to the heavily wooded bottom land hardwood terrain of the south-central part of the state, particularly from grid reference XC66 to XC69.

As the second largest wilderness area in the United States, the Atchafalaya River basin covers approximately 405,000 hectares (1,000,000 acres) of swamp and marshland from grid reference XC66 to XD27. It is probably the largest remaining overflow swamp in the United States and has outstanding value for wildlife by providing habitat for a great diversity of resident and migratory species, including possibly the Florida panther and ivory-billed woodpecker. Due to poor documentation, the ivory-billed woodpecker has not been mapped. It is one of America's rarest birds and may be extinct, although there have been two recent sightings: one in 1971 (confirmed from a photograph) and one unconfirmed, but apparently reliable, sighting in 1980, both in the Atchafalaya basin.

## 5.8 STRANDPLAIN-CHENIER PLAIN SYSTEM (GRID REFERENCE WC76 to UC56)

The Strandplain-Chenier Plain System section extends from the western end of Vermilion Bay, Louisiana (grid reference WC76) to Galveston Bay, Texas (grid reference UC56). This area is affected by the discharges of several small rivers directly into the Gulf, without large bays or barrier island systems. Extensive brackish and freshwater marshes in low-lying coastal areas are frequently broken by remnants of former beach ridges (cheniers). Offshore areas are characterized by a modest tidal range of about 0.6 meters (2 feet), turbid water, and high biological productivity.

The biotic resources of this section are keyed geographically using north-south UTM grid swaths.

### 5.8.1 Aquatic Resources

#### Widespread Species

This section is at the western end of the Fertile Fisheries Crescent and yields large numbers of finfish and shellfish, especially brown and white shrimp and Gulf menhaden. Other major recreational and commercial species that are widespread in the Gulf of Mexico waters in this section include blue crab, spotted, silver, and sand seatrout, red and black drum, Atlantic croaker, spot, southern kingfish, sheepshead, southern flounder, sea catfish, and red snapper. The five sea turtles with special status also are found in these waters.

The reefs scattered throughout this section are almost all artificial, composed of oil and gas platforms. They attract many sport fish species, including red snapper, spadefish, cobia, bluefish, groupers, and Spanish mackerel.

The cheniers and beach ridges along the coast limit salt water intrusion into the marshes. As a result, the coastal marshes of the section are generally of low salinity. They serve as nursery grounds for estuarine-dependent crabs, shrimp, and fish and also support all life stages of freshwater species such as blue and channel catfish, largemouth bass, black and white crappie, sunfish, freshwater drum, and alligator gar. These freshwater fish are sought recreationally; in addition, the catfish, freshwater drum, and gar are harvested commercially.

Geographic Inventory

The marshes southeast of White Lake (grid reference WC78 to WC57) are an important commercial and recreational fishing area for crayfish.

The White Lake-Grand Lake system (grid reference WC58 to WD11) is considered a "semi" estuary, because a control structure at the mouth of Grand Lake isolates the system from year-round marine influence. The control structure generally is closed in the spring, inhibiting the entry of estuarine-dependent species, although there is commercial and recreational fishing for shrimp and blue crabs. The major fishing activity is oriented to freshwater species, including catfish, alligator gar, largemouth and yellow bass, crappies, and sunfish.

The lake within Lacassine National Wildlife Refuge (grid reference WD11 to WD01) provides excellent largemouth bass fishing.

The Rockefeller Wildlife Refuge (grid reference WC47 to WC08) has numerous bayous, lakes, and marshes which are popular sportfishing areas for shrimp, blue crab, spotted and sand seatrout, Atlantic croaker, red and freshwater drum, southern flounder, and alligator gar.

Sabine Bank, a hard, sand bottom ridge extending from grid reference VC75 to UC94, is a major commercial fishing ground for white and brown shrimp.

Calcasieu Pass (grid reference VD69) is an important deep tidal pass for the movement of estuarine-dependent finfish and shellfish into and out of estuarine nursery and feeding grounds in Calcasieu Lake and the surrounding marshes (grid reference VD70); these important nursery and feeding grounds support brown and white shrimp, blue crab, eastern oyster, Gulf menhaden, spotted seatrout, Atlantic croaker, red and black drum, sheepshead, and southern flounder. With the exception of the Gulf menhaden, these species are commercially and/or recreationally sought in the lake.

The bayous, marshes, and lakes of Sabine National Wildlife Refuge (grid reference VD40) offer a wide variety of sportfishing opportunities, including freshwater catfish, bass, crappie, and sunfish and estuarine spotted seatrout, red drum, and southern flounder.

Sabine Pass (grid reference VC18 to VC19) and Sabine Lake and its surrounding marshes (grid reference VC19 to VD21) perform functions similar to Calcasieu Pass and Lake, described above.

The paddlefish, an endangered species in Texas, has been reported in Taylor Bayou (grid reference UD90 to UD70). This area represents the southwest limit of the species' range. However, paddlefish populations are declining throughout their range.

The East Rigs (grid reference UC86) and Fathom Rigs (grid reference UC93) attract such inshore sport reef species as sheepshead, cobia, bluefish, and Spanish and king mackerel.

### 5.8.2 Terrestrial Resources

#### Widespread Species

Common species with widespread distributions in this section include many wading bird species, which breed and winter in wetland areas; in addition, waterfowl concentrate in large numbers during fall and winter, and are hunted for sport. Many migrating and overwintering songbird species use coastal hardwood areas. Whitetail deer also are common and are hunted. Mink, river otter, nutria, muskrat, and raccoon are trapped commercially for their fur; muskrat and nutria are especially abundant.

Widespread species with special status include peregrine falcons, brown pelicans, American alligators (which are hunted commercially), and red wolves.

#### Geographic Inventory

The marshes from grid reference WC59 to WD30 contain over 40,000 hectares (98,000 acres) and support the second largest concentrations of wintering waterfowl in Louisiana, over 165,000 birds annually. It has been a traditional major wintering area for mallards, and as many as 100,000 blue-winged teal have been observed here during migration.

Although Canada goose populations have declined greatly in Louisiana in recent years due to changes in migratory patterns, a resident population still exists around and on the Rockefeller Wildlife Refuge (grid reference WC08 to WC47).

The wetlands from grid reference WD21 to WD31 support about 60,000 wintering waterfowl annually, mostly gadwall and mallard. During September, some of the largest concentrations of blue-winged teal (about 25,000) in southwest Louisiana utilize the marshes and surrounding rice fields.

The roseate spoonbill is unusual in southwestern Louisiana, and the breeding colonies at grid references WD11 and VD21 are the northernmost for the species. Spoonbills in Louisiana do not migrate, but remain in southwestern marshes year-round.

