APPENDIX A: LIST OF ACRONYMS, ABBREVIATIONS, and DEFINITIONS

Acronyms and Abbreviations

BIA	(USDOI) Bureau of Indian Affairs
BLH	Bottomland hardwood
BLM	(USDOI) Bureau of Land Management
BR	(USDOI) Bureau of Reclamation
CAA	Clean Air Act
CARA	Conservation and Reinvestment Act
CERCLA	Comprehensive, Environmental Response, Compensation and Liability Act
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
DARP(s)	Damage Assessment and Restoration Plan(s)
DO	Dissolved Oxygen
DSAY(s)	Discounted Service Acre Year(s)
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ESA	Endangered Species Act
EQA	Environmental Quality Act
FEIS	Final Environmental Impact Statement
FWPCA	Federal Water Pollution Control Act
GAP	(Louisiana) GAP Analysis Program
GIWW	Gulf Intracoastal Waterway
HEA	Habitat Equivalency Analysis
INSD	Insufficient Data
LAT	Lead Administrative Trustee
LCRT	Louisiana Department of Culture, Recreation and Tourism
LDAF	Louisiana Department of Agriculture and Forestry
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LOOP	Louisiana Offshore Oil Port
LOSCO	Louisiana Oil Spill Coordinator's Office
MMS	(USDOI) Minerals Management Service
MOA	Memoranda of Agreement
MR & T	(USACE New Orleans District [NOD]) Mississippi River and Tributaries Project
MSA(s)	Metropolitan Statistical Area(s)
NAAQS	National Ambient Air Quality Standards
NASS	(USDA) National Agricultural Statistics Service
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NF	National Forest
NMFS	(USDOC, NOAA) National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOD	(USACE) New Orleans District
NOI	Notice of Intent
NOS	(USDOC, NOAA) National Ocean Service
NPFC	National Pollution Funds Center
NPS	(USDOI) National Parks Service

NRDA(s)	Natural Resource Damage Assessment(s)
NWR	(USDOI, USFWS) National Wildlife Refuge
OAQPS	(USEPA) Office of Air Quality Planning and Standards
OIA	(USDOI) Office of Insular Affairs
OPA	Oil Pollution Act
OSC	On-Scene Coordinator
OSCF	(State) Oil Spill Contingency Fund
OSLTF	(Federal) Oil Spill Liability Trust Fund
OSM	(USDOI) Office of Surface Mining
OSPRA	Louisiana Oil Spill Prevention and Response Act
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PEIS	Programmatic Environmental Impact Statement
PRD	Public Review Document
QA	Quality Assurance
RP(s)	Responsible Party(ies)
RRP(s)	Regional Restoration Plan(s)
RRP Program	Regional Restoration Planning Program
SAV	Submerged Aquatic Vegetation
T&E	Threatened and Endangered (species)
TDS	Total Dissolved Solids
URL	Uniform Resource Locator
USACE	United States Army Corps of Engineers
USACE NOD	United State Army Corps of Engineers, New Orleans District
USDA	United States Department of Agriculture
USDOC	United States Department of Commerce
USDOD	United States Department of Defense
USDOE	United States Department of Energy
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC(s)	Volatile Organic Compound(s)
WMA	(LDWF) Wildlife Management Area

Definitions

Baseline means the condition of the natural resources and services that would have existed had the incident not occurred. Baseline data may be estimated using historical data, reference data, control data, or data on incremental changes (e.g., number of dead animals), alone or in combination, as appropriate.

Benthic means pertaining to the bottom of a body of water.

Brackish means pertaining to water with a low salt content, usually up to five parts per thousand during the period of average annual low flow.

Chronic means an effect in which the organism of interest is exposed to the contaminant such as oil for a significant stage of its life cycle or the entire life cycle (i.e., generally weeks to years depending on the reproductive life cycle of the organism). Typical effects endpoints include reproductive, growth, or development impairment as well as behavioral changes.

Claim for purposes of a release under CERCLA, means a demand in writing for a sum certain; for purposes of a discharge under CWA, it means a request, made in writing for a sum certain, for compensation for damages or removal costs resulting from an incident. Claimant as defined by section 1001 of the OPA means any person or government who presents a claim for compensation under Title I of the OPA.

Coastal waters means the waters and bed of the Gulf of Mexico within the jurisdiction of the state of Louisiana, including the arms of the Gulf of Mexico subject to tidal influence, estuaries, and any other waters within the state if such other waters are navigated by vessels with a capacity to carry ten thousand gallons or more of oil as fuel or cargo.

Corrective action means any action necessary to correct for a failure of a project to meet a specific performance criterion.

Cost-effective means the least costly activity among two or more activities that provide the same or a comparable level of benefits, in the judgment of the trustees. *CEQ* regulations mean the Council on Environmental Quality regulations implementing NEPA, 40 CFR chapter V.

Damages means damages specified in section 1002(b) of OPA (33 USC. 1002(b)), and includes the costs of assessing these damages, as defined in section 1001(5) of OPA (33 USC 2701(5)).

Discharge means any emission (other than natural seepage), intentional or unintentional, and includes, but is not limited to, spilling, leaking, pumping, pouring, emitting, emptying, or dumping, as defined in section 1001(7) of OPA (33 USC 2701(7)).

Discount rate means the rate at which dollars or other valued items or services being provided in different time periods are converted into current time period equivalents. A discount rate is used to compensate for delayed provision of services. For example, with zero inflation and a 3% interest rate, $100 available today could be invested to produce $103 one year from now. Under this scenario, if one wanted to compare dollars to be provided one year from now to dollars being provided today, a discount rate of 3% should be applied ($103 discounted at a 3% annual rate is equivalent to $100 in today's currency).

Dystrophic means having low nutrient content, but high organics.

Ecosystem means the biological community and its environment that, together, function as a system of complimentary relationships, with the transfer and circulation of energy and matter.

Ephemeral means the physical or biological components of the environment that are short lived or transitory.

Exclusive Economic Zone means the zone established by Presidential Proclamation 5030 of March 10, 1983 (3 CFR, 1984 Comp., p. 22), including the ocean waters of the areas referred to as "eastern special areas" in Article 3(1) of the Agreement between the United States of America and the Union of Soviet Socialist Republics on the Maritime Boundary, signed June 1, 1990, as defined in section 1001(8) of OPA (33 USC 2701(8)).

Exposure means direct or indirect contact with the discharged oil.

Facility means any structure, group of structures, equipment, or device (other than a vessel) which is used for one or more of the following purposes: exploring for, drilling for, producing, storing, handling, transferring, processing, or transporting oil. This term includes any motor vehicle, rolling stock, or pipeline used for one or more of these purposes, as defined in section 1001(9) of OPA (33 USC 2701(9)).

Habitat means the area that supports a given organism, population, or community.

Incident means any occurrence or series of occurrences having the same origin, involving one or more vessels, facilities, or any combination thereof, resulting in the discharge or substantial threat of discharge of oil into or upon navigable waters or adjoining shorelines or the Exclusive Economic Zone, as defined in section 1001(14) of OPA (33 USC 2701(14)).

Indian tribe (or *tribal*) means any Indian tribe, band, nation, or other organized group or community, but not including any Alaska Native regional or village corporation, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians and has governmental authority over lands belonging to or controlled by the tribe, as defined in section 1001(15) of OPA (33 USC 2701(15)).

Injury means an observable or measurable adverse change in a natural resource or impairment of a natural resource service. Injury may occur directly or indirectly to a natural resource and/or service. Injury incorporates the terms “destruction,” “loss,” and “loss of use” as provided in OPA.

Interim losses and *interim lost services (uses)* means the reduction in resources and the services they provide, relative to baseline levels, that occur from the onset of an incident until complete recovery of the injured resources.

Intertidal means the region between highest and lowest tide lines (i.e., that region covered with water at high tide and exposed at low tide) in a marine, estuarine, or tidal freshwater environment.

Lead Administrative Trustee(s) (or *LAT*) means the trustee(s) who is selected by all participating trustees whose natural resources or services are injured by an incident, for the purpose of coordinating natural resource damage assessment activities. The LAT(s) should also facilitate communication between the OSC and other natural resource trustees regarding their activities during the response phase.

National Pollution Funds Center (NPFC) means the entity established by the Secretary of Transportation whose function is the administration of the Oil Spill Liability Trust Fund (OSLTF). Among the NPFC's duties are: providing appropriate access to the OSLTF for federal agencies and states for removal actions and for federal trustees to initiate the assessment of natural resource damages; providing appropriate access to the OSLTF for claims; and coordinating cost recovery efforts.

Natural resource damage assessment (or *assessment*) means the process of collecting and analyzing information to evaluate the nature and extent of injuries resulting from an incident, and determine the restoration actions needed to bring injured natural resources and services back to baseline and make the environment and public whole for interim losses.

Natural resources means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the Exclusive Economic Zone), any state or local government or Indian tribe, or any foreign government, as defined in section 1001(20) of OPA (33 USC 2701(20)).

Navigable waters means the waters of the United States, including the territorial sea, as defined in section 1001(21) of OPA (33 USC 2701(21)).

NCP means the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan) codified at 40 CFR part 300, which addresses the identification, investigation, study, and response to incidents, as defined in section 1001(19) of OPA (33 USC 2701(19)).

NEPA means the National Environmental Policy Act, 42 USC 4321 et seq.

Oil means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil. However, the term does not include petroleum, including crude oil or any fraction thereof, that is specifically listed or designated as a hazardous substance under 42 USC 9601(14)(A) through (F), as defined in section 1001(23) of OPA (33 USC 2701(23)).

On-Scene Coordinator (or *OSC*) means the official designated by the U.S. Environmental Protection Agency or the U.S. Coast Guard to coordinate and direct response actions under the NCP, or the government official designated by the lead response agency to coordinate and direct response actions under the NCP.

OPA means the Oil Pollution Act of 1990, 33 USC 2701 *et seq*.

OSLTF means the Oil Spill Liability Trust Fund administered by the US Coast Guard National Pollution Funds Center (NPFC).

Pathway means any link that connects the incident to a natural resource and/or service, and is associated with an actual discharge of oil.

Person means an individual, corporation, partnership, association, state, municipality, commission, or political subdivision of a state, or any interstate body, as defined in section 1001(27) of OPA (33 USC 2701(27)).

Person responsible, responsible person, or responsible party means:
(a) The owner or operator of a vessel or terminal facility from which an unauthorized discharge of oil emanates or threatens to emanate.
(b) In the case of an abandoned vessel or terminal facility, the person who would have been the responsible person immediately prior to the abandonment.

(c) Any other person, but not including a person or entity who is rendering care, assistance, or advice in response to a discharge or threatened discharge of another person, who causes, allows, or permits an unauthorized discharge of oil or threatened unauthorized discharge of oil.

Public Use(s) means the services provided by natural resources for human activities; this includes, but is not limited to, cultural, archaeological, transportation, public water supply, industrial water supply, swimming, fishing, harvesting of natural resources, nature viewing, hunting, diving, sailing, boating, hiking, camping, climbing, photographing, drawing, painting, and other human uses.

Public vessel means a vessel owned or bareboat chartered and operated by the United States, or by a state or political subdivision thereof, or by a foreign nation, except when the vessel is engaged in commerce, as defined in section 1001(29) of OPA (33 USC 2701(29)).

Quality Assurance (QA) means the total integrated program for assuring the reliability of collected data.

Reasonable assessment costs means, for assessments conducted under this part, assessment costs that are incurred by trustees in accordance with this part. In cases where assessment costs are incurred but trustees do not pursue restoration, trustees may recover their reasonable assessment costs provided that they have determined that assessment actions undertaken were premised on the likelihood of injury and need for restoration. Reasonable assessment costs also include: administrative, legal, and enforcement costs necessary to carry out this part; monitoring and oversight costs; and costs associated with public participation.

Recovery means the return of injured natural resources and services to baseline.

Response (or *remove* or *remova*l) means containment and removal of oil or a hazardous substance from water and shorelines or the taking of other actions as may be necessary to minimize or mitigate damage to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches, as defined in section 1001(30) of OPA (33 USC 2701(30)).

Responsible party means:
(a) *Vessel*s. In the case of a vessel, any person owning, operating, or demise chartering the vessel.
(b) *Onshore facilitie*s. In the case of an onshore facility (other than a pipeline), any person owning or operating the facility, except a federal agency, state, municipality, commission, or political subdivision of a state, or any interstate body, that as the owner transfers possession and right to use the property to another person by lease, assignment, or permit.
(c) *Offshore facilitie*s. In the case of an offshore facility (other than a pipeline or a deepwater port licensed under the Deepwater Port Act of 1974 (33 USC 1501 *et se*q.)), the lessee or permittee of the area in which the facility is located or the holder of a right of use and easement granted under applicable state law or the Outer Continental Shelf Lands Act (43 USC 1301-1356) for the area in which the facility is located (if the holder is a different person than the lessee or permittee), except a federal agency, state, municipality, commission, or political subdivision of a state, or any interstate body, that as

owner transfers possession and right to use the property to another person by lease, assignment, or permit.
(d) *Deepwater port*s. In the case of a deepwater port licensed under the Deepwater Port Act of 1974 (33 USC 1501-1524), the licensee.
(e) *Pipeline*s. In the case of a pipeline, any person owning or operating the pipeline.
(f) *Abandonment.* In the case of an abandoned vessel, onshore facility, deepwater port, pipeline, or offshore facility, the persons who would have been responsible parties immediately prior to the abandonment of the vessel or facility, as defined in section 1001(32) of OPA (33 USC 2701(32)).

Restoration means any action (or alternative), or combination of actions (or alternatives), to restore, rehabilitate, replace, or acquire the equivalent of injured natural resources and services. Restoration includes:
(a) *Primary restoration*, which is any action, including natural recovery, that returns injured natural resources and services to baseline; and
(b) *Compensatory restoration*, which is any action taken to compensate for interim losses of natural resources and services that occur from the date of the incident until recovery.

Restoration action means any of the actions authorized under OPA (restoration, rehabilitation, replacement, or acquisition of the equivalent), or some combination of those actions. Restoration actions by trustees are intended to complement the initial response and cleanup activities of response agencies.

Restoration alternative means a combination of primary and/or compensatory restoration actions that address one or more specific injuries associated with the incident. Acceptable restoration alternatives include any of the actions authorized under OPA (restoration, rehabilitation, replacement, or acquisition of the equivalent), or any combination of those actions. Each restoration alternative must be designed so that, as a package of one or more actions, the alternative would make the environment and public whole.

Restoration Plan means a plan developed for public review and comment that describes the restoration alternatives to be considered in the restoration, rehabilitation, replacement, and/or acquisition of equivalent natural resources.

Sample means a selected segment of a population studied to gain knowledge of the whole.

Sampling means the process of taking observations of a population.

Scale means the size or spatial and temporal extent of restoration actions.

Scaling means the process of determining, for identified restoration actions, the size or scale of the actions that would be required to expedite recovery of injured resources to baseline and compensate the public for interim lost resources and services.

Scaling approach means the general framework used for scaling a restoration action. Trustees may use resource-to-resource or service-to-service approaches, or valuation approaches. In scaling compensatory restoration actions, each approach is used with the objective of providing benefits from compensatory actions equal to losses from resource injuries.

? *Resource-to-resource or service-to-service* scaling is an approach in which the natural resources injured and the services lost due to the incident are replaced by an equivalent quantity of discounted natural resources and services (or resource proxies).
Given that the focus of this guidance document is on scaling compensatory restoration actions, we primarily employ the term *service-to-service* since the underlying concept is to ensure that not only are the same or comparable resources provided, but also that the resources provide a sufficient quantity of the same or comparable services.
The *valuation* approach requires that the value of injured natural resources and/or services be measured explicitly, and that a restoration action provide natural resources and/or services of equivalent value to the public. The approach relies on the concept that lost value can be determined using one of a variety of possible units of exchange, including units of natural resource services or dollars. The primary valuation approach is value-to-value. Under some circumstances, a second valuation approach, value-to-cost, may be used.
Under the *value-to-value* approach to scaling, trustees determine the scale of restoration actions required to provide gains (or "value") equal to the value of the interim losses. Again, discounting is used to take into account differences in timing of losses and gains.
Value-to-cost is a variant of the valuation approach. Under the value-to-cost approach, a restoration action is scaled by setting the cost of the restoration action equal to the value of losses due to the injury.

Scaling method means a technique (these terms are used interchangeably in the rule and guidance documents) that is employed to generate the required information under the different scaling approaches. Examples of scaling methods include habitat equivalency analysis under the service-to-service or resource-to-resource approaches, or the travel cost method under the valuation approaches. (See Appendix D for brief descriptions and short annotated bibliographies for various scaling methods). More than one method may be employed if needed to address the different injuries resulting from an incident, but trustees must be careful to avoid double-counting when using multiple methods.

Services (or *natural resource services*) means the functions performed by a natural resource for the benefit of another natural resource and/or the public.

Significant means a difference, at a specified probability level, between or among two or more sampling distributions.

State Trustee(s) means the state trustee coordinator (Louisiana Oil Spill Coordinator) and the state natural resource trustees (Louisiana Department of Environmental Quality, Louisiana Department of Natural Resources, Louisiana Department of Wildlife and Fisheries). The definition of state trustees may also include other agencies of the state of Louisiana designated by the Governor according to the Oil Pollution Act of 1990 as state natural resource trustees.

Statistical Analysis means the formal mathematical statements of the specific hypotheses to be tested.

Subtidal means the region in marine, estuarine, or tidal freshwater environments that is deeper than the lowest tide line, such that it is always submerged at any tidal height.

Toxicity means the inherent potential of a contaminant such as oil to adversely affect individual organisms.

Trustees (or *natural resource trustee*s) means those officials of the federal and state governments, of Indian tribes, and of foreign governments, designated under 33 USC 2706(b) of OPA.

Unauthorized discharge of oil means any actual or threatened discharge of oil not authorized by a federal or state permit.

United States and *State* means the several States of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Commonwealth of the Northern Marianas, and any other territory or possession of the United States, as defined in section 1001(36) of OPA (33 USC 2701(36)).

Value means the maximum amount of goods, services, or money an individual is willing to give up to obtain a specific good or service, or the minimum amount of goods, services, or money an individual is willing to accept to forgo a specific good or service. The total value of a natural resource or service includes the value individuals derive from direct use of the natural resource, for example, swimming, boating, hunting, or birdwatching, as well as the value individuals derive from knowing a natural resource will be available for future generations.

APPENDIX B: AFFECTED ENVIRONMENT

The purpose of this appendix is to describe the affected environment in the State of Louisiana. This appendix is intended to provide a summary overview of that environment.

Physical Environment

Geology

Most of Louisiana was formed by Mississippi River sediment deposits. As sea-level rose and fell over this low-lying region, the Mississippi River was carrying vast sediment loads and sedimentary rocks from the core of the North American continent and depositing it on the rim of the Gulf of Mexico. Organic matter from highly productive marine waters has been deeply buried under the whole state and far offshore, and through various processes has turned into petroleum. Massive salt deposits, formed by evaporation of sea water during historic dry periods, provide a stable confining layer for the underlying petroleum.