Wintering populations of ducks and geese at Lacassine National Wildlife Refuge (grid reference WD11) are among the largest in the nation, with concentrations sometimes of 750,000 birds. More than a dozen species use these marshes, and the white-fronted goose is here in the greatest concentrations in the Mississippi Flyway. Fulvous whistling-ducks nest in the rice fields and concentrate here in spring and fall in the largest numbers of any United States refuge. At least 13 species of wading birds are present and most nest in the refuge. In summer, there may be over 5,000 white-faced ibises and tens of thousands of other waders; colonies often contain as many as 10,000 birds in an area as small as 2 hectares (5 acres). Bald eagles regularly winter in the refuge.

Sabine National Wildlife Refuge (grid reference VD20 to VD80) occupies nearly 58,000 hectares (143,000 acres) and is the largest waterfowl refuge on the Gulf coast. It also has an estimated 9,000 American alligators, and every year registers one of the nation's highest number of species in the Audubon Christmas Bird Count.

The marshes surrounding Johnson's Bayou (grid reference VC19 to VC39) cover over 22,000 hectares (54,000 acres) and support some of the most productive furbearer and waterfowl habitat in southwest Louisiana. Nearly 93,000 waterfowl winter here annually; most are dabblers, such as gadwall, green-winged teal, pintail, and one of the largest breeding and wintering populations of mottled duck, numbering about 1,000.

At grid reference VD21 is a major wading bird colony sometimes containing over 36,000 birds of several species, including roseate spoonbills.

Bald eagles winter in the area from grid reference VC28 to VD21.

Sea Rim State Park (grid reference VC09) provides habitat for many species, including the white ibis (threatened in Texas) and bald eagles.

Of great importance to wintering populations of migratory waterfowl in the Central Flyway is McFaddin Marsh National Wildlife Refuge (grid reference UC77 to UC98). In addition to 60,000 snow geese, ducks number up to 100,000 birds of 23 species. The mottled duck uses the marsh for summer nesting and is the only resident waterfowl species found in these coastal marshes. This area was one of the last strongholds for the red wolf; it now contains one of the densest populations of American alligators in Texas.

The marsh adjacent to Anahuac National Wildlife Refuge (grid reference UC67 to UC68) provides fee hunting for a harvest of up to 10,000 to 12,000 ducks and 2,000 to 6,000 geese. The area has high habitat value for snow geese and mottled duck.

Among birdwatchers, Anahuac National Wildlife Refuge (grid reference UC57) is famous for its rails, where five and perhaps six species can be seen in spring migration. There are also large waterfowl concentrations from November to January, occasionally with 50,000 snow geese. Sometimes masked ducks appear at the refuge, where their first confirmed nesting in the United States was recorded.

Reddish egret and white-faced ibis nest at grid reference UC56.

## 5.9 TEXAS BARRIER ISLAND SYSTEM (GRID REFERENCE UC56 to PD87)

The Texas Barrier Island System extends from Galveston Bay (grid reference UC56) to the Texas-Mexico border (grid reference PD87). Stream discharge from several small rivers generally decreases from northeast to southwest, accompanied by an improvement in water clarity to the south. A long series of barrier islands protects coastal bays and lagoons. The Laguna Madre in south Texas is so isolated by nearly continuous barrier islands that evaporation often exceeds discharge and exchange with Gulf waters, occasionally resulting in hypersalinity. Seagrass beds and oyster reefs are common in this area. Water temperatures are variable; ice formation has been recorded in bays along the northern coast, and the climate along the south coast is sufficiently mild to support limited sprouting and survival of mangroves.

The biotic resources of this section are keyed geographically using east-west UTM grid swaths.

### 5.9.1 Aquatic Resources

#### Widespread Species

The topography of the continental shelf in this section is relatively complex with numerous rock and coral outcrops as well as oil and gas platforms and sunken ships. These natural and artificial reefs attract such sport species as greater amberjack and other jacks, great barracuda, sharks, gag, jewfish, warsaw grouper, red snapper, cobia, and Spanish and king mackerel. Many of these species, especially the red snapper, are pursued commercially. The reefs also have associated with them such primary reef species as damselfish, butterflyfish, angelfish, cardinalfish, triggerfish, and squirrelfish.

Other recreationally and commercially important species common to the Gulf of Mexico in this section include brown and white shrimp, spotted and silver seatrout, Atlantic croaker, red and black drum, southern and Gulf kingfish, sheepshead, southern flounder, striped mullet, Florida pompano, bluefish, and sea and gafftopsail catfish. The coastal Gulf of Mexico waters throughout this section have some of the highest commercial yields of shrimp, in particular brown shrimp, in the entire Gulf of Mexico.

The five marine turtles with special status also occur in the Gulf of Mexico waters in this section.

The estuaries and their associated grass beds and marshes in this section act as nursery grounds and adult feeding and harvesting areas for such estuarine-dependent species as brown and white shrimp, blue crab, spotted and sand seatrout, red and black drum, Atlantic croaker, southern and Gulf kingfish, sheepshead, southern flounder, striped mullet, and sea and gafftopsail catfish. The nursery areas generally are confined to the bay shallows, seagrass beds, and surrounding marshes. In particular, the Texas State Legislature has designated most tributary bays, bayous, inlets, lakes, and rivers in the state as "nursery areas." These areas serve as significant

growth and development habitats for postlarval and juvenile shrimp and, with some exceptions, are off-limits to commercial fishing.

Tidal passes serve as major migration routes for the movement of estuarine-dependent species to and from estuarine nursery grounds. Adult fish tend to concentrate around oyster reefs and artificial structures and the deeper portions of the estuaries. With the exception of snapper, grouper, and commercial shrimp fishing, most fishing in this section occurs within the estuaries.

Freshwater fish found in the rivers and lakes of the Texas Barrier Island section include channel, blue, and flathead catfish, largemouth and spotted bass, white and black crappie, sunfish, gar, buffalo, freshwater drum, and carp. The catfish, gar, buffalo, freshwater drum, and carp are harvested commercially, while all are pursued for sport. Most freshwater systems in this section occur in the northern portions, as far south as Corpus Christi Bay; the remainder of the coast is arid, with little runoff.

Geographic Inventory

Heald Bank (grid reference UC82 to UC60), a hard sand bottom ridge, is a major commercial white and brown shrimp fishing ground, in the middle of one of the major shrimping areas in the Gulf of Mexico.

The Trinity River Delta (grid reference UC39) and the lower San Jacinto River (grid reference UC18 to TC99) are important nursery areas for estuarine-dependent finfish and shellfish species.

The Galveston Bay system (grid reference UC34 to UC18), including East Bay, Trinity Bay, and West Bay (grid references UC56 to UC36, UC39 to UC27, and UC24 to TC92, respectively), receives the most fishing pressure of any Texas bay system, because it is close to major population centers. Most sportfishing activity occurs around oyster reefs, channel edges, buoys, and oil platforms, and is oriented to spotted and sand seatrout, Atlantic croaker, southern flounder, and to a lesser extent black and red drum and sheepshead. The bay system usually has one of the highest commercial yields of any Texas bay and often leads in production of brown and white shrimp and blue crab. Over the past several years, 50 to 90 percent of all oysters harvested in Texas have come from Galveston Bay; of those, 90 percent have come from Redfish Reefs (grid reference UC26).