The oldest surface rocks are the Palaeocene formations found in the Sabine Uplift of northwest Louisiana (Regions 7 and 9), which date back over 54 million years and are composed of a thick series of non-marine sands, silty sands, clays, and gravels with some thick deposits of lignite. North central Louisiana (Region 8) is typified by Eocene (54 to 38 million years ago (mya)) non-marine and marine medium- to very fine-grained sands, silts, and silty clays, which lie on top of elevated salt-domes. Oligocene (38 to 26 mya) and Miocene (26 to 5 mya) formations are apparent, but not dominant, in Regions 7 and 8 and are typified by tan to reddish brown silt with some clay and minor amounts of very fine sand. Approximately 25% of the state's surface is occupied by deposits associated with Pleistocene (1.6 to 0.01 mya) terraces (mostly Regions 5 and 7); these also consist of sand, gravel, and mud, but underlie raised, flat surfaces with varying degrees of tilt and dissection depending on their relative ages. These surfaces are remnants of preexisting floodplains, and form trends along the major rivers in north Louisiana and coast-parallel belts in south Louisiana. Holocene (0.01 mya to present) alluvial sediments of the Mississippi, Red, Ouachita, and other rivers and smaller tributaries, together with coastal marsh deposits, occupy about 55% of Louisiana’s surface. The alluvial sediments (mostly Regions 1,2,3,6, and 9) consist of sandy and gravelly channel deposits mantled by sandy to muddy natural levee deposits, with organic-rich muddy backswamp deposits in between; coastal marsh deposits (Regions 1 through 4) are chiefly fine-grained clay, silt and organic matter.

The coastal region of Louisiana has been formed over the last 7,500 years and is the result of 7 discrete and consecutive delta lobes. If left in its natural state, the Mississippi River would have shifted most of its flow to the Atchafalaya River course beginning in the 1950s. Since the turn of the last century, however, the U.S. Army Corps of Engineers has held the Mississippi River in its present course to ease navigation and commerce, to avoid the tremendous cost of moving industrial and other operations that depend on its present location, and to prevent flooding. This containment of the river has created the current dilemma of high rates of erosion in the coastal regions of the state. If the river were allowed to shift its course naturally, and to flood, its sediment could replenish the wetlands and coastal marshes that are now deteriorating, restore the land as it subsides, and provide nutrients vital to coastal fisheries and vegetation. As it is, the river is held in an overextended course that has reached the edge of the continent shelf, and most of its sediment now accumulates there and farther out in the Gulf.

Geography

Louisiana is comprised of two primary geographic regions, the lowlands and the uplands. Much of the landscape of south Louisiana was formed during the Holocene (0.01 mya to present) epoch. The lowlands of Louisiana can be subdivided into three major divisions: the Mississippi and Red River alluvial plain, the deltaic plain, and the chenier plain.

The Mississippi River Basin drains 41% of the contiguous United States and a portion of Canada, transporting water and sediment over an area of 1.2 million square miles. The Mississippi River alluvial plain (width of 25 to 90 miles) is comprised of numerous landforms, created by successive river course switching. The Mississippi River is a classic example of a fluvially dominated, meandering river. Ridge and swale topography and abandoned channels in the form of oxbow lakes and chutes are common features. Natural levees were created with overbank flooding and stand as low, broad ridges (typically 15 feet higher than the backswamp) on the landscape. Crevasse splays, created by a break in a levee bank, form higher ground. Urban areas, infrastructure, industry, and agriculture typically develop on these higher grounds. Ridges and hills of Pleistocene–aged materials outcrop in northern Louisiana and have elevations 45 to 70 feet higher than the surrounding Holocene-aged alluvial plain.

The Red River, once a major tributary of the Mississippi River, has a similar alluvial plain (width of 2 to 10 miles) created by the occupance of several river courses. Presently, the Red River is a tributary of the Atchafalaya River. Extensive alluvial ridges, natural levees, terraces, and remnant impounded tributaries (raft lakes) are visible features on the present-day landscape (Johnson and Yodis 1998).

The Mississippi River deltaic system is composed of six deltas that were deposited over the last 7,500 years when sea levels rose and reached its present level following the advance and retreat of Pleistocene-aged inland glaciers (Mac et al. 1998). The result of the building and subsequent abandonment of these delta lobes by the river was the construction of a modern deltaic coastal plain with a total area of 28,000 square kilometers (10,811 square miles) (Coleman 1976). The most recent deltaic cycle (~last 500 years) has formed the Modern birdfoot, or Balize delta (Mac et al. 1998). The deltaic cycle consists of a constructional phase (Scruton 1960) of broad coastal marsh (sub-delta) formation and a destructional phase (Scruton 1960) with river abandonment of sediment reworking, subsidence, flooding, and sinking. Coastal headlands, barrier islands, and shoals form at the mouths of former distributaries. Prodelta clay, distributary mouth sand bars, and mudlumps are other deltaic deposits associated with the Balize delta. The Atchafalaya River is diverting a portion (~30%) of the Mississippi River's water and sediment discharge. The new Atchafalaya River delta is beginning its expansion phase (Van Heerden and Roberts 1980; Wells et al. 1982).

The chenier plain is located to the west of the Mississippi River deltaic plain and is characterized by marsh that is segmented by long, narrow coast-parallel sand and shell ridges. The low ridges support a natural vegetation cover of live oaks. Chenier shoreline morphology reflects a depositional history quite different than that of the Mississippi River deltaic plain. During western occupation of Mississippi River deltaic lobes, fine-grained sediments were transported by longshore currents and deposited as mudflats on the coast of southwest Louisiana. Conversely, sediment influx ceased with eastern occupation of Mississippi River deltaic lobes. Existing coarser sediments in the mudflats were reworked by wave action, forming sand and shell beaches. Subsequent re-occupation and abandonment of deltaic lobes has created the topographic features visible on the landscape today. As a result of differential subsidence of the chenier

ridges, river patterns in the chenier plain differ from those of the deltaic plain. Subsidence and the associated ponding of rivers have formed a series of lagoonal lakes north of the cheniers.

Louisiana comprises the largest expanse of coastal wetlands in North America, having approximately 3,800 square miles of marsh and 800 square miles of swamp. The state's wetlands support an extremely productive commercial fishery and oil and gas industry, as well as provide over-wintering habitat for migratory waterfowl.

The State of Louisiana is losing 25 to 30 square miles of marsh each year due to the combined effects of levee construction, subsidence, and associated hydrologic changes (Coast 2050 2002). *Coast 2050: Towards a Sustainable Coastal Louisiana* is a "jointly developed Federal, State, and Local plan to address Louisiana's massive coastal land loss problem and provide for a sustainable coastal ecosystem by the year 2050" (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998). Coast 2050 is an integrated, multiple use approach to ecosystem management and is supported by federal, state, and local agencies mandated to address coastal erosion. "The goals of 2050 are to create and sustain marsh by accumulating sediment and organic matter; to maintain habitat diversity by varying salinities and protecting key land forms; and to maintain the exchange of energy and organisms" (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998).

The uplands of Louisiana are comprised of two geomorphic regions, the Tertiary hills and the Pleistocene coastwise terraces. The hilly topography of upland Louisiana originated with sediment deposition in coastal environments throughout the Tertiary period. Lithified layers of sandstone, siltstone, and shale outcrop in belts parallel to the coast (generally west to east) and erode with stream and river incision. Upland ridges resistant to weathering are typically asymmetrical with north-facing steep cliffs and escarpments (~150 to 535 feet) and gentle south-facing slopes and are termed wolds (or cuestas). Easily eroded rock formations form lowlands and are termed vales. With the exception of salt domes, the oldest rocks, Eocene (38 to 54 mya) and Pleistocene in age, are located in the Tertiary hills. The hilly topography of north Louisiana is bisected by the Red River and Ouachita River alluvial plains.

The Pleistocene coastwise terraces of Louisiana are in general, situated between the Holocene alluvial and marsh deposits of southern Louisiana and the hilly upland region of northwestern Louisiana. Terraces formed during the Pleistocene, as episodic events of continental glaciation caused the Mississippi River to deposit sediments in floodplain and deltaic environments. Terraces lie in a step-like configuration parallel to the coastline as a result of uplift and subsidence in north and south Louisiana, respectively. Termed complex landforms, terraces are flat to gently sloping (40 to 350 feet) and composed of multiple surface levels of various ages, depositional environments, sedimentary sequences, and glacial or interglacial origin (Johnson and Yodis 1998).

Loess deposits, fine unconsolidated wind-blown sediments, located in upland regions are Pleistocene in age and of Mississippi River origin. During continental glaciation and resulting lower water levels, prevailing winds transported silt glacial outwash deposits onto adjacent uplands. The Mississippi River is flanked by loess deposits some 30 to 60 miles wide that thin and fine with increasing outward distance.

Pimple mounds are round to elliptical shaped topographic features unique to the landscape west of the Mississippi River alluvial plain. Located on Pleistocene terrace complexes, mounds are typically 2 to 3 feet in elevation, 50 feet in diameter, and composed of coarser grained sediments than surrounding deposits. The origin of pimple mounds is unknown.

Salt domes are both surface and subsurface features created by the process of salt penetrating overlying sediments during conditions of high pressure and temperature at great depth. The salt layer in Louisiana dates to the Jurassic period (140 to 208 mya) and corresponding lower stands in sea levels. Four to 8 miles of Cenozoic (Holocene and Pleistocene) deposits overlie the salt deposit. Topographic depressions (lakes), though rare, are surface features often associated with salt domes. Depressions form when the rate of ground water dissolution is greater than the rate of uplift, causing overlying strata to collapse. Salt domes are located in both interior basins and in coastal/offshore (collapse faults) regions of Louisiana. Salt domes in coastal areas are typically wooded and may have elevations approximating 157 feet and diameters approximating 2 miles.

Soils

Soil formation and development, or pedogenesis, is largely the dynamic and natural transformation of surface deposits via physical, chemical, and biological processes. The principal pedogenic factors are parent material, climate, topography, organisms, and time. To a lesser extent, human activities influence this process.

Seven general soil regions have been identified in Louisiana. Soil profiles exhibiting similar characteristics are termed soil series. Soil associations are defined as groups of soil series occurring together in any geomorphic setting. The seven soil regions of Louisiana, as described by Johnson and Yodis (1998), are: 1) Tertiary Upland soils; 2) Pleistocene Terrace soils; 3) Flatwoods soils; 4) Coastal Prairie soils; 5) Loess soils; 6) Alluvial soils; and 7) Gulf Coast Marsh soils.

The soils of the Tertiary Uplands have developed on Tertiary bedrock, ranging in age from about 2 to 65 million years. Highly weathered and oxidized, the soils have a distinctive red-yellow coloration. Soil characteristics include the following: low amounts of organic matter and a thin, grayish-brown surface soil; red, yellow, or brown subsoil; sandy; acidic; and low in fertility. The soils are typically used for tree farming, livestock grazing, and growing leguminous crops such as peanuts and field peas.

The Pleistocene Terrace soils have developed on upland and intermediate terrace complexes and on Tertiary-aged rock of the Red and Ouachita River alluvial plains. The soils have formed on alluvium 10,000 to 2 million years in age and are deeply dissected to gently undulating. Soils typically support forest, cropland, or pasture. A fragipan, defined as a dense and firm subsoil layer that is high in silt content and has a polygonal structure, is common. Low in permeability, excessive surface wetness is common.

Flatwood soils have developed on the prairie terrace complex of southeast Louisiana and the intermediate complex of southwest Louisiana in nearly flat and poorly drained mixed longleaf pine and hardwood forests. The soil is characterized by high acidity, low fertility, and poor drainage. Flatwood soils primarily support the lumber industry and the commercial production of strawberries.

The soils of the Coastal Prairie have developed on the prairie terrace complex of southwest Louisiana. The soil is characterized by a well developed profile, dark organic horizons, and a subsurface claypan horizon (an impermeable layer that restricts the downward movement of water). Prairie soils (primarily Crowley series) are used for rice production.

Loess deposits of sufficient thickness for profile development are of Mississippi River origin and Pleistocene in age. Soils are tan-colored and vary in calcium carbonate concentration and fertility. Loess soils support sweet potatoes, soybeans, and other crops. Common soil series are the Memphis, Calhoun, and Loring.

Alluvial soils include those of Mississippi River, Red River, and Ouachita River origin. Common soil associations of the Mississippi River alluvial plain include Commerce, Mhoon, and Sharkey. Commerce soils have developed on natural levee crests and backslopes, consist of silt and sandy loams, are well drained, and are generally used for the production of commercial crops. Soils of the Mhoon association have formed on lower positions of the backslope, are silty clays, and are poorly drained. Soils of the Sharkey association have formed in the backswamp, consist of clays, are poorly drained, and frequently flood. Both the Mhoon and Sharkey series have a high content of decomposing organic material. In addition, sand has formed point bar, chute, and crevasse splay deposits.

Soils of the coastal marsh of Louisiana primarily consist of organic matter (30 to 85%) and river silts and clays. Soils are characterized by a black and brown to gray color, are poorly drained, range in thickness from 2 to 12 feet, and are located on elevations of less than five feet. Muck soils are decomposed and black-colored; conversely, peat soils have not decomposed due to anoxic conditions and are brown in color. Common series are the Allemands, Kenner, Scatlake, Bancker, and Creole.

Sediment Quality

Sediment quality is defined as the suitability of the habitat for supporting designated uses, including but not limited to, benthic fauna and aquatic plants. In aquatic ecosystems, sediments can serve both as reservoirs and as potential sources of chemical substances to the water column (Macdonald et al. 2000) which may impair the quality of the sediment as habitat through direct toxicity to benthic fauna and aquatic plants or through sub-lethal effects, altering benthic invertebrate community structure (Chapman 1989). However, in the absence of disturbance and with sufficient sedimentation, contaminants may become sequestered in a reduced environment below the biotic zone. Under these conditions, contaminants may pose little risk to the environment or to people. Therefore, it is most appropriate to narrow consideration to surficial sediments for the purpose defined above.

Aquatic sediments are essential in maintaining the structure (assemblage of organisms) and function (processes) of aquatic ecosystems. The importance of sediment quality is the role that sediments play in supporting community productivity. The productivity of green plants, algae, and bacteria build the foundation of food webs upon which higher aquatic organisms depend. Sediments provide essential habitats for epibenthic (live on sediments) and infaunal (live in sediments) invertebrates and demersal fish, which represent important food sources for amphibians, reptiles, fish, birds, and mammals. In addition, many fish and amphibian species utilize sediments at stages in their life cycles for the purposes of spawning, incubation, refuge, and over-wintering.

Adverse alterations to sediments can have a significant effect throughout the food web. Changes to community structure at the producer and first-order consumer level may very likely change the stability of higher-order consumer groups due to changes in food availabilities. Further, compounds that biomagnify may be passed up the food web to higher-order consumers, causing lethal and/or sub-lethal effects on these organisms including birds, fish, and mammals.

Water Resources

Ground Water Resources

Louisiana's ground water supply is contained within permeable geologic formations or parts of formations, termed aquifers. Louisiana's water supply is primarily held in 13 major aquifers and aquifer systems composed of sand and gravel and confined by clay and silt. An aquifer system is a group of two or more aquifers that act as a water-yielding hydraulic unit of regional extent. Much of the ground water in Louisiana is pumped or withdrawn for household, industrial, and agricultural use. Typically, ground water in Louisiana moves in a southerly direction and towards stream valleys (Stuart et al. 1994). Pumping in urbanized and industrialized areas results in the formation of cones of depression, thus altering regional ground water flow patterns (Stuart et al. 1994).

Aquifers are classified as artesian or water-table. Artesian aquifers, or confined aquifers, are confined by overlaying and underlying impermeable formations that restrict water movement into or out of an aquifer (Stuart et al. 1994). Water-table aquifers, or unconfined aquifers, are those in which the water is not confined by low permeability units (Stuart et al. 1994). The water level in an artesian aquifer will rise above the top of the aquifer and may rise above the land surface. In a water-table aquifer, the upper surface of the aquifer rises to a level of static hydraulic pressure as there are no confining beds between the zone of saturation and the surface.

The addition of water to ground water is termed recharge. Recharge areas are defined as areas where the aquifer is at or near the land surface and water moves rapidly into the aquifer. Ground water moves very slowly through all but the most porous of formations, generally at a rate of only a few feet per year (Stuart et al. 1994). Recharge rates of aquifers vary from year to year due to changes in weather patterns and usage. Louisiana's annual rainfall is enough to replenish some of the water drawn from the state's aquifers. Discharge from an aquifer occurs both naturally and artificially by man's withdrawal. Due to extreme drought conditions experienced in the recent past, along with increased demand, some freshwater users have experienced shortages. Ground water quantity issues are currently being studied under legislative mandate in an attempt to resolve shortages and protect aquifers.

Louisiana's 13 major aquifers and aquifer systems are described in Table B-1 (Stuart et al. 1994).

Ground Water Quality

Much of Louisiana's ground water is suitable for use with little or no treatment; however, water quality is susceptible to both natural and human induced contamination. Water is defined as fresh if it has a dissolved chloride concentration of 250 milligrams/liter or less (Stuart et al. 1994). Many of the state's aquifers contain saltwater, defined as water having chloride levels of 250 milligrams/liter or greater (Stuart et al. 1994). The zone of transition between salt and freshwater is termed a saltwater wedge. Coastward, the aquifer is completely salty. Landward, the top of the aquifer becomes increasingly fresh

until fresh throughout. Saltwater may be present in inland aquifers which dip towards the coast and/or Mississippi River valley. Saltwater encroachment laterally or vertically into the freshwater lens can be a result of pumping. Freshwater in the coastal parishes of Terrebonne, Lafourche, Assumption, Jefferson, Orleans, Plaquemines, St. Charles, St. Bernard, and St. James is limited; thereby requiring large amounts of water to be withdrawn from surface water sources for public-supply purposes (Lovelace 1991). Saltwater encroachment has occurred into aquifers in south Baton Rouge and into the Chicot aquifer system of southwestern Louisiana (Stuart et al. 1994).

Ground water quality is affected by naturally occurring inorganic properties or constituents that, above established U.S. Environmental Protection Agency (USEPA) levels, may pose a health risk. Properties or constituents of concern in Louisiana include the following: pH, color, hardness, calcium and magnesium, sodium, sulfate, chloride, fluoride, dissolved solids, nitrogen and nitrate plus nitrite, and iron and manganese (Stuart et al. 1994). High iron concentrations are of particular concern to users of the Chicot aquifer system, the Cockfield aquifer, and the Sparta aquifer (U.S. Geological Survey 1998). Also, iron and chloride are problematic in localized areas of the Mississippi River alluvial aquifer. High color is objectionable to users in the New Orleans area and to some areas that withdraw water from the Sparta, Evangeline, and Jasper aquifer systems (Stuart et al. 1994). Throughout the state, high sodium concentrations in ground water resources is problematic for agricultural industries.

Of recent concern, is human-induced contamination of ground water supplies. Only within the last 20 years was it realized that ground water reserves might be affected by surficial activities. In Louisiana, primary concerns are: 1) contamination from surface disposal of agricultural chemicals and petroleum products; 2) contamination by hazardous waste sites around the state; and 3) contamination from surface wastes and saltwater through abandoned wells (Stuart et al. 1994). Industrial wastes, landfills, septic tanks, animal wastes, and leaking underground storage tanks are additional sources of potential contamination.

Surface Water Resources

Louisiana's abundant water bodies, although difficult to enumerate, are estimated to comprise approximately 7% of the total surface area of the state (Louisiana Department of Environmental Quality 2000). The USEPA estimates the state to contain 66,294 miles of rivers and streams, 1,078,031 acres (1,684 square miles) of lakes and reservoirs, 5,882,070 acres (9,191 square miles) of fresh and tidal wetlands, and 4,899,840 acres (7,656 square miles) of estuaries (Louisiana Department of Environmental Quality 2000).

The Mississippi River, the longest river on the North American continent, is Louisiana's most important surface water resource. The Mississippi River system in Louisiana is the terminus for the largest capacity inland waterway system in the world (Louisiana Department of Transportation and Development 2002). The river serves as a navigation

Table B-1: Louisiana Aquifers

Aquifer Name	Location	Sediments	Recharge	Use	Description
Cockfield	northeast Louisiana	very fine to fine sand	rainfall on outcrop area; leakage fro overlying alluvial aquifer; leakage from underlying aquifers	~600 million gal/day; primarily public supply	water movement is eastward and southward
Sparta	north and north-centra Louisiana	very fine to medium sand; interbedded wit thin layers of clay and lignite	rainfall on outcrop area and water moving downward through terrace deposits; leakage from overlying Cockfield and underlying Carrizo-Wilcox aquifers	~64 million gal/day primarily industry and public supply	recharge towards east and south and Monroe; high sodium in eastern part of aqu makes unsuitable for irrigation
Carrizo-Wilcox	northwest Louisiana; both sides of Red River	fine to medium sand, silt, clay, and lignite	rainfall on surficial sediments	~13 million gal/day public, domestic, and small farm supply	aquifer discharges into Red and Sabine Rivers
Chicot Aquifer System	southwest Louisiana	coarse sand and gravel	primarily in northern part of aquifer; rainfall in Allen and Beauregard Parishes; leakage form overlying an underlying areas	~690 million gal/day; primarily agriculture	groundwater movement towards coast and pumping stations; water soft in recharge and southern area; harder in central and southeastern areas; subdivision: 220 ft sand, 500 ft sand, 700 ft sand, upper sand unit, lower sand unit
Evangeline	southwest Louisiana	fine to medium sand; sand units separate by clay	rainfall in Vernon, Avoyelles, and Rapides Parishes; leakage from Chicot aquifer; leakage from underlying aquifers	~14 million gal/day primarily public supply	water generally moves southward; seepage into Sabine and Calcasieu Rivers towards west and into Atchafalaya River towards east; overlying Chicot system provides water for irrigation
Jasper Aquifer System	southwest Louisiana	fine to medium sand; extensive clay layers separate from overlying and underlying aquifers	rainfall in Vernon and Natchitoches Parishes	~46 million gal/day primarily public supply	comprised of the Williamson Creek (upper) aquifer and the Carnahan Bayou (low aquifer; groundwater movement towards south and southeast and pumping cente water from Carnahan Bayou slightly harder than from Williamson Creek
Catahoula	western edge of Louisiana in a northeasterly direction across the state	fine to medium sand; forms sandstone	rainfall on outcrop area and percolating through overlying alluvia and terrace deposits	~3 million gal/day; primarily public supply	limited use as a source of freshwater; divided into three freshwater areas by saltwater under Red River Valley and Little River divide
Chicot Equivalent	southeast Louisiana	fine to coarse sand and gravel	along Louisiana-Mississippi State line; rainfall or leakage from surficial sands; leakage from underlying aquifers	~88 million gal/day; primarily industry	principal sands are 400 ft and 600 ft Baton Rouge; Gramercy, Norco, and Gonzales-New Orleans; 1,200 ft New Orleans; upper Pontchatoula water generally moves southward. saltwater moves northward across Baton Rouge fault into 600 sand; 1,200 ft sand in New Orleans not pumped because water is saline; upper Ponchatoula is least developed
Evangeline Equivalent	southeast Louisiana	fine to medium sand	in south-central and southwest Mississippi; rainfall on surficial sands	~68 million gal/day primarily public use	comprised of 800 ft sand, 1,000 ft sand, 1,200 ft sand, 1,500 ft sand, and 1,700 ft sand of the Baton Rouge area; lower Pontchatoula; Big Branch; Kentwood; Abita; Covington; and Slidell aquifers; water generally moves southward
Jasper Equivalent	southeast Louisiana	fine to coarse sand	in southwestern Mississippi; rainfall on surficial sands; leakage from overlying aquifers	~112 million gal/day; primarily industry and public use	principal aquifers are 2,000 ft sand, 2,400 ft sand, and 2,800 ft sand of Baton Rouge area; Tchefuncta; Hammond; Amite; and Ramsay aquifers
Mississippi River Alluvia	follows the river's course from northeastern to south-central Louisiana	sand and gravel; fine grained in upper part grading to coarse in lower part; confined b overlying fine sand, silt, and clay (0 to 150 ft thick)	rainfall on aquifer surface and underlying aquifers; leakage from underlying aquifers, locally from Mississippi River near pumping centers	~284 million gal/day, primarily irrigation	in southern Louisiana joins with alluvium of the Atchafalaya River to form a large alluvial aquifer, water generally moves southward, seepage into major streams and withdrawal from wells; requires treatment for domestic and public supply use; saltwater from underlying aquifers, oil and gas activities, and ancient unflushed saltwater; threats include improperly plugged or abandoned wells and misuse of agricultural chemicals; no detection of major organic contamination
Red River Alluvial	Red River Valley	clay, silt, and fine sand grading to coarse sand and gravel	rainfall on fine-grained surficial sediments; leakage from underlying aquifers	~4 million gal/day; primarily aquaculture	small amount of water pumped because treatment is required for most uses
Upland Terrace	discontinuous band along northwestern edge of Red River Valley and western edge of Mississippi River Valley	clay, silt, and fine sand grading to coarse sand and gravel	rainfall on fine-grained surficial sediments; leakage from underlying aquifers	~22 million gal/day primarily public supply and industry	not extensively used for freshwater due to potential for contamination

artery of great importance (in conjunction with the Gulf Intracoastal Waterway [GIWW]) and supplies water for the cities and industries that have developed along its banks. The Mississippi River drainage basin is the fourth largest in the world, draining 41% of the continental United States. The basin encompasses greater than 1.2 million square miles, includes all or parts of 31 states, and three Canadian provinces. Other important rivers in the state include the Red, Atchafalaya, Ouachita, Sabine, Calcasieu, Mermentau, Vermilion, Pearl, and Black.

The state's numerous bayous comprise a drainage network and often act as distributaries, rather than tributaries, and serve as drainage outlets. Bayous Teche, Macon, Lafourche, and Boeuf are the largest.

Louisiana's lacustrine resources include lagoons, oxbow lakes, and raft lakes. Barataria, Timbalier, and Terrebonne Bays and Lakes Pontchartrain, Maurepas, and Salvador are typical of lagoonal lakes on the deltaic plain. Oxbow lakes form when meander bends are cutoff from a river's course and are located throughout Louisiana's Mississippi River alluvial plain. False River is one such example. Remnant impounded tributaries are termed raft lakes in the Red River alluvial plain. Caddo, Bistineau, and Black Lakes are such examples.

Numerous natural and manmade reservoirs are located in central and north Louisiana, of which Toledo Bend is the largest. This 186,000-acre lake (1,200 miles of shoreline) was created by damming the Sabine River on the Louisiana-Texas border.

Surface Water Quality

Water quality data for the State of Louisiana are routinely collected by LDEQ for monitoring and evaluation purposes. The *2000 Water Quality Inventory Section 305(b)* indicated that as of January 2000, 19.5% (95) of Louisiana's 476 named regulatory subsegments, or water bodies, were fully supporting their overall designated use and 4.0% (19) were fully supporting but threatened. Water bodies that were partially supporting their overall designated use accounted for 29.8% (142) of Louisiana's assessed streams, lakes, wetlands, and estuaries. Water bodies not supporting their overall designated use accounted for 10.7% (51). The category Insufficient Data (INSD) was utilized to account for those water bodies where LDEQ's ambient water quality data or other reliable data were not available to make a defensible assessment. Water bodies assessed INSD accounted for 35.5% (169).

The following was the status of Louisiana's 351 named regulatory rivers and streams as of 2000: 63 (17.9%) were fully supporting their overall designated use (represents 26.2% or 2,483 miles of total assessed stream miles); 12 (3.4%) were fully supported but threatened (2.8% or 261 miles); 109 (31.1%) were partially supporting use (37.3% or 3,528 miles); 44 (12.5%) were not supporting designated use (11.1% or 1,048 miles); and 123 (34.9%) were assessed the category INSD (22.5% or 2,136 miles). Metals (arsenic, cadmium, copper, lead, and mercury) were the suspected cause for most impaired river/stream miles. Pathogen indicators (fecal coliforms) were the second most frequently cited suspected cause of river/stream impairment. Organic enrichment/low dissolved oxygen (DO) was the third largest suspected cause of river/stream impairment. Sources of river/stream impairment included natural, agricultural, municipal point source, and septic tanks.

The following was the status of Louisiana's 66 named regulatory lakes and reservoirs as of 2000: 14 (21.2%) were determined to be fully supporting their overall designated use

(represents 57.1% or 378,960 acres of total assessed lakes and reservoirs); two (3.0%) were fully supported but threatened (0.7% or 4,838 acres); 23 (34.9%) were partially supporting use (14.8% or 98,190 acres); three (4.5%) were not supporting designated use (5.5% or 36,188 acres); and 24 (36.4%) were assessed as INSD (22% or 145,948 acres). Mercury in fish tissue or water quality criteria exceedences was suspected for most impaired lacustrine acreages. Lead, copper, and cadmium were cited as suspected causes for the impairment of lakes/reservoirs. Organic enrichment/low DO was the next most frequently cited cause of impairment. In addition, salinity/total dissolved solids (TDS)/chlorides and pathogen indicators were cited as suspected sources. Sources of lakes/reservoirs impairment included atmospheric deposition, natural, and hydromodification.

The following was the status of Louisiana's 51 evaluated estuary subsegments as of 2000: 15 (29.4%) were fully supportive of their designated use (represents 33.2% or 1,644 square miles of total assessed estuary subsegments); five (9.8%) were fully supported but threatened (6.2% or 308 square miles); eight (15.7%) were partially supporting overall designated use (36.3% or 1,795 square miles); four (7.8%) were not supporting designated use (5.8% or 288 square miles); and 19 (37.3%) were assigned as INSD (18.4% or 912 square miles). Metals and mercury were primary suspects in estuarine impairment. Pathogen indicators and nutrients followed. Atmospheric deposition, municipal point sources, and septic tanks were indicated as sources of impairment.

The following was the status of Louisiana's eight evaluated wetland areas as of 2000: three (represents 52.4% or 845 square miles of total assessed wetland areas) were considered fully supporting overall designated use; two (19.5% or 315 square miles) were partially supporting overall use; and three (28.1% or 453 square miles) were classified as INSD. Mercury, cadmium, copper, and lead were cited as suspected causes of estuarine impairment. Atmospheric deposition was indicated as a source.

Climate

The climate of Louisiana is classified as subtropical and is governed by various terrestrial and atmospheric controls. Situated along the northern Gulf of Mexico between 29° and 33° north latitude, Louisiana's climate and temperature pattern are strongly influenced by seasonal changes in atmospheric circulation. During the summer months, prevailing southerly and southeasterly winds, associated with the Bermuda High, transport warm, moist air from the Gulf of Mexico across the coast and deep into the continental United States. This maritime tropical air mass significantly influences temperature and humidity across the state. Summer temperatures range between 85°F and 95°F during the afternoons and 65°F to 75°F during the early mornings and humid conditions prevail with occasional periods of hot and dry weather. During the months between September and May, variable weather conditions prevail as arctic and polar air masses associated with extratropical cyclones aperiodically inundate the state and produce cooler and drier conditions. Maritime polar and continental polar air masses can cause large and rather sudden drops in temperature. The average January temperatures for Louisiana range from 55°F to 60°F in the afternoons and near freezing to 40°F during the early morning hours.

Climate patterns differ across the state. Northern Louisiana records larger annual temperature variations and lower average annual rainfall than southern Louisiana because it is further from the influences of the Gulf of Mexico. In central and north Louisiana, freezing temperatures (32°F or lower) are recorded on 30 to 40 days during an

average year. South Louisiana experiences lower annual temperature variations due to its proximity to the temperature-moderating Gulf of Mexico. Freezing temperatures are recorded 10 to 35 days during an average year. Louisiana's coastal parishes and areas along the Mississippi River, south of New Orleans, do not record freezing temperatures in every year. During the summer, daytime highs rarely exceed 100°F in the costal parishes.

Precipitation in Louisiana is largely due to convectional activity and extratropical storms during the summer and winter months, respectively. Summer precipitation is most common during the mid-afternoon. Winter precipitation is associated with extratropical storms and cold front passages. Rainfall in Louisiana varies and generally decreases from the southeast (62 to 66 inches per year) to the northwest (48 inches per year) regions of the state. Central Louisiana is a region of transition, having characteristics of both the northern and southern regions of the state.

Louisiana is susceptible to tropical waves, tropical depressions, tropical storms, and hurricanes due to its proximity to the Gulf of Mexico. Historical data from 1901 to 1995 indicate that 25 hurricanes and 30 tropical storms have made landfall along the Louisiana coastline (Johnson and Yodis 1998). These weather events can produce significant amounts of precipitation over a very short period of time and are often accompanied by strong winds, tornadoes, and storm surge along the coastal areas.

Air Quality

The LDEQ maintains a statewide monitoring network that consists of 44 air-monitoring stations. The data collected are used to determine compliance with National Ambient Air Quality Standards (NAAQS) and track trends in air quality. The EPA Office of Air Quality Planning and Standards (OAQPS) set NAAQS for six principal pollutants considered harmful to public health and the environment. Termed criteria pollutants, the six are carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), lead (Pb), particulate <10 micrometers (PM-10), and sulfur dioxide (SO2). Volatile organic compounds (VOCs), many of which are hazardous air pollutants, are not listed as criteria air pollutants but are measured at selected sites throughout Louisiana. Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m3), and micrograms per cubic meter of air (µg/m3). See Table B-2 for NAAQS (Louisiana Department of Environmental Quality 1997).

The CAA establishes two types of national air quality standards, primary and secondary. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. A geographic area that meets or exceeds primary standards is classified as an attainment area. Areas that violate NAAQS for one or more of the six criteria pollutants are classified as nonattainment areas. See B-2 for NAAQS.

Louisiana violates the 1-hour average ozone primary and secondary standards (0.12 ppm; 235 µg/m3) in the five parishes of Ascension, East Baton Rouge, Iberville, Livingston, and West Baton Rouge (Louisiana Department of Environmental Quality 1997). Collectively, these parishes are called the Baton Rouge Nonattainment Area (Louisiana Department of Environmental Quality 1997). Louisiana is in attainment for the remaining five criteria pollutants (Oubre, personal communication 2002).

Table B- 2: Louisiana Air Quality -NAAQS

Pollutant	Averaging Time	Standard Value*	Standard Type
Carbon Monoxide (CO)	8-hour Average	9 ppm (10mg/m$^{3)}$	Primary
	1-hour Average	35 ppm (40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Primary & Secondary
Ozone (O_3)	1-hour Average	0.12 ppm (235 µg/m^3)	Primary & Secondary
	8-hour Average**	0.08 ppm (157 µg/m^3)	Primary & Secondary
Lead (Pb)	Quarterly Average	1.5 µg/m^3	Primary & Secondary
Particulate < 10 micrometers (PM-10)	Annual Arithmetic Mean	50 µg/m^3	Primary & Secondary
	24-hour Average	150 µg/m^3	Primary & Secondary
Particulate < 2.5 micrometers (PM-2.5)	Annual Arithmetic Mean**	15 µg/m^3	Primary & Secondary
	24-hour Average**	65 µg/m^3	Primary & Secondary
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	0.03 ppm (80 µg/m^3)	Primary
	24-hour Average	0.14 ppm (365 µg/m^3)	Primary
	3-hour Average	0.50 ppm (1300 µg/m^3)	Secondary

* Parenthetical value is an approximate equivalent concentration
** The 8-hour average ozone standard and the PM-2.5 standards are included only for the purpose of providing information. A May 1999 Federal Court ruling blocked the EPA's authority to implement these standards, as proposed in July 1997. The U.S. Environmental Protection Agency and the Department of Justice have appealed the court's decision and are seeking to have it overturned.

Noise

The Louisiana Department of Environmental Quality (LDEQ) was given the authority to govern the regulation of noise pollution by the USEPA. However, inaction in the development of a program may occur when a mandate by the federal government is not funded. Due to the lack of funding provided to the LDEQ by the EPA to date, there are no regulations or programs for the administration of noise-pollution related activities. Therefore, no data exists at the state-level relative to this subject and noise pollution is subject to local ordinances (LaCoure, personal communication 2002).

Biological Resources

Nekton

Louisiana's diversity of fresh and saltwater environments, in the form of bayous, rivers, streams, oxbows, ponds, marshes, swamps, lakes, and coastline, provide essential habitat for many species of fresh and saltwater fish, estuarine-marine invertebrates, and marine mammals. There are more than 500 nektonic species that live in Louisiana's waters (Douglas 1974). The larger rivers of the state (Mississippi, Atchafalaya, Red, Ouachita, Sabine, Pearl, and Black), along with numerous smaller tributaries (Amite, Boeuf, Chitto, Calcasieu, Comite, Tangipahoa, and Tickfaw), together with thousands of small ponds, creeks, and streams, provide habitat for the freshwater fish of Louisiana. In conjunction with these freshwater systems, Louisiana has 7,721 miles of shoreline and extensive estuaries, sounds, lagoons, and brackish bayous (NOAA 1975; Farrow et al. 1992; Bureau of the Census 1994). Coastal waters and waterways provide habitat for many species of fish, invertebrates, and mammals. The unique combination of fresh and saltwater habitats in Louisiana is cause for a large biological diversity and number of species.

The freshwater regions of Louisiana include more than 40,000 miles of rivers, bayous, and creeks, nearly 450,000 acres of lakes and ponds, and over 3.5 million acres of marsh (Calhoun 1997). Each habitat supports a variety of species and populations. Louisiana has 22 families and 148 species of freshwater fish (Douglas 1974). Easily accessible waterways and an abundance of warm-freshwater game fish, such as the largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctulatus*), and black crappie (*Pomoxis nigromaculatus*), has made the waters of Louisiana the destination of choice for freshwater fishermen. While the aforementioned three species are most highly prized by fishermen, the state's waters contain an abundance of other species that encompass many sizes and shapes. The following list of freshwater species is only a small representation of all those that are found in the state and includes only those species which have a statewide distribution or significant commercial or sport fishing value. Species include the Mississippi silvery minnow (*Hybognathus nuchalis*), golden shiner (*Notemigonus crysoleucas*), creek chub (*Semotilus atromaculatus*), carp (*Cyprinus carpio carpio*), channel catfish (*Ictalurus punctatus*), pirate perch (*Aphredoderus sayanus*), mosquito fish (*Gambusia affinis*), white bass (*Morone chrysops*), yellow bass (*Morone mississippiensis*), stripped bass (*Morone saxatilis*), rock bass (*Ambloplites rupestris*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), warmouth (*Lepomis gulosus*), longear sunfish (*Lepomis megalotis*), redear sunfish (*Lepomis microlophus*), spotted sunfish (*Lepomis punctatus*), spotted bass, largemouth bass, white crappie (*Pomoxis annularis)*, black crappie (*Pomoxis nigromaculatus*), sand darter (*Ammocrypta clara*), banded darter (*Etheostoma zonale*), freshwater drum (*Aplodinotus grunniens)*, spotted gar (*Lepisosteus oculatus*) and longnose gar (*Lepisosteus osseus*), bowfin (or choupique) (*Amia calva*), bigmouth buffalo (*Ictiobus cyprinellus*), smallmouth buffalo (*Ictiobus babalus*), and paddlefish (*Polyodon spathula*).