The tidal pass to Galveston Bay (grid reference UC34 to UC24) and San Luis Pass (grid reference TC91) are major migration routes for the movement of estuarine-dependent finfish and shellfish to and from estuarine nursery grounds.

The platforms of the Buccaneer Gas and Oil Field (grid reference UB39) act as artificial reefs and, with the associated encrusting organisms, attract numerous sport fish species, including sharks, red snapper, little tunny, king mackerel, bluefish, and cobia.

East Bank (grid reference TB78) is a major sportfishing area for Spanish and king mackerel and young red snapper in the winter. Inside of East Bank is an important white shrimp spawning area.

A liberty ship was intentionally sunk near the V.A. Fogg (grid reference UB26) as an artificial reef habitat; it attracts such species as sharks, groupers, jacks, red snapper, and mackerel.

Claypile Bank (grid reference UB83) and Stetson Bank (grid reference UB71) are major topographic features of the Texas continental shelf. Although less diverse than other offshore topographic features, they both are characterized by sponges, and at Stetson Bank, Millepora coral; Claypile Bank has filamentous and leafy algae. Red snapper and several grouper species are abundant at these banks and support a large commercial and recreational fishery.

The tidal passes from grid reference TB59 to TB06 are important migratory routes for the movement of estuarine-dependent finfish and shellfish to and from estuarine nursery grounds.

The Matagorda Bay system (grid reference QG66), including East Matagorda Bay, Tres Palacios Bay, Carancahua Bay, and Lavaca Bay (grid references TB38 to TB18, QG77, QG57, and QG37, respectively), has the second highest yield of shrimp and oysters of the eight major Texas bay systems. The seagrass beds, composed mainly of widgeon grass and shoal grass, and shallow bay margins provide nursery and feeding areas for estuarine-dependent finfish and shellfish species. Major commercial and recreational species include brown and white shrimp, eastern oyster, blue crab, spotted and sand seatrout, Atlantic croaker, red and black drum, sheepshead, southern flounder, and gafftopsail catfish. The Matagorda Bay system also has a high density of Atlantic bottlenose dolphin.

Dog Island Reef (grid reference TB06 to QG97) and Shell Island Reef (grid reference QG86 to QG87) are the major oyster producing reefs in the Matagorda Bay system.

Cavallo Pass (grid reference QG54) and Cedar Bayou (grid reference QG10) are major migratory routes for the movement of estuarine-dependent finfish and shellfish to and from estuarine nursery grounds.

The Matagorda Liberty Ship Reef (grid reference QG81) is a series of three, deliberately sunk, liberty ships, which attract such sport species as groupers, red snapper, sharks, cobia, sheepshead, and Spanish and king mackerel.

The San Antonio Bay system, including Espiritu Santo, Ayres, and Mesquite Bays (grid reference QG54 to QG11) is one of the least disturbed bays in the Texas Barrier Island section. The shallows, marshes, and seagrass beds are important nursery and feeding areas for estuarine-dependent species, of which blue crab, oysters, shrimp, red drum, spotted seatrout, black drum, and southern flounder are commercially and recreationally the most important.

The Guadalupe River (grid reference QG14 to PH70) and San Antonio River (grid reference QG05 to NH90) systems have some of the most diverse fish populations of any Gulf coast rivers in Texas. Both the Guadalupe River (grid reference PH70) and the San Antonio River (grid reference PG29 to NH90) support the river darter, a threatened species in Texas. This species is at the southwest limit of its range and is disjunct from its main population center in the Mississippi Valley.

The Copano-Aransas Bay complex (grid reference QG01 to PG70 and QG01 to PF98) yields one of the highest commercial finfish harvests of any of the Texas bays. Major species include red drum, spotted seatrout, black drum, sheepshead, and southern flounder. The flounder harvest is the largest of all Texas coastal bays; blue crabs also are harvested in large numbers. Major recreational species include the above, as well as sheepshead and sand seatrout.

Aransas Pass (grid reference PF98) is a major migratory route for the movement of estuarine-dependent finfish and shellfish to and from estuarine nursery areas.

Redfish Bay (grid reference PF88) contains large beds of seagrasses, consisting mainly of shoal grass, widgeon grass, and turtle grass, which provide shelter and nursery areas for estuarine-dependent species.

The South Texas Banks (grid reference QF77 to QF43) are the most important commercial and recreational snapper and grouper fishing grounds along the Texas coast. This group of topographic features, consisting of North and South Baker Banks (grid references QF77 and QF76 to QF66), Aransas and Hospital Banks (grid reference QF45 to QF44), and Southern Bank (grid reference QF43), generally is characterized by Antipatharian coral and sponges. Major fish include red and vermilion snapper, groupers, greater amberjack, and great barracuda, as well as primary reef fishes.

The reef at grid reference QF15 is a deliberately sunk liberty ship, which provides artificial reef habitat to attract such sport fish as sharks, groupers, red snapper, bluefish, cobia, and Spanish and king mackerel.

Corpus Christi Bay and Nueces Bay (grid reference PF87 to PF48) provide feeding and nursery areas for commercially and recreationally important estuarine-dependent species. These bays have a relatively high production of finfish, including spotted seatrout, red and black drum, sheepshead, and southern flounder, but a relatively low production of blue crabs and shrimp. Commercial production of oysters in the bay is virtually nonexistent due to devastation by slime mold disease and reduced freshwater inflow.

The Nueces River (grid reference PF48 to NG92) represents a faunal break separating the central and southern basins of Texas and marks the southwest range limit for most of the eastern lowland/Mississippi Valley freshwater fish species.

Lake Corpus Christi (grid reference PG00) offers excellent freshwater sportfishing opportunities. Channel, blue, and flathead catfish are the major species taken; white crappie is next in importance.

Seagrasses are widespread throughout the Laguna Madre system with shoal grass and to a lesser extent widgeon grass dominating Upper Laguna Madre (grid reference PF76 to PE58) and shoal grass, widgeon grass, manatee grass, and turtle grass in Lower Laguna Madre (grid reference PE56 to PD88). The grasses are an important habitat for adult drums and seatrout and an important nursery area for juvenile estuarine-dependent finfish and shellfish.

Upper and Lower Laguna Madre are unequaled in the Texas bay system in the commercial production of finfish. Red and black drum and spotted seatrout are the major species; 53 percent of the total Texas catch of black drum and 60 percent of the total Texas catch of red drum are harvested from Laguna Madre. Hypersaline conditions combined with instability of other physical parameters are responsible for the lower species diversity, but high individual numbers, in these lagoons.

The oyster beds of South Bay (grid reference PD88 to PD87) are the only commercially producing beds in the entire Laguna Madre system.