The red swamp crawfish (*Procambarus clarkii*) and white river crawfish (*Procambarus acutus*) are well-known and valuable freshwater crustaceans. Having a statewide distribution, crawfish are found in many bodies of water and are concentrated within the overflow basins of the Atchafalaya, Red, and Pearl Rivers. Crawfish can survive both in and out of the water and are active burrowers, building large systems of underground tunnels and galleries (Huner and Barr 1991). The diet of the crawfish consists primarily of water plants, detritus, and aquatic insects and insect larvae.

The convergence of the Mississippi River with the Gulf of Mexico has created a range of habitats utilized by both freshwater and saltwater species. These brackish waters provide essential habitat for many species of fish, most notably the red drum (redfish) (*Sciaenops ocellatus*), southern flounder (*Paralichthys lethostigma*), sheepshead (*Archosargus probatocephalus*), Atlantic croaker (*Micropogonias undulates*), spot (*Leiostomus xanthurus*), sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), Gulf menhaden (*Brevoortia petronus*), bay anchovy (*Anchoa mitchilli*), catfishes (*Ictaluridae*), sheephead minnow (*Cyprinodon variegates*), livebearers (*Poeciliidae*) killifishes (*Fundulide*), silversides (*Membras* sp.), and gobies (*Gobiidae*).

The deeper coastal waters offshore are habitat to many finfish common to the Gulf of Mexico. Many species congregate around the stanchions of the deepwater drilling rigs. These artificial reefs provide shelter to offshore species including the bluefish (*Pomatomus saltatrix*), dolphin (*Coryphaena hippurus*), and blacktip shark (*Carcharhinus limbatus*). The following fish have a greater association with the rigs themselves: red

snapper (*Lutjanus campechanus*), sheepshead (*Archosargus probatocephalus*), spadefish (*Chaetodipterus faber*), and gray triggerfish (*Balistes capriscus*).

Offshore rigs, artificial reefs, oyster reefs, breakwaters, jetties, and snapper banks provide habitat to diverse assemblages of encrusting organisms (epibenthic organisms), including hydroids and corals (*Phylum Cnidaria*), bryzoans (*Phylum Entoprocta*), sponges (*Phylum Porifera*), barnacles, amphipods, decapods, and other crustaceans (*Phylum Arthropoda*) and fish. Those environs farthest offshore often support species of tropical origin.

The waters of Louisiana comprise numerous species of estuarine-marine invertebrates including the brown shrimp (*Penaeus aztecus*), white shrimp (*Penaeus setiferus*), seabob shrimp (*Xiphopenaeus kroyeri*), pink shrimp (*Penaeus Ouorarum*), and royal red shrimp (*Pleoticus robustus*). Brown and white shrimp, the most abundant of the shrimp species, spawn in the Gulf of Mexico. Throughout February and March the brown shrimp larvae move into the lower estuaries, where postlarval and juvenile growth takes place. As young adults the shrimp emigrate into deeper estuarine waters, eventually moving into the nearshore Gulf of Mexico in early to mid summer. Emigration is keyed to lunar tides (Blackmon 1974). White shrimp follow a similar pattern of migration with few exceptions. Most notably, inshore development occurs in June through August with emigration into the Gulf driven by late fall/early winter cold frontal passages (Mac et al. 1998).

Although decapod species found in coastal waters are quite diverse and prevalent, the blue crab (*Callinectes sapidus*) is the most common and important commercial crab species in the north central Gulf of Mexico. The blue crab can survive in a range of environments, from offshore marine waters to freshwater marshes. Like the shrimp, the blue crab is dependent upon the state's estuaries for the completion of its life cycle. In late summer, egg-baring females migrate offshore to spawn. Shortly thereafter, the larvae of the blue crab adopt the inshore migration patterns of estuarine-marine fish. Mature male blue crabs remain in brackish and freshwater estuaries for the remainder of their lives; conversely, female blue crabs complete their life cycle on the continental shelf (Mac et al. 1998).

The nektonic mollusk recorded in greatest numbers within the estuaries is the brief squid (*Lollinguncula brevis*). Long fin (*Loligo pealei*) and arrow squid (*Doryteuthis plei*) are also common and are commercially important as bait for commercial and recreational fishing, as well as for human consumption.

Louisiana's innumerable surface freshwater hydrologic systems, brackish estuaries, and deeper coastal waters provide essential habitats and conditions for the state's hundreds of nektonic species and together form what is considered part of one of the world's most productive fisheries regions. As a result of low stream gradients throughout most of the state, many waters move slowly, particularly in association with swamps and other wetlands, and are therefore dystrophic. Local aquatic communities appear to have adapted to these conditions and populations are typically healthy despite low oxygen conditions. However, during periods of extended drought and low water levels, coupled with warm temperatures and high algal respiration, fishkills may occur. Population growth has caused additional impacts to aquatic habitats. In recent years, hypoxic conditions have been documented annually, to varying degrees, for extensive areas on the continental shelf off of Louisiana. In an effort to reduce this phenomenon, programs are currently being developed and implemented in states within the extensive Mississippi River watershed, aimed at reducing nutrient input into the Mississippi River and its

tributaries. Runoff problems are also being addressed statewide under the Nonpoint Source Program.

Benthos

Benthic organisms are defined as those that live on or in association with the bottom of a body of water. Benthic organisms can be split into two large categories: infauna (those below the sediment surface) and epifauna (those above the sediment surface). Benthic organisms are an important link in Louisiana's aquatic ecosystems.

Most coastal communities indicative of soft bottom (poorly consolidated silty clay) habitats, are rich in organic material (detritus) and are very productive. However, currents and wave energy perturb these communities and consequently, assemblages are often dominated by opportunistic species. This is not necessarily the case in streams and waterways found elsewhere in the state, where stream bottom community composition varies with the ecoregion.

The eastern oyster (*Crassostrea virginica)* is a well-known and important benthic organism both economically and ecologically. The oyster begins life as a free-floating larva and remains suspended in the water column for several days while developing a tiny bivalve shell. The embryo lives at the mercy of the tides and currents while seeking to attach itself to a clean and hard surface. If no surface is found, the oyster falls to the sea floor and is buried. If a suitable surface is found, the larva cements itself onto that surface and loses all organs of locomotion; thus remaining stationary. The young oyster grows rapidly, building a larger shell. The oyster develops best in a mixture of fresh and saltwater, ranging from 20% to 75% the salinity of ocean water (Dugas 1982). Louisiana's coastal intertidal and subtidal zones, brackish bayous, and inlets provide essential habitat for the development of the oyster. The oyster filters seawater through tiny, hair-like structures on the gills, removing oxygen, mineral salts, and microscopic floating plants (diatoms)/other microscopic organisms. A single oyster can pump 100 gallons of water a day through its shell, thereby feeding and cleansing itself (Dugas 1982). Of ecological significance, the processes of straining and filtration cleanse the water of the estuaries. In addition, oysters build extensive reefs or beds. Oyster reefs comprise the majority of hard substrate found in Louisiana's coastal waters. These structures provide protection and support for both the oyster and other diverse macrofauna.

Wildlife

Louisiana has a diverse array of wildlife. There are 71 species of mammals, 130 species of reptiles and amphibians, and 430 species of birds recorded in Louisiana (Dennett 1997). The overall abundance and diversity of wildlife is directly attributed to the variety of habitats located throughout the state. Changes in habitat type generally follow the geographical boundaries of the state. Wildlife is distributed throughout the pine and hardwood forests, prairies, coastal marshes, and alluvial plains of Louisiana. Each habitat supports large numbers of animal and bird species, many of which are utilized by the populous of the state, including trappers and sport hunters, naturalists, students, and others who enjoy observing wildlife.

Mammalian habitats in Louisiana are extremely diverse, ranging from open-ocean, protected estuaries, coastal marshes, and freshwater swamps and marshes, to thick pine and hardwood forests, grasslands, and prairies. The mammals that utilize these habitats are equally as varied. In size they range from the small eastern harvest mouse (*Reithrodontomys humulis*) to the large Louisiana black bear (*Ursus americanus*).

Louisiana has a number of species of Neotropical fauna, as a result of warm climate and proximity to the Gulf of Mexico. Neotropical species evolved in Latin America at various times in the past and dispersed northward and eastward into Texas and Louisiana. Neotropical fauna include the nine-banded armadillo (*Dasypus novemcinctus*), Virginia opossum (*Didelphis marsupialis*), northern yellow bat (*Lasiurus intermedius*), Brazilian free-tailed bat (*Talarida brasiliensis*), marsh rice rat (*Oryzomys palustris*), fulvous harvest mouse (*Reithrodontomys fulvescens*), and the hispid cotton rat (*Sigmodon hispidus*). Although not indigenous to the continental United States, a few, such as the Virginia opossum, have lived here for more than 20,000 years (Choate et al. 1994).

The following descriptions of mammals were synthesized from information contained within Choate et al. 1994 text *Handbook of Mammals of the South-Central States*.

Order Artiodactyla consists of even-toed ungulates, otherwise known as "hoofed mammals." Louisiana, prior to modern civilization, had American elk (*Cervus elaphus*) and bison (*Bison bison*). Both have now been extirpated from the southeast. The only ungulate that lives in Louisiana today is the whitetail deer (*Odocoileus virginianus*).

Members of the order Carnivora inhabit all landmasses, including Antarctica. Carnivores are generally flesh eaters, although species regularly consume fruits, nuts, and other plant matter. Louisiana has many of these familiar mammals including the coyote (*Canis latrans*), red wolf (*Canis rufus*) (in captivity), gray fox (*Urocyon cinereoargenteus*), black bear (*Ursus americanus)*, ringtail (*Bassariscus astutus*), raccoon (*Procyon lotor*), long tailed weasel (*Mustela frenata)*, mink (*Mustela vison*), eastern spotted skunk (*Spilogale putorius*), stripped skunk (*Mephitis mephitis*), river otter (*Lontra canadensis*), mountain lion (*Puma concolor*), and bobcat (*Lynx rufus*).

Order Chiroptera are volant mammals, capable of true flight. All bats in Louisiana are insectivorous. Species in Louisiana include the southeastern myotis (*Myotis austroriparius*), silver haired bat (*Lasionycteris noctivagans*), eastern pipestrelle (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis)*, evening bat (*Nycticeius humeralis*), northern yellow bat (*Lasiurus intermedius*), Seminole bat (*Lasiurus seminolus*), and the Brazilian free-tailed bat (*Talarida brasiliensis*).

Opossums (*Didelphis marsupialis*) are the only species of the order Didelphimorphia found in the state. They are the most primitive of all living mammals and have a fossil record dating to the late Cretaceous period (75 to 80 million years ago). Opossums differ from other mammals in that the young are relatively undeveloped when born and must live the first part of their lives within the mother's marsupium, or "pouch".

Another primitive order of mammals with beginnings in the late Cretaceous period is the order Insectivora. This order includes shrews and moles, which are found throughout Louisiana. Species include the southeastern shrew (*Sorex longirostris*), southern short-tailed shrew (*Blarina carolinensis*), least shrew (*Cryptotis parva*), and the eastern mole (*Scalopus aquaticus*).

Order Lagomorpha includes hares and rabbits, which are found throughout Louisiana and valued by sport hunters and trappers. Species in Louisiana include the swamp rabbit (*Sylvilagus aquaticus*) and the eastern cottontail (*Sylvilagus floridanus*). Both species are

characterized as nocturnal, have semi-solid bones to reduce body weight, and a diet composed entirely of plant matter.

Order Rodentia is the most diverse group of living mammals. Members of this order are located on every landmass, with the exception of New Zealand and Antarctica. Louisiana has many different species including the eastern chipmunk (*Tamias striatus*), eastern gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), southern flying squirrel (*Glaucomys volans*), hispid pocket mouse (*Chaetodipus hispidus*), beaver (*Castor Canadensis*), marsh rice rat (*Oryzomys palustris*), fulvous harvest mouse (*Reithrodontomys fulvescens*), cotton mouse (*Peromyscus gossypinus*), white footed mouse (*Peromyscus leucopus*), golden mouse (*Ochrotomys nuttalli*), hispid cotton rat (*Sigmodon hispidus*), eastern wood rat (*Neotoma floridana*), prairie vole (*Microtus ochrogaster*), woodland vole (*Microtus pinetorum*), and muskrat (*Ondatra zibethicus*).

The nine-banded armadillo (*Dasypus novemcinctus*) is the only species of the order Xenarthra found in Louisiana.

Louisiana's subtropical climate and abundant precipitation create an ideal habitat for cold-blooded animals. Throughout the state, amphibians and reptiles are found in great numbers. In addition to natural habitats, frogs, turtles, and snakes can be found in man-made lakes, ponds, parks, and homeowners' yards. Louisiana provides habitat to the American alligator (*Alligator mississippiensis*), which after virtual extirpation by trappers and hunters has made a strong comeback throughout the state.

The following descriptions of amphibians and reptiles were synthesized from information contained within Dundee and Rossman's 1989 text, *The Amphibians and Reptiles of Louisiana*.

Class Amphibia, order Anura, consists of frogs and toads. All members of this order are characterized by abbreviated chunky bodies, lack of tail, and elongated hind legs used for jumping. Species found in Louisiana include the northern cricket frog (*Acris crepitans*), gray treefrog (*Hyla versicolor*), green treefrog (*Hyla cinerea*), spring peeper (*Pseudacris crucifer*), ornate chorus frog (*Pseudacris nigrita*), striped chorus frog (*Pseudacris triseriata*), greenhouse frog (*Eleutherodactyus planirostris*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*), southern leopard frog (*Rana sphenocephala*), American toad (*Bufo americanus*), oak toad (*Bufo quercicus*), and southern toad (*Bufo terrestris*).

Class Amphibia, order Urodela, includes salamanders and newts. The following are found in Louisiana: spotted salamander (*Ambystoma maculatum*), marbled salamander (*Ambystoma opacum*), tiger salamander (*Ambystoma tigrinum*), southern dusky salamander (*Desmognathus auriculatus*), long-tailed salamander (*Eurycea longicauda*), slimy salamander (*Plethodon kisatchie*), southern red-backed salamander (*Pseudotriton ruber*), gulf coast waterdog (*Necturus maculosus*), mudpuppy (*Necturus maculosus*), and eastern newt (*Notophthalmus viridescens*). Most live in moist forested regions, and unlike other amphibians, lay their eggs on land rather than in water.

Class Reptilia, order Crocodylia includes the American alligator (*Alligator mississippiensis*). The American alligator was once very common throughout the state. The skin of the alligator, highly prized for commercial value, led to massive kills by hunters and trappers. Louisiana outlawed the hunting and trapping of alligators in 1963, and under this new protection the American alligator recovered quickly. A limited hunting

season was reopened in 1972. Today the American alligator can be found virtually statewide, with the exception of the hill country of central and northern Louisiana.

Order Squamata consists of lizards and snakes. Fourteen lizard species are found in Louisiana and all are carnivores that consume other lizards, insects, worms, and small prey. Lizards that inhabit Louisiana include the slender glass lizard (*Ophisaurus attenuatus*), eastern glass lizard (*Ophisaurus ventralis*), Mediterranean gecko (*Hemidactylus turcicus*), green anole (*Anoles carolinensis*), collared lizard (Crotaphytus collaris), Texas horned lizard (*Phrynosoma cornutum*), eastern fence lizard (*Sceloporus undulatus*), coal skink (*Eumeces anthracinus pluvialis*), five-lined skink (*Eumeces fasciatus*), prairie skink (*Eumeces septentrionalis*), and ground skink (*Scincella lateralis*). The second division of order Squamata is the snake. The snake is the most diverse reptile found in Louisiana, with 39 species common to the state. The southern water snake (*Nerodia fasciata*) is known to live in every parish. All snakes are carnivores and lacking any holding claws and cutting teeth, must swallow their prey whole. Louisiana has a few venomous species (families Elapidae and Viperidae) and many non-venomous species (family Colubridae). Louisiana's subtropical climate is habitat to North America's only species from the highly poisonous Elapidae family. The eastern coral snake (*Micrurus fulvius fulvius*) is easily recognized by bright bands of yellow, red, and black. The second family of venomous snakes in Louisiana is the Viperidae and includes the copperhead (*Agkistrodon contortrix*), cottonmouth (*Agkistrodon piscivorus*), eastern diamond-backed rattlesnake (*Crotalus adamanteus*), timber rattlesnake (*Crotalus horridus*), and pygmy rattlesnake (*Sistrurus m. barbouri*). Non-venomous snakes, of the family Colubridae, include the worm snake (*Carphophis amoenus*), scarlet snake (*Cemophora coccinea*), racer, corn snake (*Elaphe guttata*), rat snake (*Elaphe obsoleta*), mud snake (*Farancia abacura*), rainbow snake (*Farancia erytrogr*), eastern hog-nosed snake (*Heterod platerinos*), king snake (*Lampropeltis getulus*), milk snake (*Lampropeltis triangulum*), coachwhip (*Masticophis flagellum*), salt marsh snake (*Nerodia clarki*), southern water snake (*Nerodia fasciata*), rough green snake (*Opheodrys aestivus*), pine snake (*Pituophis ruthveni*), crayfish snake (*Regina grahamii and Regina grahami*), brown snake (*Storeria dekayi*), red-bellied snake (*Storeria occipitomaculata*), flat headed snake (*Tantilla grac*), eastern ribbon snake (*Thamnophis sauritus*), western ribbon snake (*Thamnophis proximus*), and the common garter snake (*Thamnophis sirtalis*).

Class Reptilia, order Testudines, includes turtles, tortoises, and terrapins. This ancient group has existed for nearly 200 million years with little change in basic body form. Turtles, tortoises, and terrapins are defined by limb type. Turtles have paddle-like appendages and live in the ocean. Terrapins have semi-webbed feet and live in and out of freshwater. Tortoises have stump-like limbs with abbreviated toes and live on land. Species found in Louisiana include the following: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (Dermochelys coriacea), snapping turtle (*Chelydra serpentina*), alligator snapping turtle (*Macroclemys temminckii*), painted turtle (*Chrysemys picta*), chicken turtle (*Deirochelys reticularia*), Mississippi map turtle (*Graptemys kohni*), eastern box turtle (*Terrapene carolina*), western box turtle (*Terrapene ornata*), eastern mud turtle (*Kinosternon subrubrum*), softshell turtle (*Apalone muticus*), and gopher tortoise (*Gopherus polyphemus*).