Brazos Santiago Pass (grid reference PD88) is a major migratory route for the movement of estuarine-dependent finfish and shellfish to and from estuarine nursery grounds.

The green sea turtle is found in relatively high numbers among the extensive seagrass beds in Lower Laguna Madre (grid reference PE56 to PD87).

An experimental sea turtle release program is taking place at Malaquite Beach on Padre Island (grid reference PF63 to PF62). Eggs of the Kemp's Ridley sea turtle are collected as they are laid on a beach near Tampico, Mexico, the only known Gulf of Mexico nesting beach for this species. The eggs are immediately placed in containers filled with Padre Island sand where they incubate. It is hoped that this process enables the turtles to imprint on Padre Island sand. Just before hatching, the eggs are transported to Malaquite Beach, where the species historically nested; as they hatch, the turtles are released to allow for further imprinting. Once they reach the water, they are collected and kept in tanks until they are old enough to survive with minimum predation. They then are released permanently into the Gulf of Mexico.

Another group of south Texas banks, characterized by Antipatharian coral and sponges, is located between grid reference QE29 and QE26. These banks are major commercial and recreational fishing areas for red snapper and grouper and major recreational fishing grounds for vermilion snapper, greater amberjack, and great barracuda. These banks include Dream Bank (grid reference QE29), Small and Big Adam Rock (grid reference QE18), Blackfish Ridge (grid reference QE27), and Mysterious (grid reference QE26).

Steamer Bank (grid reference PE76) and Seabree Bank (grid reference QE02 to PE92) are major inshore commercial red snapper banks. An artificial liberty ship reef is located on Seabree Bank.

The Rio Grande cichlid, found in the coastal rivers of southernmost Texas (landward of grid reference PE61 to PD85), is the northernmost representative of its neotropical fish family, and is the only cichlid native to the United

States. It is a popular sport fish and has been introduced to spring-fed central Texas rivers.

The West Indian manatee is a casual visitor to the mouth of the Rio Grande (grid reference PD87) and may be a remnant of a northern Gulf of Mexico population. High salinities are believed to prevent year-round occurrences.

### 5.9.2 Terrestrial Resources

#### Widespread Species

Coastal beaches host numerous shorebirds, small islands and shellbars provide nest sites for American oystercatchers, wetlands support herons and egrets, coastal hardwood woodlots are important for overwintering songbirds, and bays and marshes concentrate wintering waterfowl in this section. Common widespread mammals include bobcat, whitetail deer, gray fox, nutria, coyote, raccoon, badger, coati, mink, river otter, and peccary; some of these furbearers are trapped commercially. Badger, coati, and peccary are restricted to this section within the Gulf coast.

A number of special status raptors occur in this section. The peregrine falcon winters here, the osprey migrates through, and four other hawk species occur only in this section within the Gulf coast region. Similarly, several species of amphibians and reptiles as well as the ocelot and jaguarundi, only occur here. Most of these restricted species are found near the Texas-Mexico border. Other widespread special status species inhabiting this section include the least tern, white-faced ibis, reddish egret, and bald eagle.

#### Geographic Inventory

Restricted to this section of the Gulf coast, the Attwater's greater prairie chicken has been found at grid references UC05 and TC96.

Brazoria National Wildlife Refuge (grid reference TC81) offers habitat for large numbers of ducks, geese, and wading birds. Sometimes concentrations reach a thousand or more wood storks, 700 mottled ducks (some are permanent residents and breed here), and up to 400 roseate spoonbills. The refuge is an excellent birding area, especially in winter, and frequently it is the highest in the nation in number of species seen on the annual Audubon Christmas Bird Count.

A major breeding concentration area for bald eagles, a rare occurrence in this section, is located along the Brazos River between grid reference TC51 and TC54. Three of seven active nests in Texas in 1977 and 1978 were located here.

Attwater's greater prairie chickens inhabit open lands at grid references TC17, TD30, and TD11, and bald eagles concentrate during migration at grid reference TD22.

The marsh at grid reference TC50 to TB69 holds more than 500 sandhill cranes throughout the winter. More Canada and white-fronted geese use this section of marsh than any other marsh in Brazoria County.

The coastal salt marshes of San Bernard National Wildlife Refuge (grid reference TB59) contain ancestral wintering grounds of snow geese, which at times number 125,000. Concentrations of snow, Canada, and white-fronted geese peak in December and January. Nearby, bald eagles often can be found at grid reference TB49.

An island in Ayres Bay (grid reference QG11) contains one of the largest waterbird rookeries on the Texas coast. It supports rare breeding colonies of reddish egrets, brown pelicans, and roseate spoonbills, as well as the more common gulls, terns, and skimmers. The area is also one of the few Texas nesting grounds of the American oystercatcher.

American alligators are found in a particularly dense concentration at grid reference QG15.

Bald eagles are rare breeders in this section of the Gulf coast, but nests have occurred at grid reference PG95. One of only two nesting concentration areas for this species in Texas is found at grid reference QG06; at least four of seven or so recently active nests in Texas have been found here. Another location for breeding bald eagles occurs nearby at grid reference PG76.

A large area of importance to the endangered Attwater's greater prairie chicken extends from grid reference PG65 to QG04.

Whooping cranes are found on the Gulf coast only during winter from grid reference QG02 to QG43. Within this area, Aransas National Wildlife Refuge provides critical habitat for the 100 or so wild cranes in existence. The refuge also has the longest bird species list of any national wildlife refuge, about 350 species, including wood storks and Attwater's greater prairie chickens.

Nearby, at grid reference PG91, is Goose Island State Recreation Area, where the major species of importance is an overmature tree, a coast live oak, listed by the U.S. Forest Service as at least 1,000 years old. It measures over 11 meters (35 feet) in circumference, 13.4 meters (44 feet) in height, and has a crown spread of 27 meters (89 feet). It possesses historical significance and is recognized as the national champion of its species.

The Rob and Bessie Welder Wildlife Foundation (grid reference PG51 to PG61) is a private refuge of 3,150 hectares (7,800 acres), where 55 mammal species, 55 reptiles and amphibians, and 400 bird species have been identified, including wood storks.

Many of the islands from grid reference PF99 to PD78 provide nesting habitat for least terns, reddish egrets, and roseate spoonbills.

The only location for the endangered black lace cactus is at grid reference PF03.

Laguna Madre from grid reference PE58 to PE70 has long supported large concentrations of waterfowl, especially redhead ducks. Nearly 78 percent of the world population of this species winters in this area, where up to 490,000 have been recorded in past winters. The seagrass beds are important to the

diet of redheads and are the main reason they are attracted to this area. Laguna Madre is the primary waterfowl area in the lower Texas coastal zone and also has value for white and brown pelicans.

South Bird Island Sanctuary (grid reference PF64) is one of only a few islands in Upper Laguna Madre where white pelicans nest; this is the only saltwater nesting colony of white pelicans in the United States.