The most diverse and abundant land animal in Louisiana is the bird. Louisiana has no less than 411 different bird species that live here for part or all of the year (Lowery 1974). These species descend from 19 orders and 66 families. The diversity and abundance of

birds in Louisiana is attributed to the state's geographic position and climate, which support numerous habitat types. Rivers, streams, bayous, lakes, ponds, coastal marshes, and tidal beaches and estuaries provide unequalled habitat for the hundreds of bird species. In addition, Louisiana has abundant hardwood swamplands, beech-oak uplands, pine forests, and treeless grassy plains, all of which provide habitat to land birds. The single greatest factor providing such great diversity is the presence of the Mississippi River. Louisiana lies in the Mississippi and Central flyways, routes for birds migrating from the Rocky Mountain region, the midwest, and the east. The yearly mass movement of birds to the south in the fall brings many northern nesting birds to Louisiana. Some remain all winter, while others rest before continuing on to destinations further south.

The following descriptions of birds were synthesized from information contained within Lowery's 1974 text, *Louisiana Birds*.

The order Ciconiiformes includes herons, bitterns, storks, and ibises. Representative species in the state include the following: great blue heron (*Ardea herodias*), green heron (*Butorides virescens*), little blue heron (*Egretta caerulea*), cattle egret (*Bubulcus ibis*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), American bittern (*Botaurus lentiginosus*), wood stork (*Mycteria americana*), white faced ibis (*Plegadis chihi*), and scarlet ibis (*Eudocimus ruber*).

Gulls, terns, plovers, and sandpipers, of order Charadriiformes, include the herring gull (*Larus argentatus*), ring billed gull (*Larus delawarensis*), laughing gull (*Larus atricilla*), common tern (*Sterna hirundo*), royal tern (*Sterna maxima*), black tern (*Chlidonias niger*), piping plover (*Charadrius melodus*), whimbrel (*Numenius phaeopus*), and American woodcock (*Scolopax minor*).

Order Pelecaniformes includes cormorants and pelicans. Representative species in Louisiana include the the brown pelican (*Pelecanus occidentalis*), eastern (great) white pelican (*Pelecanus erythrorhynchos*), and the double-crested cormorant (*Phalacrocorax auritus*).

The whooping crane (*Grus americana*) and sandhill crane (*Grus canadensis*) are of the order Gruiformes.

The storm petrel (*Oceanites gracilis*) is representative of the order Procellariiformes.

Ducks (dabbling, diving, merganser, tree, and stiff-tailed), geese, and swans comprise the order Anseriformes and inhabit water, rushes, cane, and other marsh vegetation. In autumn, great numbers of ducks and geese arrive in Louisiana via the Mississippi and Central flyways to winter. Representative species include the mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), red-breasted merganser (*Mergus serrator*), green-winged teal (*Anas crecca*), American black duck (*Anas rubripes*), gadwall (*Anas strepera*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), American wigeon (*Anas americana*), redhead (*Aythya americana*), canvasback (*Aythya valisineria*), goldeneye (*Bucephala clangula*), ruddy duck (*Oxyura jamaicensis*), bufflehead (*Bucephala albeola*), fulvous tree duck (*Dendrocygna bicolor*), Canadian goose (*Branta canadensis*), snow goose (*Chen caerulescens*).

Upland game birds of the order Galliformes found in Louisiana include the bobwhite quail (*Colinus virginianus*), ring-necked pheasant (*Phasianus colchicus*), and the wild turkey

(*Meleagris gallopavo*). The prairie chicken (*Tympanuchus cupido*) was last recorded in 1919.

Louisiana has birds of prey of the order Falconiformes. Representative species include the Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), peregrine falcon (*Falco peregrinus*), merlin (*Falco columbarius*), and the American kestrel (*Falco sparverius*).

The nine orders of Columbiformes (doves and pigeons), Psittaciformes (parrots), Cuculiformes (cuckoos), Strigiformesn (owls), Caprimulgiformes (goatsuckers), Apodiformes (swifts and hummingbirds), Coraciiformes (rollers, kingfishers, and relatives), Piciformes (woodpeckers, toucans, and relatives), and Passeriformes (songbirds or passerines and perching birds) are comprised of birds that inhabit nearly all areas of the state. An abbreviated listing of the hundreds of species includes the following: mourning dove (*Zenaida macroura*), ground dove (*Columbina passerina*), yellow-billed cuckoo (*Coccyzus americanus*), barn owl (*Tyto alba*), screech owl (*Otus asio*), horned owl (*Bubo virginianus*), snowy owl (*Nyctea scandiaca*), burrowing owl (*Athene cunicularia*), long eared owl (*Asio otus*), whip-poor will (*Caprimulgus vociferus*), nighthawk (*Chordeiles minor*), chimney swift (*Chaetura pelagica*), ruby throated hummingbird (*Archilochus colubris*), black chinned hummingbird (*Archilochus alexandri*), broad tailed humming bird (*Selasphorus platycercus*), belted kingfisher (*Ceryle alcyon*), red-bellied woodpecker (*Melanerpes carolinus*), red-headed woodpecker (*Melanerpes erythrocephalus*), pileated woodpecker (*Dryocopus pileatus*), eastern kingbird (*Tyrannus tyrannus*), sulphur bellied flycatcher (*Myiodynastes luteiventris*), Acadian flycatcher (*Empidonax virescens*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), blue jay (*Cyanocitta cristata*), common crow (*Corvus brachyrhynchos*), Carolina chickadee (*Poecile carolinensis*), winter wren (*Troglodytes troglodytes*), marsh wren (*Cistothorus palustris*), northern mockingbird (*Mimus polyglottos*), American robin (*Turdus migratorius*), wood thrush (*Hylocichla mustelina*), eastern bluebird (*Sialia sialis*), starling (*Sturnus vulgaris*), golden-winged warbler (*Vermivora chrysoptera*), Baltimore oriole (*Icterus galbula*), common grackle (*Quiscalus quiscula*), northern cardinal (*Cardinalis cardinalis*), goldfinch (*Carduelis tristis*).

Habitat Types and Associated Biota

The Louisiana GAP Analysis Program provides technical descriptions for the majority of the habitats listed below (see http://sdms.nwrc.gov/gap/gap2.html). Therefore, the following descriptors will elaborate on the biotic descriptors of the community, not the structural characteristics.

Dominant biota associated with the habitat types discussed below are summarized in the following tables:

- Vegetation (Table B-3)
- Mammals (Table B-4)
- Reptiles and Amphibians (Table B-5)
- Birds and Water Foul (Tables 6-12)
- A key to habitat type abbreviations can be found in Table 13

As for fish associated with these habitat types, there are too many to list in table format. At least 500 fresh and salt water fish species utilize Louisiana's aquatic habitats from northern lakes to off-shore reefs. Therefore, it can be assumed that all aquatic habitats

discussed below have fish species associated with them. For a complete list of freshwater fishes in Louisiana refer to the Peterson Field Guide for Freshwater Fishes (1991). For a complete list of salt water fishes refer to www.fishbase.org.

Table B- 3: Common Vegetation of Louisiana and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table B-13 for key)
Spartina alterniflora	smooth cordgrass	SM, B/IM
Distichlis spicata	spikegrass	SM, B/IM,
Salicornia perennis	woody glasswort	SM
Juncus roemerianus	black rush	SM
Spartina patens	marshhay cordgrass	SM, B/IM, FM
Scirpus spp.	bulrushes, three squares	B/IM, FM
Phragmites australis	common reed	B/IM
Phragmites communis	roseau cane	FM
Typha spp.	cattail	FM
Zizania aquatica	wild rice	FM
Panicum hemitomon	maidencane	FM
Cladium jamaicense	saw grass	FM
Eleocharis spp.	spike-rush	FM
Pontederia cordata	pickerelweed	FM
Sagittaria spp.	arrowhead	FM
Salix nigra	black willow	FM, WF, OS
Quercus spp.	oak	WF, UF
Liquidambar styraciflua	sweet gum	WF, UF
Nyssa spp.	gum	WF
Acer rubrum	red maple	WF
Taxodium distichum	bald cypress	WF
Ulmus americana	american elm	WF
Fraxinus spp.	ash	WF
Liriodendron tulipifera	tulip poplar	WF
Platanus occidentalis	sycamore	WF
Quercus lyrata	overcup oak	WF
Magnolia virginana	swamp magnolia	WF
Cephalanthus occidentalis	buttonbush	WF
Avicennia germinans	black mangrove	MS
Carya spp.	hickory	UF
Pinus palustris	long leaf pine	UF
Pinus echinata	short leaf pine	UF
Potamogeton spp.	pondweed	M/ESAV, FSAV
Zostera marina	eel grass	M/ESAV
Ceratophyllum demersum	coontail	FSAV
Utricularia sp.	bladder wort	FSAV
Eichhornia crassipes	water hyacinth	FSAV
Alternanthera philoxeroides	alligatorweed	FSAV
Limnobium spongia	American frog-bit	FSAV
Pistia stratiotes	water lettuce	FSAV
Nymphaea odorata	white water lily	FSAV
Hydrilla verticillata	hydrilla	FSAV

Table B- 4: Common Mammals of Louisiana and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table B-13 for key)
Odocoileus virginianus	whitetail dear	B/IM, FM, WF, OS, WS/S, UF, A/C/G, US/S, FS, U
Sylvilagus spp.	swamp rabbit, eastern cottontail	B/IM, FM, WF, OS, WS/S, UF, A/C/G, US/S, U
Myocastor coypus	nutria	B/IM, FM, WF, OS, WS/S, FS
Ondatra zibethica	muskrat	B/IM, FM, WF, OS, WS/S, FS

Procyon lotor	raccoon	B/IM, FM, WF, OS, WS/S, UF, US/S, FS, M/ES, A/C/G, U
Sus scrofa	wild boar	FM, WF, OS, UF, WS/S, US/S
Reithrodontomys spp.	mice	SM, B/IM, FM, WF, OS, UF, MS, UF, A/C/G, WS/S, US/S, FS, M/ES
Ursus americanus	black bear	WF, UF, OS
Dasypus novemcinctus	armadillo	WF, OS, UF, A/C/G, WS/S, US/S
Canis latrans	coyote	UF, A/C/G, WF, OS, WS/S, US/S
Canis niger	red wolf	UF, A/C/G, US/S
Vulpes fulva	red fox	WF, OS, UF, A/C/G, US/S, WS/S
Urocyon cinereoargenteus	gray fox	UF, A/C/G, US/S
Felis concolor	mountain lion	WF, OS, UF, US/S
Lynx rufus	bobcat	WF, OS, UF, US/S

Marsh (Salt, Intermediate, Fresh, and Flotant)

There are four types of marsh found in Louisiana: Salt, Intermediate/Brackish, and marsh. These sub-categories of marsh are detailed below as described by Mitsch and Gosselink (1987).

Salt Marsh

Located at and around the margins of sounds and estuaries, backs of barrier islands, and old flood tide deltas near closed inlets with regular salt water tides, salt marsh vegetation is dominated by*Spartina alterniflora* at the lower elevations (low marsh) typically between mean low tide and mean high tide. Zonation of vegetation occurs between mean tide and mean high tide with zones of*Juncus romerianus*, *Spartina alterniflora*, and sometimes other brackish marsh species. Salt marsh communities are highly productive due to the dynamic environment in which they are found. In this setting, organic matter is regularly removed and sediment deposited by the tides. Under optimal conditions (i.e., presence of a coarse-grain sediment source) tidal sedimentation causes a rise in the marsh surface and landward migration of the marsh. Sediment may also be deposited on the shoreline, causing estuarineward progradation of the marsh. Marshes on the backsides of barrier islands may be subject to episodic burial by sand overwash.

Salt marshes are distinguished from all other community types by the dominance of *Spartina alterniflora* as well as by their tidal, saltwater environments. Relatively narrow zones of brackish marsh at the upper edge are considered part of the salt marsh, but larger expanses in the heads of creeks and in the interior of large marsh islands are considered separate brackish marsh communities.

Table B- 5: Common Reptiles and Amphibians of Louisiana and their Associated Habitats

Scientific Name	Common Name	Habitats (see Table B-13 for key)
Alligator mississippiensis	American alligator	SM, B/IM, FM, WF, OS, MS, M/ESAV, FSAV, M/EBS, FB
Chelydra serpentina	snapping turtle	B/IM, FM, M/ES, FS, WF, OS, M/ESAV, FSAV, M/EBS, FB
Sternotherus spp.	musk turtle	FM, FS, WF, OS, FSAV, FB
Kinosternon spp.	mud turtle	B/IM, M/ES, FM, FS, WF, OS, FSAV, M/ESAV, M/EBS, FB
Graptemys kohnii	Mississippi map turtle	FM, FS, WF, OS, FSAV, FB
Malaclemys terrapin	diamondback terrapin	SM, B/IM, M/ES, M/ESAV, M/EBS
Deirochelys reticularia	chicken turtle	FM, FS, WF, OS, FSAV, FB
Chrysemys picta	painted turtle	FM, FS, WF, OS, FSAV, FB
Pseudemys concinna	river cooter (turtle)	FM, FS, WF, OS, FSAV, FB
Trachemys scripta	slider (turtle)	FM, FS, WF, OS, FSAV, FB
Terrapene spp.	box turtles	WF, OS, UF, A/C/G, WS/S, US/S, FS,
Apalone spp.	softshell turtles	FM, FS, WF, OS, FSAV, FB
Nerodia spp.	water snake	SM, B/IM, M/ES, M/ESAV, FM, FS, WF, OS, FSAV
Regina spp.	crawfish snake	FM, FS, WF, OS, FSAV, A/C/G, WS/S
Thamnophis spp.	garter, ribbon snakes	FM, FS, WF, OS, FSAV, UF, A/C/G, US/S, WS/S
Storeria spp.	redbelly, brown snakes	FM, FS, FSAV, WF, OS, UF, A/C/G, US/S, WS/S
Virginia spp.	earth snakes	FM, FS, FSAV, WF, OS, UF, A/C/G, US/S, WS/S
Diadophis punctatus	ringneck snake	WF, OS, UF, A/C/G, US/S, WS/S, FS
Heterodon platirhinos	eastern hognose snake	WF, OS, UF, A/C/G, US/S, WS/S, FS
Cemophora coccinea	scarlet snake	WF, OS, UF, A/C/G, US/S, WS/S, FS
Opheodrys aestivus	rough green snake	WF, OS, UF, A/C/G, US/S, WS/S, FS, FM
Farancia abacura	mud snake	SM, B/IM, M/ES, M/ESAV, FM, FS, WF, OS, FSAV
Coluber constrictor	racer (snake)	WF, OS, FM, FS, WS/S
Pituophis melanoleucus	Louisiana pine snake	UF, A/C/G, WF, OS, WS/S, US/S
Elaphe spp.	rat snakes	UF, A/C/G, WF, OS, US/S, WS/S
Lampropeltis spp.	milk snake, kingsnake	B/IM, M/ES, FM, FS, WF, OS, UF, A/C/G, WS/S, US/S
Tantilla spp.	crowned, flathead snakes	FM, FS, WF, OS, UF, A/C/G, WS/S, US/S
Agkistrodon piscivorus	cottonmouth (snake)	B/IM, M/ES, FM, FS, WF, OS, WS/S
Agkistrodon contortrix	copperhead (snake)	FS, WF, OS, US/S, WS/S, A/C/G, UF
Micrurus fulvius	coral snake	WF, OS, FS, UF, A/C/G, US/S, WS/S
Sistrurus miliarius	pigmy rattlesnake	FS, WF, OS, WS/S, US/S, A/C/G, UF
Crotalus horridus	timber rattlesnake	FS, WF, OS, WS/S, US/S, A/C/G, UF
Lepidochelys kempii	Atlantic ridley (sea turtle)	M/ES
Dermochelys coriacea	leatherback (sea turtle)	M/ES
Ophisaurus attenuatus	slender glass lizard	A/C/G, UB, UF, U, US/S, M/ES
Ophisaurus ventralis	eastern glass lizard	A/C/G, UB, UF, U, US/S, M/ES
Scincella lateralis	ground skink	WF, WS/S, UF, OS, A/C/G, FS, M/ES, U, US/S, UB
Hyla ssp.	tree frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, OS, WS/S
Psuedacris ssp.	chorus frogs	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, OS, WS/S, A/C/G
Acris ssp.	cricket frog	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, OS, WS/S, A/C/G
Rana ssp.	true frog	B/IM, M/ES, M/ESAV, FM, FS, FSAV, WF, OS, WS/S, US/S, A/C/G, UF

Table B- 6: Common Birds of Louisiana and their Associated Habitats - Ducks, Duck-like and Swimming Birds

Scientific Name	Common Name	Season*	Habitats (see Table B-13 for key)
Gavia immer	common loon	W	M/ES, FS, M/ESAV, FSAV, W
Podiceps spp.	grebes	W	M/ES, M/ESAV, W
Phalacrocorax auritus	double-crested cormorant	W	M/ES, M/ESAV, FS, FSAV, W
Anhinga anhinga	American anhinga	YR	WF, OS, A/C/G, FS, WS/S, W
Chen caerulescens	snow goose	W	M/ES, FS, B/IM, FM, A/C/G, W
Branta Canadensis	Canada goose	W	M/ES, FS, B/IM, FM, A/C/G, W
Anas fulvigula	mottled duck	YR	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas rubripes	American black duck	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas strepera	gadwall	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Anas platyphynchos	mallard	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, WF, OS, WS/S, W
Anus acuta	common pintail	W	SM, B/IM, M/ES, FM, FS, M/ESAV, FSAV, W
Americana	American wigeon	W	B/IM, M/ES, FM, FS, M/ESAV, FSAV, A/C/G, W
Aix sponsa	wood duck	YR	WF, WS/S, FS, OS, W
Anas clypeata	northern shoveler	W	FM, FS, FSAV, SM, B/IM, M/ES, M/ESAV, W
Anas discors	blue winged teal	YR	FM, FS, FSAV, W
Anas crecca	green-winged teal	W	M/ES, B/IM, FM, FS, FSAV, W
Aythya valisineria	canvasback	W	SM, B/IM, FM, M/ES, FS, M/ESAV, FSAV, W
Aythya collaris	ring-necked duck	W	WF, WS/S, FS, OS, W
Aythya affinis	lesser scaup	W	FS, FSAV, M/ES, W
Aythya marila	greater scaup	W	FS, FSAV, M/ES, W
Bucephala clangula	common goldeneye	W	WF, WS/S, FS, W, OS, M/ES
Bucephala albeola	bufflehead	W	FS, FSAV, M/ES, M/ESAV, W
Oxyura jamaicensis	ruddy duck	W	FS, FM, FSAV, M/ES, W
Mergus serrator	red-breasted merganser	W	FS, M/ES, FSAV, W
Gelochelidon nilotica	gull-billed tern	W	SM, M/ES, WB, A/C/G, W, B/IM
Lophodytes cucullatus	hooded merganser	W, Br	WF, WS/S, OS, FS, W
Fulica Americana	American coot	YR	W, FM, B/IM, FS, B/IS, A/C/G, M/ESAV, FSAV
Gallinula chloropus	common gallinule	YR	W, FM, FS, FSAV
Porphyrula martinica	purple gallinule	YR	W, FM, FS, WF, OS, FSAV

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 7: Common Birds of Louisiana and their Associated Habitats - Fowl

Scientific Name	Common Name	Season*	Habitats (see Table B-13 for key)
Meleagris gallopavo	wild turkey	YR	WF, OS, UF, WS/S, US/S
Colinus virginianus	common bobwhite	YR	A/C/G, US/S, U, UF, WF