Within grid reference PE61 is the largest known breeding colony in Texas for the reddish egret. In 1976, there were 411 pairs representing 25 percent of all breeding pairs along the entire Texas coast. Populations have been increasing steadily since the 1960's low, for which pesticide levels were partially responsible.

Laguna Atascosa National Wildlife Refuge (grid reference PE61) serves as a transition zone for tropical and temperate biota. Many species common in Central America, and seen in few other places in the United States, occur here. This is the southernmost point in the Central Flyway for redhead ducks, which concentrate here in winter in huge numbers, along with other duck species. Sometimes over a million ducks can be found in the refuge. In spring, spectacular migrations of small land birds often occur. The bird list for the refuge contains over 330 species and is second only to Aransas among the nation's national wildlife refuges. Ocelot and jaguarundi have been recorded from here. Species regularly occurring here, but rare farther north, include black-bellied whistling-duck, least grebe, white-tailed and Harris' hawk, groove-billed ani, chachalaca, and kiskadee flycatcher.

Santa Ana National Wildlife Refuge (grid reference PD18) occupies only 1,584 hectares (3,913 acres) and is one of the nation's smallest refuges; yet it is called the jewel of the national wildlife refuge system, because it contains a remnant habitat representative of conditions once occurring on much of the Texas-Mexico border along the Rio Grande. The rich bottom land and thick lush vegetation contain numbers of plant and animal species found nowhere else in the United States, many at the northernmost limits of their range. Both the endangered ocelot and jaguarundi may be found here, as well as rare species such as the least grebe, black-bellied whistling-duck, white-tailed and Harris' hawk, groove-billed ani, chachalaca, kiskadee flycatcher, tropical kingbird, long-billed thrasher, Lichtenstein's oriole, green jay, and black-headed oriole.

The Texas indigo snake essentially is limited in the Gulf of Mexico Zone to the vicinity of grid reference PD28 to PD69.

A major location on the Gulf coast for the white-winged dove extends from grid reference PD40 to PD55.

## 5.10 LIST OF SOURCES FOR THE GULF OF MEXICO ZONE

The List of Sources has been expanded into a matrix (Table 10), linking individual reference sources to the topics for which each reference was used in the preparation of the inventory maps and report.

Table 10. List of sources for the Gulf of Mexico Zone.

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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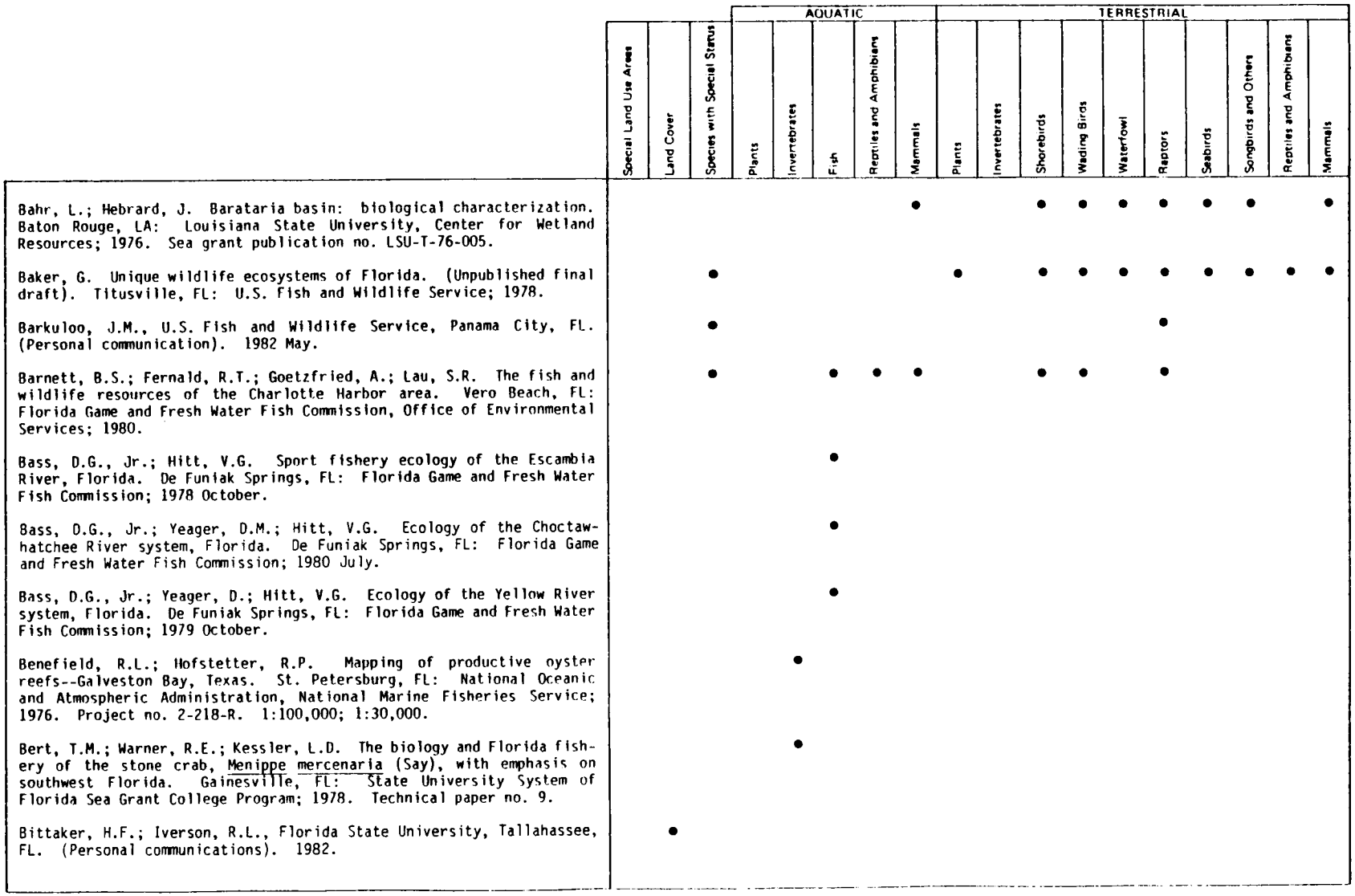


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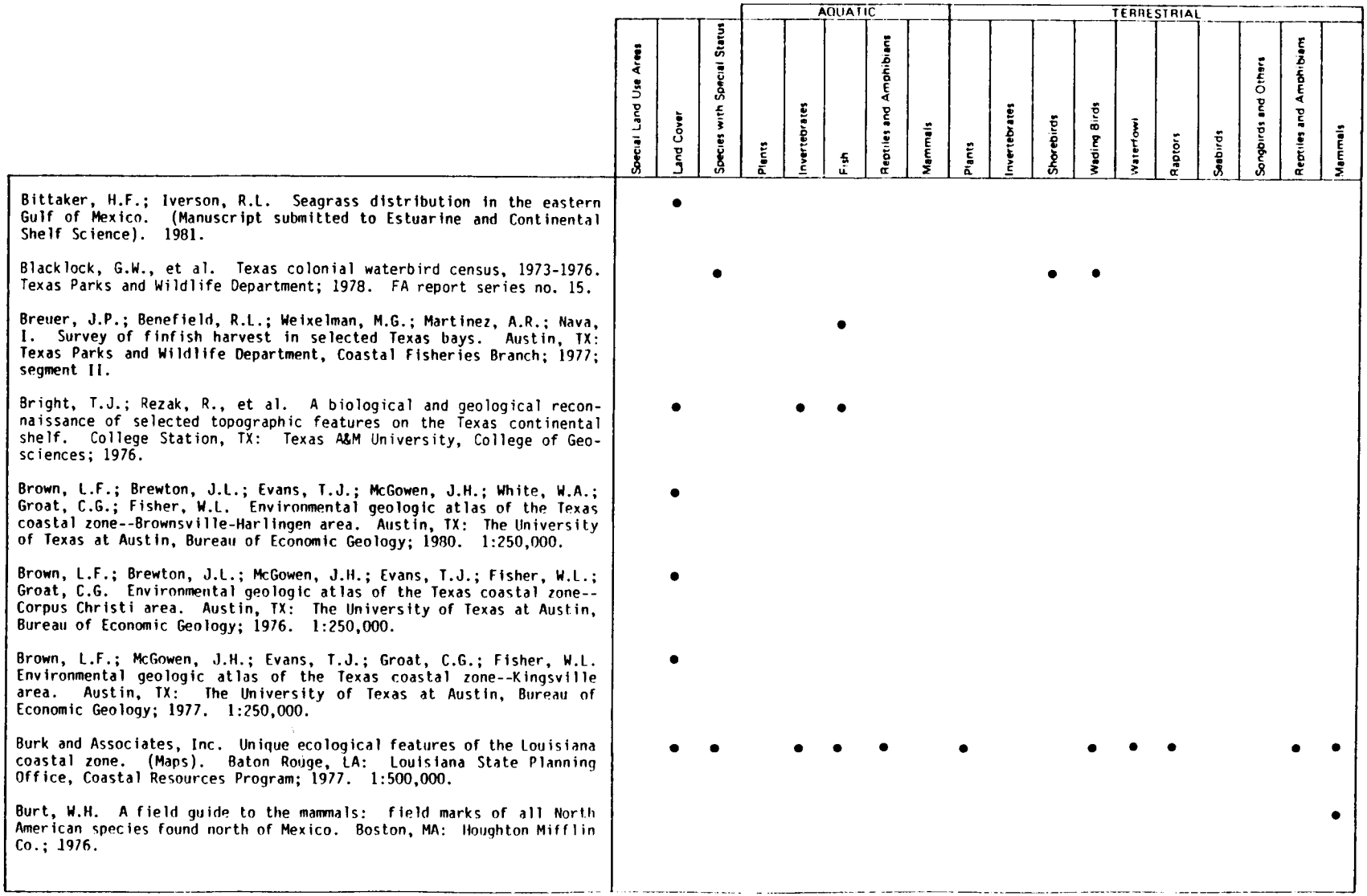


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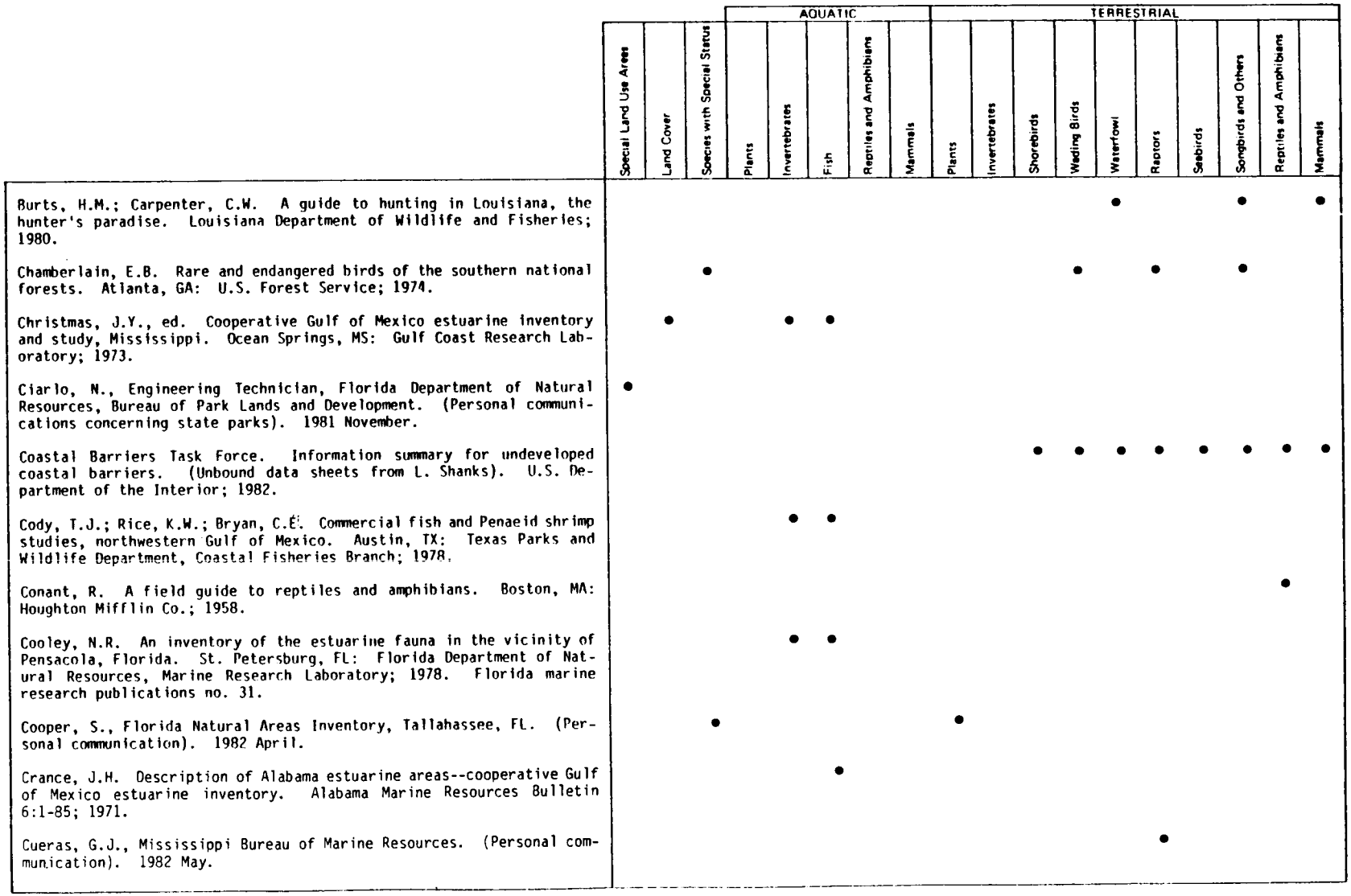