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 8: Common Birds of Louisiana and their Associated Habitats – Waders

Scientific Name	Common Name	Season*	Habitats (see Table B-13 for key)
Ardea herodias	great blue heron	W	FM, B/IM, SM, WB, FS, M/ES, WF, MS, OS, WS/S, W
Florida caerulea	little blue heron	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, A/C/G, W, FS, ME/S
Hydranassa tricolor	Louisiana heron	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, ME/S
Dichromanassa rufescens	reddish egret	Br	B/IM, SM, WB, W, M/ES
Casmerodius albus	great egret	YR	FM, B/IM, SM, WB, WF, W, FS, ME/S, WF, FS, M/ES
Egretta thula	snowy egret	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES
Bubulcus ibis	cattle egret	YR	FM, WB, W, A/C/G, N/VU, FS
Nycticorax nycticorax	black-crowned night heron	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES
Nyctanassa violacea	yellow-crowned night heron	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES
Butorides striatus	green heron	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES
Ixobrychus exilis	least bittern	Br	FM, FS, W
Botaurus lentiginosus	American bittern	W	FM, FS, W
Mycteria americana	wood stork	Br	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES
Plegadis chihi	white-faced ibis	W, Br	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES, A/C/G
Eudocimus albus	white ibis	YR	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES, A/C/G
Rallus spp.	rails	W, Br	FM, B/IM, SM, WB, WF, MS, OS, WS/S, W, FS, M/ES
Haematopus palliates	American oystercatcher	YR	SM, B/IM, M/ES
Himantopus mexicanus	blacknecked stilt	YR	FM, FS, W, WB
Recurvirostra americana	American avocet	W	M/ES, FS, W
Pluvialis squatarola	black-bellied plover	W	FS, WB, ME/S, W
Arenaria interpres	ruddy turnstone	W	FS, WB, ME/S, W, WS/S
Charadrius semipalmatus	semipalmated plovers	W	ME/S
Charadrius melodus	piping plover	W	ME/S
Charadrius alexandrinus	snowy plover	W	ME/S
Charadrius wilsonia	Wilson's plover	Br	ME/S
Charadrius vociferous	killdeer	YR	A/C/G, FS, WS/S, W
Philohelo minor	American woodcock	YR	WS/S, WF, OS
Capella gallinago	common snipe	W	WB, FM, B/IM, A/C/G
Limnodromus griseus	short-billed dowitcher	W	WB, FM, B/IM, FS
Calidris canutus	red knot	W	M/ES, FS
Catoptrophorus semipalmatus	willet	YR	FM, B/IM, SM, M/ES, WB
Tringa melanoleuca	greater yellowlegs	W	FM, WB, FS, W, OS, WF, WS/S
Tringa flavipes	lesser yellowlegs	W	FM, WB, FS, W, WF, WS/S, M/ES, B/IM, SM
Calidris alba	sanderling	W	FS, M/ES
Calidris alpine	dunlin	W	WB, M/ES, FS
Actitus macularia	spotted sandpiper	W	WS/S, FS
Calidris minutilla	least sandpiper	W	WB, FM, W, FS
Calidris mauri	western sandpiper	W	WB, M/ES, FS

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 9: Common Birds of Louisiana and their Associated Habitats – Raptors

Scientific Name	Common Name	Season*	**Habitats (see Table B-13 for key)**
Elanoides forficatus	swallow-tailed kite	Br	WF, OS, WS/S
Ictinia mississippiensis	Mississippi kite	Br	WF, OS, WS/S
Accipiter striatus	sharp-shinned hawk	W	WF, UF, OS, WS/S, US/S
Accipiter cooperii	Cooper's hawk	YR	WF, UF, OS, WS/S, US/S
Circus cyanus	northern harrier	W	FM, B/IM, A/C/G
Buteo jamaicensis	red-tailed hawk	YR	A/C/G, WF, OS, UF, FM, WS/S
Buteo lineatus	red-shouldered hawk	YR	A/C/G, WF, OS, UF, FM, WS/S
Buteo platypterus	broad-winged hawk	Br	WF, UF, OS
Haliaeetus leucocephalus	bald eagle	Br	WF, UF
pandion	osprey	YR	WF, FS, M/ES
Cathartes aura	turkey vulture	YR	U, WF, UF
Coragyps atratus	black vulture	YR	U, WF, UF
Falco sparverius	American kestrel	YR	A/C/G, U, WF, UF
Falco columbarius	merlin	W	UF, WF, FM, A/C/G
Falco peregrinus	peregrine falcon	W	A/C/G, U
Asio flammeus	short-eared owl	W	A/C/G, FM, B/IM, SM
Otus asio	common screech owl	YR	WF, UF, A/C/G, US/S, WS/S, OS
Asio otus	long-eared owl	W	WF, UF, WS/S, US/S
Bubo virginianus	great horned owl	YR	WF, UF, WS/S, US/S, A/C/G

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 10: Common Birds of Louisiana and their Associated Habitats - Non-Perching Land Birds

Scientific Name	Common Name	Season*	**Habitats (see Table B-13 for key)**
Zenaida macroura	mourning dove	YR	A/C/G, U, UF, US/S
Columbina passerine	common ground dove	YR	A/C/G, UF
Coccyzus americanus	yellow-billed cuckoo	Br	UF, US/S, A/C/G
Geococcyx californianus	greater roadrunner	YR	A/C/G, US/S
Chordeiles minor	common nighthawk	Br	A/C/G, UF, U
Caprimulgus vociferous	whip-poor-will	W	UF, WF
Caprimulgus carolinensis	chuck-will's-widow	Br	WF, UF, WS/S, US/S, OS
Archilochus colubris	ruby-throathed hummingbird	Br	U, A/C/G, UF
Megaceryle alcyon	belted kingfisher	YR	FS, M/ES, W, FM, B/IM, SM
Melanerpes erythrocephalus	red-headed woodpecker	YR	A/C/G, U, UF, US/S
Dryocopus pileatus	pileated woodpecker	YR	UF, WF
Colaptes auratus	common flicker	YR	UF, WF, U, A/C/G
Melanerpes carolinus	red-bellied woodpecker	YR	WF, UF, U, A/C/G
Sphyrapicus varius	yellow-bellied sapsucker	W	WF, UF,
Picoides pubescens	downy woodpecker	YR	WF, UF, OS, WS/S, US/S
Picoides villosus	hairy woodpecker	YR	WF, UF, OS, WS/S, US/S

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 11: Common Birds of Louisiana and their Associated Habitats - Seabirds and Gulls

Scientific Name	**Common Name**	**Season***	**Habitats (see Table B-13 for key)**
Pelecanus erythrorhynchos	white pelican	W	W, FS, M/ES, FM, B/IM
Pelecanus occidentalis	brown pelican	YR, Br	SM, B/IM, FM, FS, M/ES, W
Fregata magnificens	magnificent frigatebird	Br	SM, M/ES
Morus bassanus	northern gannet	W	M/ES
Larus spp.	gulls	W	SM, B/IM, FM, M/ES, FS, W, N/VU, A/C/G
Sterna spp.	terns	W, Br	SM, B/IM, FM, WB, W, M/ES, FS
Rynchops niger	black skimmer	Yr	SM, B/IM, WB, W, M/ES

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 12: Common Birds of Louisiana and their Associated Habitats - Perching Birds

Scientific Name	Common Name	Season*	**Habitats (see Table B-13 for key)**
Tyrannus tyrannus	eastern kingbird	Br	UF, WF, WS/S, A/C/G, U
Muscivora forficata	scissor-tailed woodpecker	W, Br	A/C/G, U
Myiarchus crinitus	great crested flycatcher	Br	UF, WF
Contopus virens	eastern pewee	Br	UF, WF, WS/S, US/S
Empidonax virescens	Acadian flycatcher	Br	UF, WF, OS
Anthus spinoletta	water pipit	W	FS, M/ES, A/C/G
Anthus spragueii	Sprague's pipit	W	A/C/G
Progne subis	purple martin	Br	FS, A/C/G, U
Hirundo rustica	barn swallow	Br	A/C/G, FM, FS, W, U
Iridoprocne bicolor	tree swallow	W	A/C/G, FS, WB, FM, WF, U
Stelgidopteryx ruficollis	rough-winged swallow	YR, Br	FS, WS/S, FM
Chaetura pelagica	chimney swift	Br	U
Corvus ossifragus	fish crow	YR	FS, A/C/G, M/ES
Corvus brachyrhynchos	American crow	YR	UF, WF, A/C/G, WS/S, FS
Cyanocitta cristata	blue jay	YR	UF, A/C/G, U
Parus carolinensis	Carolina chickadee	YR	UF, A/C/G, U
Parus bicolor	tufted titmouse	YR	WF, UF, U, A/C/G
Sitta carolinensis	white-breasted nuthatch	YR	WF, UF, U, OS
Sitta Canadensis	red-breasted nuthatch	W	UF, WF, U
Sitta pusilla	brown-headed nuthatch	YR	UF, WF
Certhia familiaris	brown creeper	W	WF, UF, WS/S, US/S, U
Troglodytes aedon	house wren	W	A/C/G, U, US/S, UF
Troglodytes troglodytes	winter wren	W	UF
Thryomanes bewickii	bewick's wren	W	A/C/G, U
Thryothorus ludovicianus	Carolina wren	YR	U, A/C/G, US/S
Cistothorus platensis	sedge wren	W	A/C/G, FM
Regulus satrapa	golden-crowned kinglet	W	UF, WF
Regulus calendula	ruby-crowned kinglet	W	UF, WF
Polioptila caerulea	blue-gray gnatcatcher	YR, Br	UF, WF, US/S, WS/S
Toxostoma rufum	brown thrasher	YR	US/S, WS/S
Dumetella carolinensis	gray catbird	W, YR	US/S, WS/S, A/C/G, U
Mimus polyglottos	northern mockingbird	YR	US/S, UF, A/C/G, U
Sialia sialis	eastern bluebird	YR	A/C/G, US/S, WS/S, U
Turdus migratorius	American robin	YR	U, A/C/G, UF
Catharus guttatus	hermit thrush	W	UF, WF, US/S, WS/S, A/C/G
Hylocichla mustelina	wood thrush	Br	UF, WF
Lanius excubitor	loggerhead shrike	YR	A/C/G
Bombycilla cedrorum	cedar waxwing	W	UF, WF, US/S, A/C/G
Vireo spp.	vireos	Br, W, YR	UF, US/S, U, UB
Protonotaria citrea	prothonotary warbler	Br	WF, OS, WS/S
Parula americana	northern parula warbler	Br	WF, OS
Dendroica dominica	yellow-throated warbler	YR, Br	UF, U
Mniotilta varia	black-and-white warbler	W, Br	UF
Dendroica coronata	yellow-rumped warbler	W	UF, WF, US/S, WS/S
Setophaga ruticilla	American redstart	Br	UF, US/S
Dendroica pinus	pine warbler	YR	UF
Dendroica discolor	prairie warbler	Br	US/S
Dendroica palmarum	palm warbler	W	A/C/G, UF, U, US/S
Limnothlypis swainsonii	Swainson's warbler	Br	WF, OS, WB, WS/S
Helmitheros vermivorus	worm-eating warbler	Br	UF, US/S, UB

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 12: Common Birds of Louisiana and their Associated Habitats - Perching Birds (continued)

Scientific Name	Common Name	Season*	**Habitats (see Table B-13 for key)**
Vermivora celata	orange-crowned warbler	W	US/S
Wilsonia pusilla	Wilson's warbler	W	WS/S, OS
Wilsonia citrine	hooded warbler	Br	WF, OS, WS/S
Oporornis philidelphia	Kentucky warbler	Br	A/C/G, UB, US/S
Geothlypis trichas	common yellowthroat	YR	FW, OS, FM, WS/S
Icteria virens	yellow-breasted chat	Br	WS/S, US/S
Seiurus motacilla	Louisiana waterthrush	Br	WF, OS, FS, WS/S
Seiurus aurocapillus	ovenbird	W	UF, US/S
Agelaius phoeniceus	red-winged blackbird	YR	FM, WF, OS, A/C/G, FS, WS/S
Molothrus ater	brown-headed cowbird	YR	A/C/G, WS/S, WF, US/S, UF
Euphagus carolinus	rusty blackbird	W	WS/S, WF, OS
Euphagus cyanocephalus	Brewer's blackbird	W	A/C/G, U
Quiscalus quiscula	common grackle	YR	A/C/G, U, WS/S
Quiscalus major	boat-tailed grackle	YR	SM, M/ES
Sturnella magna	eastern meadowlark	YR	A/C/G
Sturnella neglecta	western meadowlark	W, Br	A/C/G
Sturnus vulgaris	European starling	YR	U, A/C/G
Icterus spurious	orchard oriole	Br	A/C/G, UF, US/S
Icterus galbula	Baltimore oriole	W, Br	UF, U
Piranga rubra	summer tanager	Br	UF, U
Passer domesticus	house sparrow	YR	A/C/G, U
Spiza americana	dickcissel	Br	A/C/G
Calcarius lapponicus	lapland longspur	W	A/C/G
Junco hyemalis	northern junco	W	UF, US/S, U, A/C/G
Cardinalis cardinalis	northern cardinal	YR	U, A/C/G, UF, US/S
Carpodacus purpureus	purple finch	W	UF
Carduelis tristis	American goldfinch	W, Br	US/S, A/C/G, U, UF
Carduelis pinus	pine siskin	W	UF, A/C/G, US/S
Guiraca caerulea	blue grosbeak	Br	US/S, WS/S, A/C/G
Passerina cyanea	indigo bunting	Br	A/C/G, US/S
Passerina ciris	painted bunting	Br	US/S, UF, U, A/C/G
Pipilo erythrophthalmus	rufous-sided towhee	YR, W	UF, US/S
Zonotrichia spp.	sparrows	W, YR, Br	UF, WF, US/S, WS/S, U, A/C/G, FM, B/IM, SM

*Br = present during breeding season (generally spring and/or summer)
W = present in winter
YR = present year round

Table B- 13: Key for Habitat Type Abbreviations in Tables 3-12.

Habitat Type	Abbreviation
Saltwater Marsh	SM
Brackish/Intermediate Marsh	B/IM
Freshwater Marsh	FM
Wetland Forest	WF
Wetland Scrub-Shrub	WS/S
Mangrove Swamp	MS
Upland Forest	UF
Marine/Estuarine SAV	M/ESAV
Freshwater SAV	FSAV
Other Swamps (black willow & batture)	OS
Agriculture-Cropland-Grassland	A/C/G
Freshwater Shore	FS
Marine/Estuarine Shore	M/ES
Vegetated/Non-Vegetated Urban	U
Upland Scrub/Shrub	US/S
Wetland Barren	WB
Upland Barren	UB
Water	W
Marine/Estuarine Benthic Subtidal	M/EBS
Freshwater Benthic	FB
Marine/Estuarine Encrusting Communities	M/EEC
Living Reefs	LR

Brackish/Intermediate Marsh

Found along the margins of sounds and estuaries somewhat removed from connection with the sea, so that salinity is diluted by freshwater inflow and tidal range is generally less than in salt marshes. Those marshes in areas with substantial regular lunar tides have a regular input of nutrients which makes them highly productive. In addition to high inflow of nutrients, regularly flooded marshes are typically supplied with abundant sediment and may produce tidal mud flats and estuarineward progradation of the marsh. Areas with only irregular wind tidal flooding have much less nutrient input, less mineral sedimentation, and accumulate relatively more organic matter. They lack mud flats and their estuarine edges are scarped and erosional. As sea level rises, mineral or organic sedimentation causes the marsh surface to rise, the landward edge will migrate landward, and changes in tidal inlets may cause changes in salinity.

Brackish marshes are distinguished by their tidal environment and usually by the dominance of *Juncus romerianus*. There is a primary difference in dynamics between the regularly flooded marshes in the southern portion of the coastal zone and the predominantly irregularly flooded marshes in the northern coastal zone. Areas exposed to wave action from large estuaries may also be different in dynamics from narrow marshes in small tributaries.

Tidal Freshwater Marsh

Found at the margins of estuaries, or drowned rivers and creeks, they are regularly or irregularly flooded with freshwater tides. Historically in Louisiana, this marsh type was extensive, but its range has steadily reduced since the mid-1950's due to numerous factors including subsidence, sea-level rise, salt water intrusion, and altered hydrology as a result of river leveeing and oil and gas access canals. Tidal freshwater marshes are sustained largely through tidal flooding which brings in nutrients derived from seawater and varying amounts of sediment to the community. Regularly flooded marshes are

reported to have high productivity, equivalent to salt marshes at the same latitude (Odum et al. 1984). Irregularly flooded marshes and marshes in areas with little mineral sediment are assumed less productive. Tidal freshwater marsh is distinguished from adjacent swamp forest and upland forests by the lack of a dominant tree or shrub layer.

Floating or "Flotant" Marsh

Contrary to the stationary marshes outlined above, flotant marshes are produced independently of external influences (autogenic processes). In interior marshes that salt does not reach or have been cut off from riverine inputs, the fullest expression of autogenic development occurs. With the substrates supply of new sediments almost entirely cut off, the cumulative vertical accretion becomes increasingly organic (as the elevation is contributed to or maintained by the build-up of organic matter). As a result, the marsh becomes increasingly light until the whole mat becomes buoyant enough to float. When that occurs the flooding regime is no longer unpredictable, but is now a stable one in which the sediment is always saturated but the surface nearly never flooded. Because the surface is nearly never flooded, the major source of nutrients – waterborne sediments – is lost. To adapt, the plants colonizing the mat have high belowground productivity (dense root system) to "wick up" nutrients from the organic saturated solution between the mat and the substrate. Species typically found on a floating mat are *Eleocharis* sp., *Hydrocotyle* sp., *Panicum hemitomon*, *Sagitarria* sp., as well as many others.

Wetland Forest (Evergreen, Deciduous, and Mixed)

Wetland forests, besides being broken into evergreen, deciduous, and mixed are segmented by their flooding frequency. Those areas that experience permanent to semi-permanent flooding are deepwater swamps while those receiving only seasonal riverine pulses are generally characterized as bottomland hardwood (BLH) forests. The distinction is not only made because of flooding regime, but the species composition that occurs as a result. In Louisiana, the cypress (*Taxodium* sp.) and tupelo/gum swamps are the major deepwater forested wetlands and are characterized by bald cypress – water tupelo communities with permanent or near permanent standing water (Mitsch and Gosselink 1987). Bottomland hardwood forests usually occur as an ecotone between aquatic and upland ecosystems but have distinct vegetation and soil characteristics. The vegetation in BLH forests is dominated by diverse trees that are adapted to the wide variety of environmental conditions on the floodplain. Typical species are black willow (*Salix nigra*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), laurel oak (*Quercus laurifolia*), American elm (*Ulmus americana*), and sweetgum (*Liquidambar styraciflua*), to name a few.