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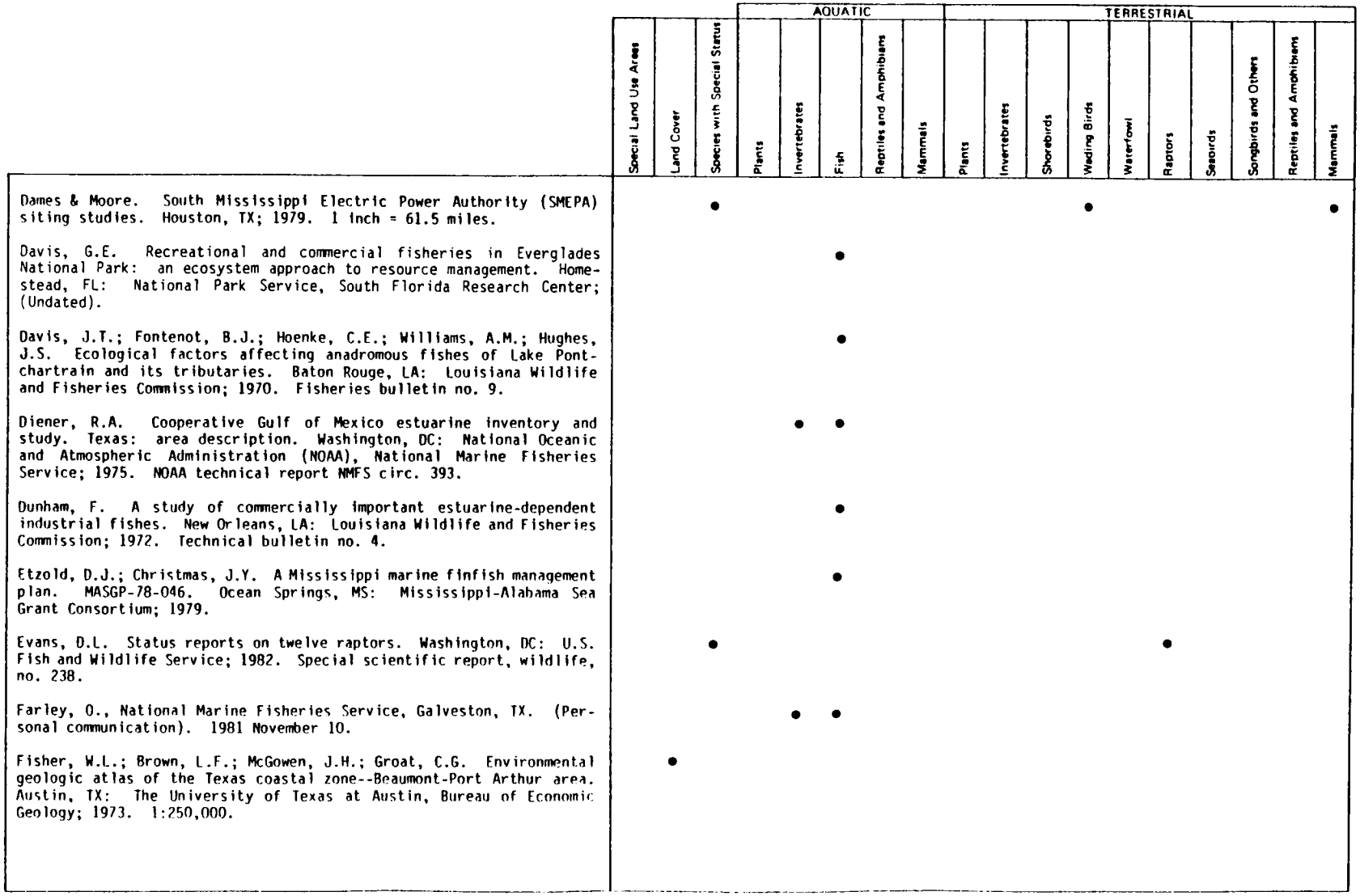


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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

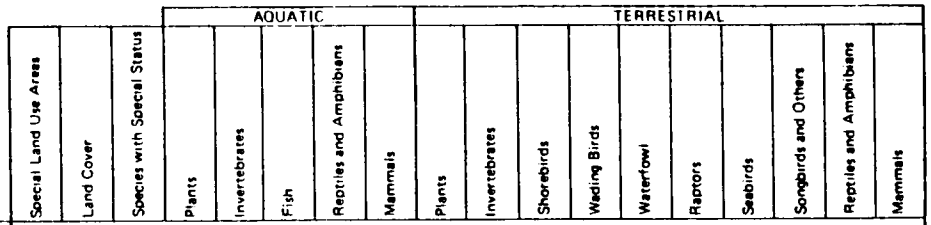


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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