Wetland Shrub/Scrub (Evergreen, Deciduous, and Mixed)

A scrub-shrub wetland typifies a community in transition and exemplifies the dynamic nature of wetlands in general. Many emergent wetlands, if positively accreting and left undisturbed, will gradually be replaced through succession by woody vegetation that will in time climax with the scrub-shrub phase. The scrub-shrub wetland is often found grading shoreward from an emergent wetland which borders a lake, bayou, or pond. The woody vegetation accounts for at least 30% of the vegetation present, and must be less than 20 feet (6 meters) tall. Species composition is dependent on the length of inundation, with black willow (*Salix nigra*) and dogwood (*Cornus* sp.) growing in the temporarily to seasonally wet areas and buttonbush (*Cephalanthus occidentalis*) in semipermanently flooded areas. The soils in this community typically are wet phases of alluvial soils. They may have been cropland at one time, particularly where they border large constructed reservoirs. They also may be present along the flanks of spoil disposal

areas particularly spoil banks along canals dredged through marsh. Soils range in reaction from strongly acid to neutral.

Upland Forest (Evergreen, Deciduous, and Mixed)

On the tertiary hills of northwest Louisiana and the Pleistocene terraces, southern pine forest is most common on the sandy hill soils. The southern pine forest in Louisiana has three major belts: the shortleaf pine-hardwoods, the longleaf pine, and the flatwoods. Shortleaf pine-hardwood forests are a mixed composition consisting of shortleaf pine (*Pinus echinata*) and loblolly pine (*Pinus taeda*), oak (*Quercus* sp.), and hickory (*Carya* sp.). Longleaf pine (*Pinus palustris*) forests have historically been over-cut and over utilized due to their importance as a marketable timber and use as naval stores before the advent of non-wooden ships in the naval fleet. Restoration of longleaf stands has begun, though it is slow to return due to the trees growth rate and lack of protected sites. Once established, longleaf pine has a strong resistance to fire damage. In fact, its original dominance was attributed to repeat fires and its unique reproductive strategy as the mature forests are fire climax communities. Longleaf pine forests are dominated by near monocultures of *P. palustris* in the overstory. The understories, however, are known for their high species richness and diversity and are typically the site of many rare species with strict edaphic requirements. Flatwoods are mixed forests of longleaf pine (*P. palustris*) and hardwoods or slash pine (*Pinus elliottii*), longleaf pine (*Pinus palustris*), and an undergrowth of woody shrubs, notably palmetto (*Sabal* spp.) and waxmyrtle (*Myrica cerifera*). In the western flatwoods, slash pine (*P. elliottii*) and numerous shrubs in the mid-story are absent. Upland hardwoods are found along the bluffs of Louisiana's alluvial plains and consist of oak (Quercus spp.), hickory (Carya spp.), gum (Tupelo spp.), magnolia (*Magnolia* spp.), dogwood (*Cornus* spp.), and holly (*Ilex* spp.). These species dominate the higher ground of blufflands adjacent to the alluvial plains. The most extensive such forests in Louisiana are along the western fringes of the Florida Parishes, on Macon Ridge, and along the eastern edge of the Southwest prairie.

Upland Shrub/Scrub (Evergreen, Deciduous, and Mixed)

This habitat is generally found on rolling to more steeply sloping sandy sediments with a clay layer near the surface, or with sandy to loamy well drained soils. Sites are terrestrial, usually dry to xeric, but may have a perched water table for brief periods. A clay layer may restrict rooting depth, making deeper moisture unavailable to plants during dry periods. Contrary to coastal areas, scrub/shrub is typically an understory/midstory component of a *Pinus palustris* (longleaf pine) dominated overstory forest. The diversity of variations within this community is high, therefore, naming the species inclusive of scrub/shrub would be too lengthy for the purposes of this document. However, the generally occurring genus' in these communities are oak (*Quercus* sp.), sassafras (*Sassafras* sp.), dogwood (*Cornus* sp.), and persimmon (*Diospyros* sp).

Dense Pine Thicket

Dense pine thickets are composed primarily of upland shrub/scrub needle-leaf evergreen communities which are predominantly young (from approximately 10 to 15 years and less in age) pine plantations. Due to intensive management of these areas, the understory is relatively clear of vegetation except for occasionally occurring smaller shrub/scrub and vines. Significant areas of pine thickets are composed of loblolly (*Pinus taeda*) and slash pine (*Pinus* elliottii) regeneration – the primary marketable timber species in Louisiana.

Agriculture-Cropland-Grassland

Agriculture-cropland-grassland is made-up of diverse land cover and land uses. Uses and crops typical of this habitat type are orchards (primarily pecan), vineyards,

experimental plots, plant nurseries, yards, and right of ways. Row and cover crops consist of various grain crops, cotton, sweet potatoes, soy beans and gardens. Aquaculture consists of crawfish (also rice farming) and catfish ponds. Grasslands are dominated by perennial gramminoids.

Wetland Barren

Wetland barrens are exposed areas that are inundated annually and located or associated primarily in flood plain or river basins, streams, lakes, ponds and impoundments. These areas are typically the result of dredge material unsuitable for growth (usually with a high shell content) being deposited in localized areas. They remain unvegetated if located about the range of active sediment deposition. If they are located at an elevation suitable for sediment deposition, primary succession of vegetative communities may begin but will likely be influenced by the underlying and previously barren substrate.

Upland Barren

Upland barrens consist primarily of exposed areas that are not inundated annually and are not located in flood plains or river basins, streams, lakes, ponds and impoundments. Some areas consist of active or inactive gravel or burrow pits, landfills, erosional scars, soil parking areas/logging landings or recently cleared areas.

Open Water

Open water surfaces areas (natural or man-made structures) are rivers, streams, canals, ditches, lakes, reservoirs, and ponds.

Marine/Estuarine Shore

Unvegetated shorelines of Louisiana's estuaries and coast are characterized both by the substratum type and the organisms that live on and within the sediments (or soils). Sediment characteristics (e.g., grain size, organic content, etc.) play a large role in determining the species composition and abundance, as well as the feeding strategies of the organisms that inhabit a given area of shoreline. Estuarine beaches may be composed of organic material, although most are largely inorganic sediments. This habitat is a transition zone between the marine and estuarine aquatic habitats and upland or wetland habitats. It provides many ecological services to other resources, such as feeding and loafing areas for birds and other wildlife. Plant debris and dead organisms that form a wrack-line provide additional food sources for larger organisms, as well as habitat for smaller ones. As considered here, this resource category includes the sediments (mud, sand, etc.) and organic debris, and associated invertebrates, bacteria, and algae, and the services that this habitat provides to other resources.

Freshwater Shore

Unvegetated shorelines of Louisiana's rivers, streams, bayous, ponds, lakes, and other fresh waterbodies are characterized both by the substratum type and the organisms that live on and within the sediments (or soils). This habitat also includes gravel and sandbars in rivers and streams. Sediment characteristics (e.g., grain size, organic content, etc.) play a large role in determining the species composition and abundance, as well as the feeding strategies of the organisms that inhabit a given area of shoreline. This habitat is a transition zone between the freshwater aquatic habitats and upland or wetland habitats. It provides many ecological services to other resources, such as feeding and loafing areas for birds and other wildlife. Plant debris and dead organisms that wash up on freshwater shorelines provide additional food sources for larger organisms as well as habitat for smaller ones. As considered here, this resource

category includes the sediments (mud, sand, gravel, etc.) and organic debris, and associated invertebrates, bacteria, and algae, and the services that this habitat provides to other resources.

Marine/Estuarine and Freshwater Benthic (soft-sedimentary)

Benthic soft-sedimentary habitat (hereafter "benthic habitat") in the Gulf of Mexico along the Louisiana coast and in Louisiana estuaries is characterized both by the substratum type and the organisms that live on and within the sediments. Sediment characteristics (e.g., grain size, organic content, etc.) play a large role in determining the species composition and abundance, as well as the feeding strategies of the benthic organisms that inhabit a given area. Benthic organisms, in turn, influence the chemistry and structure of the sediments in which they live through activities such as burrowing, deposit feeding, and tube building. An important function of benthic habitat is the decomposition of particulate organic material that enters the sediments as fecal pellets, dead phytoplankton, zooplankton, and other water column organisms, and plant matter from submerged aquatic vegetation and marshes. The bacteria that feed on this organic matter are consumed by meiofauna and deposit-feeding organisms, such as some polychaete worm and bivalve species. The organisms that inhabit benthic environments are important food sources for many juvenile fishes, as well as brown and white shrimp, and blue crabs, among other organisms. Therefore benthic habitats provide many services to the marine and estuarine ecosystem.

Marine/Estuarine Encrusting Community (natural/artificial substrates)

Wide varieties of organisms settle and attach to hard substrates (both natural and artificial) and provide shelter or a feeding location or both for other organisms. The composition of the encrusting community differs depending on whether it is subtidal or intertidal, and if intertidal, the location within the intertidal zone. Apart from barnacles that are commonly found in the intertidal zone, this habitat is also inhabited by species of algae, crabs, tube-building worms, anemones, starfish, and many others. Organisms in this habitat exhibit a number of feeding strategies, including grazing on algae and bacteria, suspension feeding on phytoplankton and particulate organic matter, and predation on organisms living on, or associated with, the hard substrate. This resource category includes the substrate itself, the attached organisms, and the closely associated mobile organisms that depend on this habitat.

Living Reefs

Living reefs are present in both marine and freshwater environments and are three-dimensional structures formed by living organisms such as oysters, mussels, and corals. Living reefs provide primary production through algae and other plants that are present in this habitat. Reefs also provide valuable habitat and refuge for fish and other animals. Their physical presence can create up-wellings with associated nutrients which increase productivity of these areas. Organisms in this habitat exhibit a number of feeding strategies, including grazing on algae and bacteria, suspension feeding on phytoplankton and particulate organic matter, and predation on organisms living on, or associated with, the hard substrate. This resource category includes the organisms forming the primary skeleton of the reef itself, the attached plants and animals, and the closely associated mobile organisms that depend on this habitat.

Marine/Estuarine Submerged Aquatics Vegetation

Submerged aquatic vegetation (SAV) is comprised of rooted vascular plants located in areas continually covered with very shallow water. These communities are found throughout coastal Louisiana where the water is clear and wave or other disturbances are

low. Species composition shifts as salinity regimes change through time. Submersed aquatic wetlands have many functions including: providing habitat for invertebrate species; providing food or shelter or both for juvenile and adult fish, waterfowl, and other wildlife; retarding flow velocities, stabilizing bottom sediments, and slowing erosion; and oxygenating the water and recycling nutrients and heavy metals.

Freshwater Submerged Aquatics Vegetation

Submerged freshwater aquatic vegetation (SAV) is comprised of vascular plants located in areas continually covered with water. Submersed aquatic vegetation in wetlands have many functions including: providing habitat for invertebrate species; providing food or shelter or both for juvenile and adult fish, waterfowl, and other wildlife; retarding flow velocities, stabilizing bottom sediments, and slowing erosion; and oxygenating the water and recycling nutrients and heavy metals. The State of Louisiana is actively trying to control the abundance of exotic and native aquatic vegetation species. At a moderate level of abundance, freshwater SAV provide important habitat services; however, an overabundance speeds eutrophication, contributes to fish population imbalances, and impedes navigation.

Mangrove Swamp

The mangrove swamp is an association of halophytic trees, shrubs, and other plants growing in brackish to saline tidal waters of tropical and sub-tropical coastlines. These communities have been well studied, and researchers have established the importance of mangrove swamps in exporting organic matter to adjacent coastal food chains, in providing physical stability to certain shorelines to prevent erosion, in protecting inland areas from severe damage during hurricanes and tidal waves, and in serving as sinks for nutrients and carbon.

Like the adjacent coastal salt marsh, mangrove swamps can develop only where there is adequate protection from wave action. Several physiographic settings favor the protection of mangrove swamps, including (1) protected shallow bays, (2) protected estuaries, (3) lagoons, (4) the leeward sides of peninsulas and islands, (5) protected seaways, (6) behind spits, and (7) behind offshore shell or shingle islands.

In addition to the required physical from wave action, the range and the duration of the flooding of tides exert a significant influence over the extent and functioning of the mangrove swamp, importing nutrients, aerating the soil water, and stabilizing soil salinity. Salt water is important to the mangroves in eliminating competition from freshwater species. The tides provide a subsidy for the movement and distribution of the seeds of several mangrove species. They also circulate the organic sediments in some fringe mangroves for the benefit of filter feeding organisms such as oysters, sponges, and barnacles and for deposit feeders such as snails and fiddler crabs.

The development of mangrove swamps is the result of topography, substrate, and freshwater hydrology as well as tidal action. Only the most cold tolerant mangrove, *Avicennia germinans* (black mangrove) is found in Louisiana. It periodically suffers die back in years in which severe periods of cold weather occur.

Batture

The strip of land between the Mississippi River and the levee is referred to as batture. Batture comprises thousands of acres of land, with some large individual tracts in places where the levee is set back at some distance from the river. They differ in characteristics from cypress-tupelo (*Taxodium-Nyssa*) swamps in that their soils and soil moisture are

influenced by steep elevation gradients and the Spring flood pulses of the Mississippi River, they process large fluxes of energy and materials from upstream, and are comprised of different overstory vegetation (Mitsch and Gosselink 1991). The unpredictable flooding and drying sequence supports a vegetative community dominated by black willow (*Salix nigra*) and other woody species with equivalent morphological and/or physiological adaptations to survive, achieve maturity, and reproduce in a habitat where the soils within the root zone may become anaerobic for various periods during the growing season or not at all for years. As with most types of swamps, batture has high natural resource and wildlife habitat values as it is used by a number of plant, invertebrate, mammal, fish, and bird species, and is an important migratory flyway. In addition to biotic importance, batture also provides beneficial functions to downstream communities such as water quality improvement, nutrient cycling and retention, and floodwater storage through the seasonal collection of fine sediments from floodwaters and the increased basin area the swamps provide.

Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 (16 USC 1531, et seq.) is administered by the U.S. Department of the Interior (DOI), U.S. Fish and Wildlife Service (FWS) and the U.S. Department of Commerce (DOC), National Marine Fisheries Service (NMFS). The FWS is primarily responsible for terrestrial and freshwater species and migratory birds and the NMFS for anadromous and marine fish species. The FWS and NMFS share the responsibility for conservation of marine mammals. The FWS has responsibility for walruses, all other marine mammals (such as sea otters, polar bears, and manatees) anadromus fish, and marine reptiles. The NMFS conserves and manages most pinnipeds and all whales. The ESA directs all federal agencies to conserve endangered and threatened species and their habitats and encourages such agencies to utilize their authorities to further these purposes. The purpose of the ESA is to conserve "the ecosystems upon which endangered and threatened species depend" and to conserve and recover listed species (Endangered Species Act [16 USC 1531, et seq.]). Endangered species are species in danger of extinction throughout all or a significant portion of its range. Threatened species are defined as species likely to become endangered within the foreseeable future.

Under Section 4 of the ESA, plant and animal species are listed solely on the basis of the species' biological status and threats to its existence. A species that closely resembles an endangered or threatened species may be listed due to similarity of appearance. Candidate species are listed and are species for which there is enough information to warrant proposing them for listing as endangered or threatened, but these species have not yet been proposed for listing. Section 4 of the Act provides for designations of critical habitat for listed species and includes geographic areas "on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection" (Endangered Species Act [16 USC 1531, et seq.]).

The published list for the State of Louisiana includes 23 animal and three plant species (see Appendix C) (U.S. Department of the Interior, Fish and Wildlife Service 2003). One candidate species is listed for the state (U.S. Department of the Interior, Fish and Wildlife Service 2003).

Section 6 of the ESA encourages each state to develop and maintain conservation programs for resident federally-listed threatened and endangered species. Species listed

as threatened and endangered in Louisiana are maintained by the Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries (LDWF).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801, et seq.) provides for stewardship of the nation's fishery resources within the Exclusive Economic Zone, covering all U.S. coastal waters 200 miles seaward from the boundary of state territorial waters. The resource management goal is to achieve and maintain the optimum yield from U.S. marine fisheries. The Act also establishes a program to promote the protection of Essential Fish Habitat (EFH) throughout state and federal waters in the planning of federal actions. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH.

Congress defined EFH as "those waters and substrate to fish for spawning, breeding, feeding, or growth to maturity" (Magnuson-Stevens Fishery Conservation and Management Act [16 USC 1802(10)]). The EFH regulations go on further to define *waters* to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Cultural Resources

Louisiana has been inhabited for at least the last 12,000 years. From approximately 12,000 to 8,000 BC, early people hunted large Pleistocene mammals. With the end of the Ice Age and changes in climate, inhabitants adapted to hunting smaller game and to gathering plants. The advanced cultures of Poverty Point, Tchefuncte, and Marksville developed between 2000 BC and first century AD. Beginning around 700 AD, the cultures of Troyville-Coles Creek, Plaquemine, Caddoan, and Mississippian developed successively. The nine cultural units mentioned above are termed prehistoric meaning prior to contact with the Europeans.

The arrival of the Europeans and subsequent disease and westward expansion in the sixteenth century caused the demise of large Indian population centers. Plantation-based agriculture (cotton and sugarcane) and small-scale farming developed in the 1700s and 1800s, respectively. The Civil War radically changed Louisiana's culture and labor base, developing the oil, gas, and lumbering industries (Smith et al. 1983). Louisiana's five historic cultural units are termed Historic Contact, Exploration and Colonization, Antebellum, War and Aftermath, and Industrialization and Modernization.

Louisiana's prehistoric and historic sites have been selected for historical, cultural, and/or architectural value. Presently, there are 16 prehistoric and historic sites, which may also be referred to as State Commemorative Areas, within the state. Sites include, but are not limited to, buildings and associated grounds, military post/forts, cemetery, Civil War battlefields, ancient civilization grounds, Native American grounds, and water control structures. Of the 16 sites, three are located in West Feliciana Parish, three in Natchitoches Parish, two in East Feliciana Parish, one in Sabine Parish, one in Orleans

Parish, one in St. Martin Parish, one in De Soto Parish, one in Avoyelles Parish, one in Iberville Parish, one in West Carroll Parish, and one in Tensas Parish. Additional information is available from the Louisiana Department of Culture, Recreation and Tourism (LCRT), Office of State Parks.

The National Register of Historic Places is the nation's official listing of buildings, structures, objects, sites, or districts worthy of preservation because they illustrate something about our nation's history or culture at the national, state, or local level. Enacted by the U.S. Congress (National Historic Preservation Act of 1966, 16 USC 470, et seq.), the National Register of Historic Places is administered by the states. In the State of Louisiana, the National Register of Historic Places is administered by the LCRT, Office of Cultural Development, Division of Historic Preservation.

The National Register of Historic Places recognizes five significant properties, classified as buildings, structures, objects, sites, or districts. The following terms were set forth by the USDOI, National Park Service (NPS), Interagency Resources Division. A building is created principally to shelter any form of human activity and/or to refer to a historically and functionally related unit. A structure is used to distinguish from buildings those functional constructions made usually for purposes other than creating human shelter. An object is used to distinguish from buildings and structures those constructions that are primarily artistic in nature or are relatively small in scale and simply constructed; associated with a specific setting or environment. A site is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possess historic, cultural, or archeological value regardless of the value of any existing structure. A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

When evaluated within its local, state, or national historic context, a property must be significant for one or more of four criteria for evaluation as set forth by the USDOI, NPS, Interagency Resources Division. Associative value (Criteria A and B): properties significant for their association or linkage to events or persons important in the past. Design or construction value (Criteria C): properties significant as representatives of the manmade expression of culture or technology. Information value (Criteria D): properties significant for their ability to yield important information about prehistory or history. Properties achieving significance within the last 50 years are excluded unless they are of exceptional importance, as 50 years is a general estimate of time needed to develop historical perspective and to evaluate significance.