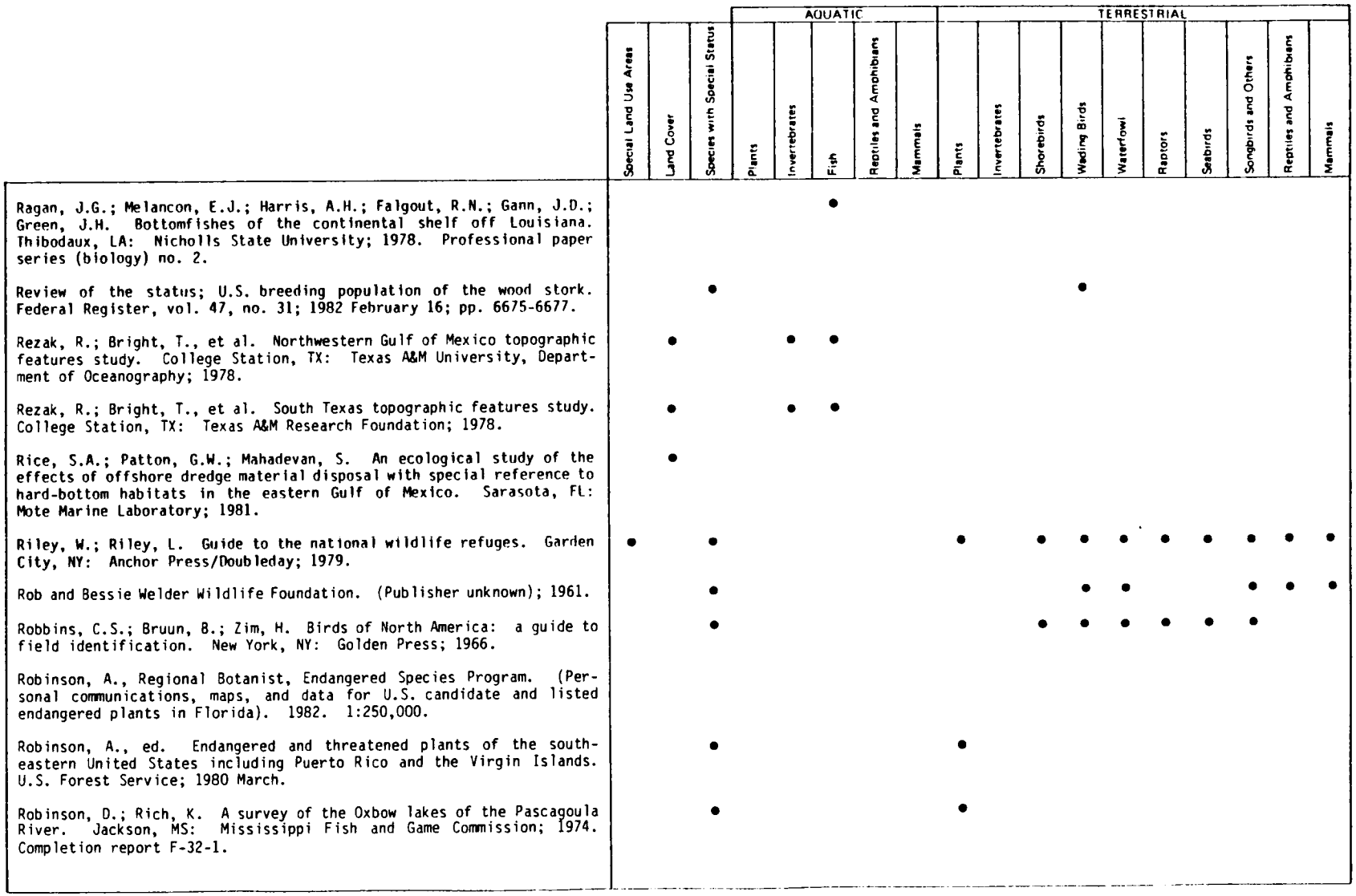



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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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Table 10 (continued).

| | AQUATIC | | | | | | TERRESTRIAL | | | | | | | | | |
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| | Special Land Use Areas | Land Cover | Species with Special Status | Plants | Invertebrates | Fish | Reptiles and Amphibians | Mammals | Plants | Invertebrates | Shorebirds | Wading Birds | Waterfowl | Raptors | Seabirds | Songbirds and Others | Reptiles and Amphibians | Mammals |
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Table 10 (concluded).

| | Special Land Use Areas | Land Cover | Species with Special Status | AQUATIC: Plants | AQUATIC: Invertebrates | AQUATIC: Fish | AQUATIC: Reptiles and Amphibians | AQUATIC: Mammals | TERRESTRIAL: Plants | TERRESTRIAL: Invertebrates | TERRESTRIAL: Shorebirds | TERRESTRIAL: Wading Birds | TERRESTRIAL: Waterfowl | TERRESTRIAL: Raptors | TERRESTRIAL: Seabirds | TERRESTRIAL: Songbirds and Others | TERRESTRIAL: Reptiles and Amphibians | TERRESTRIAL: Mammals |
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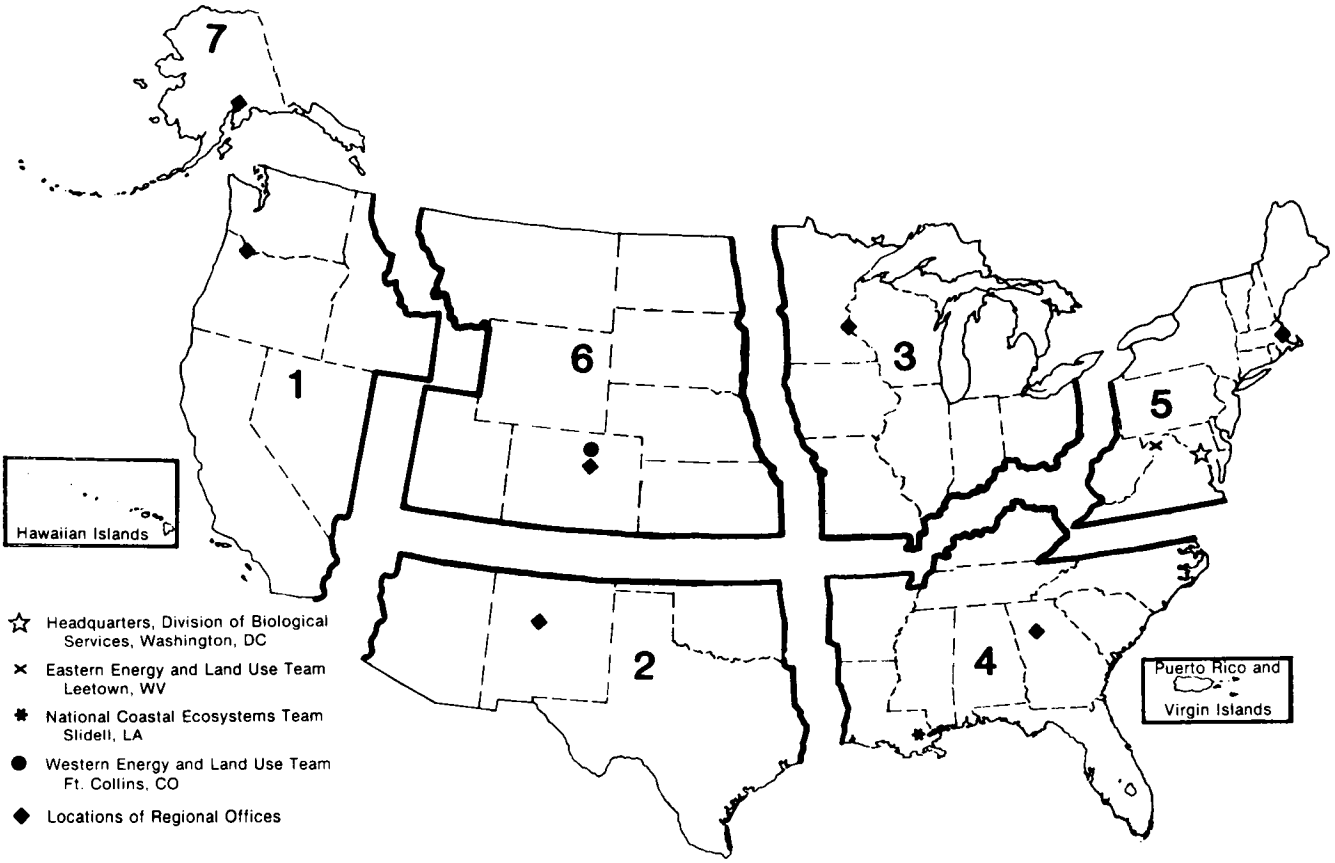


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# DEPARTMENT OF THE INTERIOR

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