Presently, the State of Louisiana has 1,161 properties listed on the National Register of Historic Places. Properties by parish are broken down as follows: six in Acadia; three in Allen; 21 in Ascension; nine in Assumption; 27 in Avoyelles; ten in Beauregard; 12 in Bienville; four in Bossier; 63 in Caddo; 14 in Calcasieu; nine in Caldwell; two in Cameron; ten in Catahoula; ten in Claiborne; 11 in Concordia; 29 in De Soto; 75 in East Baton Rouge; five in East Carroll; 26 in East Feliciana; three in Evangeline; six in Franklin; four in Grant; 25 in Iberia; 18 in Iberville; four in Jackson; 16 in Jefferson Davis; 18 in Jefferson; 22 in Lafayette ; 17 in Lafourche; three in LaSalle; 26 in Lincoln; 11 in Livingston; 12 in Madison; five in Morehouse; 27 in Natchitoches; 121 in Orleans; 28 in Ouachita; eight in Plaquemines; 29 in Pointe Coupee; 69 in Rapides; two in Red River; nine in Richland; seven in Sabine; seven in St. Bernard; six in St. Charles; two in St. Helena; 17 in St. James; 12 in St. John the Baptist; 34 in St. Landry; 24 in St. Martin; 26 in St. Mary; 32 in St. Tammany ; 28 in Tangipahoa; nine in Tensas; 17 in Terrebonne; ten

in Union; 16 in Vermilion; seven in Vernon; 14 in Washington; 17 in Webster; ten in West Baton Rouge; one in West Carroll; 30 in West Feliciana; and six in Winn. Additional information is available from the LCRT, Office of Cultural Development, Division of Historic Preservation.

Population

The nationwide census of the year 2000 (United States Department of Commerce, Census Bureau 2000) recorded the population of the State of Louisiana at 4,468,976, indicating a 5.9% increase in growth from the 1990 census. The majority of the population, approximately 69%, lived in the eight Metropolitan Statistical Areas (MSAs) as defined by the U.S. Census Bureau. The eight MSAs are the greater Alexandria, Baton Rouge, Houma, Lafayette, Lake Charles, Monroe, New Orleans, and Shreveport areas. The eight MSAs recorded a slight relative population increase of 0.7% from the 1990 census. The remaining 31% of the populous lived in cities, towns, and rural communities outside of MSA boundaries.

Race was reported as follows: 63.9% (2,856,161) Caucasian or white; 32.5% (1,451,944) African-American or black; 1.2% (54,758) Asian; 0.57% (25,477) American Indian or Alaska native; 0.03% (1,240) Native Hawaiian or Pacific Islander; 0.7% (31,131) other race; and 1.1% (48,265) reported two or more races. The population was 51.6% female and 48.4% male.

The 2000 census recorded a labor force in Louisiana of 2,012,831 persons, of which 91.9% were employed, 7.3% were unemployed, and 0.8% were employed in the armed services. The average household income for the state was $30,466 and the average per capita income was $17,131. In Louisiana, 20.3% of the total populous and 27.1% of children under the age of 18 were living at or below the poverty level. Education was reported as 76.7% of residents having completed high school and 19.4% having completed four or more years of upper level schooling.

The census recorded 27 different ancestral backgrounds and 8.5% of households reported speaking another language in the home besides English. A large percentage of residents, 80.2%, were born in and resided in the state, 19.1% migrated from other states, and 0.7% emigrated from other countries.

Infrastructure and Public Services

Physical infrastructure and public services include commonly provided federal, state, parish, municipal, and/or private facilities that support development and protect public health and safety, including (but not limited to) transportation (highways, roads, bridges, ferries, rails, airports, ports, and navigation), flood protection (levees, floodways, channel improvement and stabilization, and principal tributary basin improvements), solid waste disposal and treatment, water supply and wastewater disposal, drainage, electricity, housing, educational facilities, health care facilities, and police and fire protection. Infrastructure and public service development depend heavily on levels of population, migration patterns, and employment trends (particularly trends in the oil and gas industry and support services, which can fluctuate dramatically).

The following information was largely extracted from Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998*Coast 2050: Toward a Sustainable Coastal Louisiana*; 1997 *Roads of Louisiana*; and Calhoun 2002*Louisiana Almanac 2002-2003 Edition*. Louisiana has more than 60,000 miles of roads in interstate highways, U.S. highways, state

highways, parish roads, and city streets. Louisiana's interstate system is comprised of six routes and six connecting routes and bypasses. Interstate highways 10, 12, and 20 are primary west-east routes across the state. Interstates 49, 55, and 59 are primary north-south routes across the state. Several state highways, Highways 1, 23, 27, 39, and 82, serve as evacuation routes from the coastal zone. State and parish maintained bridges number greater than 13,000 and include over 150 movable bridges (swing-span, lift-span, bascule, and pontoon). Approximately 15 state and parish operated ferries provide service across water bodies. Southern Pacific, Kansas City Southern, Amtrak, Illinois Central, and Union Pacific are primary rail lines. Louisiana has approximately 450 publicly and privately owned and used airports, heliports, and seaplane bases. Louisiana ranks first in the nation in total shipping tonnage, handling over 450 million tons of cargo each year through public and private installations located within the state's jurisdiction of six deep-draft ports: New Orleans, Greater Baton Rouge, Lake Charles, South Louisiana, Plaquemines Parish, and St. Bernard. Fifteen smaller ports are situated within the coastal zone and primarily serve the oil and gas and fishing industries. The privately owned Louisiana Offshore Oil Port (LOOP) offloads approximately ten to 13% of the countries imported crude petroleum. The GIWW is a critical shallow-draft transportation link that carries an annual average of 70 millions tons of freight (primarily liquid bulk items such as petroleum and petroleum products, industrial chemicals, pipe and other supplies for the oil fields, and sulfur) between the Mississippi and Texas state lines. An alternate GIWW route, linking Morgan City and Port Allen, averages 25 million tons of cargo shipped per year.

The following information was summarized from the U.S. Army Corps of Engineers New Orleans District (USACE NOD) homepage*The Mississippi River and Tributaries Project* (1999). The Flood Control Act of 1928 committed the federal government to a program of flood control and authorized the Mississippi River and Tributaries (MR & T) Project. The four major elements of the project are: levees for containing flood flows; floodways for the passage of excess flows past critical reaches of the Mississippi; channel improvement and stabilization for stabilizing the channel in order to provide an efficient navigation alignment, increase the flood-carrying capacity of the river, and for protection of the levees system; and tributary basin improvements for major drainage and for flood control, such as dams and reservoirs, pumping plants, and auxiliary channels.

The Mississippi River main stem levee system, comprised of levees, floodwalls, and various control structures is 2,203 miles in total length. Approximately 1,607 miles lie along the Mississippi River itself and 596 miles lie along the south banks of the Arkansas and Red Rivers and in the Atchafalaya Basin.

Project floodwaters are diverted to the Atchafalaya River via the Morganza and West Atchafalaya floodways and the Old River Control Structure. At their terminus, a broad floodway passes flow to the Gulf of Mexico through the Wax Lake and Berwick Bay outlets. Floodwaters flowing down the main channel are diverted into Lake Pontchartrain and the Gulf through the Bonnet Carre spillway and continue down river to the Gulf.

Channel improvements and stabilization are accomplished by cutoffs (shorten river/reduce flood heights), revetments (stop meandering), dikes (direct flow), and improvement dredging (realign channels).

Two of the four major drainage basins in the lower Mississippi River Valley Project are located in Louisiana, the Tensas in northeast Louisiana and the Atchafalaya in south Louisiana.

There are approximately 26 landfill service areas, which include both industrial and municipal waste sites, in the state.

Education consists of (but is not limited to) state elementary and secondary schools, charter schools (independent public schools), nonpublic independent academies or religions institutions, four-year and two-year public universities/colleges, four-year nonpublic universities/colleges, state vocational-technical schools, approved special state schools, approved proprietary schools, approved flight training schools, public libraries, and museums and exhibition spaces (Calhoun 2002).

The Department of Health and Hospitals (LDHH) provides all public health services for the State of Louisiana through four program offices (Office of Charity Hospital of Louisiana at New Orleans, Office of Hospitals, Office of Human Services, and Office of Public Health) under a two-office administrative arm (Office of the Secretary and Office of Management and Finance) (Calhoun 2002). There are approximately 174 hospitals, 72 alcohol/drug abuse facilities, 23 community health centers, nine state developmental centers, 43 mental health clinics, 61 rural health clinics, 109 public health units, and 352 nursing homes in Louisiana (Calhoun 2002).

Industry

Commercial Fisheries and Aquaculture

The inland waters, costal marshes, and offshore waters of Louisiana support fishing and aquaculture industries. The shrimp fishery is Louisiana's largest commercial fishery, accounting for over 85% of the value of the state's edible fisheries production (Louisiana Department of Wildlife and Fisheries 2000). The shrimp industry is based on the brown and white shrimp (*Penaeus aztecus and Penaeus setiferus)*, harvested inshore in the spring and fall respectively, which accounts for 93 to 96% of landings by poundage (Louisiana Department of Wildlife and Fisheries 2000). The seabob (*Xiphopenaeus kroyeri*), pink shrimp (*Penaeus Duorarum*), and royal red shrimp (*Pleoticus robustus*) account for the remaining four to seven percent (Louisiana Department of Wildlife and Fisheries 2000). On average, 40% of Louisiana landings were taken in inshore state waters, 43% were taken in the state's offshore waters, and 17% were taken in federal waters off of Louisiana's coast from 1976 to 1990 (Louisiana Department of Wildlife and Fisheries 2000). White shrimp landings for the year 2000 totaled 75,864,278 pounds (34,411.8 metric tons) for a value of $152,374,346 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). The total take of brown shrimp for the year 2000 was 62,115,422 pounds (28,175.4 metric tons) for a value of $96,514,340 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). Processing industries are a source of additional employment.

The shrimp fishery, as mandated by the Louisiana Legislature, is under the supervision and control of the Louisiana Wildlife and Fisheries Commission. The commission has been given the authority to set seasons based on technical and biological data that indicates when marketable shrimp, in sufficient quantities, are available for harvest. The Louisiana Legislature dictates legal gear, licenses and fees, legal sizes, and other aspects of the shrimp fishery.

Oyster production in Louisiana is a $30 million dockside industry (Louisiana Department of Wildlife and Fisheries 2002). Louisiana's coastal waters produce an average of 13 million pounds of oysters annually, of which 60% are shipped to other states and

countries (Louisiana Department of Wildlife and Fisheries 2002). Eastern oyster (*Crassostrea virginica*) landings for the year 2000 totaled 11,513,438 pounds (5,222.5 metric tons) for a value of $24,614,159 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). The cultivation of oysters is a partnership between the state and private oysterman through the use of both public seed grounds and privately leased state water bottoms for $2.00 per acre per year (Louisiana Department of Wildlife and Fisheries 2001). Oysters are harvested and sold by the sack for a current selling price of between $10 and $20 (Louisiana Department of Wildlife and Fisheries 2001).

The blue crab (*Callinectes sapidus*) is the only crab of commercial importance in the State of Louisiana. Blue crab landings for the year 2000 totaled 51,430,385 pounds (23,328.7 metric tons) for a value of $36,770,381 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). Peeler blue crab landings for the year 2000 totaled 544,716 pounds (247.1 metric tons) for a value of $906,196 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). The total take of soft blue crab for the year 2000 was 56,887 pounds (25.8 metric tons) for a value of $262,140 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000).

The Atlantic menhaden (*Brevoortia tyrannus*) is by far the most prolific commercial finfish caught in Louisiana's waters. Atlantic menhaden landings for the year 2000 totaled 1,111,978,535 pounds (504,390.2 metric tons) for a value of $68,586,452 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). In addition, there are important fisheries for sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), black drum (*Pogonias cromis*), red drum (*Sciaenops ocellatus*), and southern flounder (*Paralichthys lethostigma*). Freshwater species of commercial importance include blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), yellow bullhead (*Ameiurus natalis*), bowfin (*Amia calva*), carp (*Cyprinus carpio carpio*), gar (*Lepisosteus occulatus* and *Lepisosteus spatula*), and buffalo (bigmouth *Ictiobus cypriellus* and smallmouth *Ictiobus bubalus*). The total take of all species combined for the year 2000 was 1,357,933,958 pounds (615,954.8 metric tons) for a value of $418,917,774 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). The Finfish Management Program within the LDWF has developed a comprehensive monitoring program for the purpose of making recommendations for the management of coastal finfish stocks. The department issued 19,438 commercial fisherman's licenses in 2000 to 2001 (Landry, personal communication 2001).

The farm value for Louisiana's aquaculture crops in the year 2000 was estimated at $121 million (Calhoun 2002). Louisiana is the fourth leading state in the production of catfish and year 2000 total landings (of blue catfish [*Ictalurus furcatus*], channel catfish [*Ictalurus punctatus*], and flathead catfish [*Pylodictis olivaris*]) were 6,216,318 pounds (2819.7 metric tons) valued at just over $3 million (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). The number of farm-raised American alligators (*Alligator mississippiensis*) in 2000 approached all-time highs, although poundage and dollars are unknown. Crawfish acreage and production declined sharply in 2000. Landings totaled 392,875 pound (178.2 metric tons) for a value of $677,116 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 2000). Crawfish landings for the year 1999 totaled 13,226,019 pounds (5,999.3 metric tons) for a value of $10,479,528 (National Oceanic and Atmospheric Administration, National Marine Fisheries Service 1999).

Forestry

The forests and woodlands of Louisiana are managed by the Louisiana Department of Agriculture and Forestry (LDAF), Office of Forestry. Forestland comprises 48% of the state's total area or approximately 13.8 million acres, a decline of 4.5% since 1974 (Calhoun 2002). The decline is due to the conversion of land to agriculture, urban expansion and infrastructure development, and mineral development (Calhoun 2002). There are 148,000 owners of Louisiana forestland, of which private, non-industrial landowners own 62%, forest products industries own 29%, and the general public owns nine percent (Louisiana Department of Agriculture and Forestry 2002). Fifty-nine of the state's 64 parishes contain commercial forest acreage.

Louisiana's forest products industries are the second largest manufacturing employer in the state with over 900 firms that directly employ over 25,000 people (Louisiana Department of Agriculture and Forestry 2002). An additional 8,000 people are employed in industries that support harvesting and transportation of forest products (Louisiana Department of Agriculture and Forestry 2002). Forestry in Louisiana generates an economic impact (4.4 billion in 1999) greater than all other agricultural products combined (Calhoun 2002). The estimated 2000 value of timber resources (value received by landowners from the sale of timber) was $654 million (University of Louisiana at Monroe 2000).

Sawtimber production for the year 2000 totaled 1,312,371,139 Board Feet (Doyle Scale) (University of Louisiana at Monroe 2000). Cordwood (pine and hardwood pulpwood and chip-n-saw) production for the year 2000 totaled 6,065,787 cords (University of Louisiana at Monroe 2000). Non-timber forestry (Christmas trees, pine straw, firewood, and tree seedlings) generated an estimated income of 11.3 million in 2000 (Calhoun 2002).

Agriculture

Agricultural data were synthesized from the University of Louisiana at Monroe, Center for Business and Economic Research, Louisiana Electronic Assistance Program and Calhoun 2002 *Louisiana Almanac 2002-2003 Edition*.

Animal production in Louisiana produces over a billion dollars in farm income annually and nearly a billion dollars in value added worth. The Louisiana poultry industry is the largest animal agricultural business in the state, with more than 550 commercial producers in 12 parishes. Gross farm value exceeds 730 million dollars annually.

The beef industry is a 300 million dollar business in the state, with producers numbering greater than 12,000.

Milk is produced in 23 Louisiana parishes, with Tangipahoa, Washington, De Soto, St. Helena, and Beauregard Parishes accounting for over 88% of total production. There are more than 400 dairy farms and 54,000 milk cows in the state. On-farm value of milk is estimated at greater than 110 million dollars annually.

Louisiana has more than 500 pork producers in 53 parishes. Total pig production has a gross farm value of nearly seven million dollars and a value added total greater than one million dollars.

Plant production in Louisiana produces over two billion dollars in gross farm income annually and greater than five billion annually in value added worth. Sugarcane is grown

on approximately 490,000 acres by 785 producers in 24 parishes. Total production of processed sugar is nearly 1,550,000 tons with a gross farm value of greater than $362,700,000 annually.

Louisiana's cotton industry has suffered in recent years due to drought conditions. More than 2,600 cotton farmers plant approximately 690,000 acres of cotton annually. Total crop is valued at approximately 235 million dollars.

The rice industry is nearly a 200 million dollar business. Acreage approximates 478,000, and the crop is planted and harvested by close to 1,900 producers.

Louisiana citrus is grown on more than 1,300 acres and has a gross farm value of nearly six million dollars annually. Peaches, strawberries, blueberries, blackberries, figs, muscadine grapes, mayhaws, pears, plums, apples, persimmons, and pecans are also commercially grown and sold in Louisiana.

Soybeans are an 87 million dollar business in the state, with production on more than 907,000 acres by 4,500 producers.

Sweet potatoes are planted on 27,000 acres and have a gross farm value of more than 57 million dollars with a value added of more than 41 million dollars.

The three primary feed grains grown in Louisiana are corn, grain sorghum, and oats. The gross farm value for feed grains was greater than 105 million dollars.

Wheat is harvested on approximately 161,000 acres by 600 producers. Total production approximates eight million bushels annually. Gross farm value is estimated at greater than 19 million.

Louisiana's commercial vegetable industry employs nearly 2,300 growers and produces 45 different vegetable crops on approximately 6,500 acres. The crops combined have a gross farm value of more than 29 million. Field tomatoes, fresh mustard, southern peas, Irish potatoes, and cucumbers are important crops.

The commercial production of nursery crops has a total value of 166 million dollars. Woody ornamental plants, floriculture and bedding plants, foliage plants, and fruit trees are important commercial nursery crops.

Oil & Gas

Louisiana's oil and natural gas industry began in Jennings in 1901 when the Heywood well produced oil in commercial quantities. In 1908 the first natural gas pipeline was laid in Louisiana, transporting gas from Caddo Field to Shreveport, Louisiana. In 1909 the "new refinery" (as it was named then) in Baton Rouge became operational. Today the refinery is owned and operated by Exxon-Mobil and is one of the largest on the North American continent. Construction commenced on the first long-distance oil pipeline in 1909. Crude oil was being transported from Caddo Parish in northwestern Louisiana to the "new refinery" in Baton Rouge, Louisiana by 1910. About 1910, the first over-water drilling occurred on Caddo Lake near Shreveport, Louisiana. The next 40 years were dominated by the discovery of the large fields of Bull Bayou, Monroe Gas, Haynesville Gas, Olla, Lake St John, Main Mass, Eugene Island, Bay Marchand, Vermillion, South Pass, and West Cameron. The year 1947 marked the birth of the offshore oil and gas industry. In 1969 Louisiana oil production peaked at 728,494,272 barrels of crude and

condensate. Louisiana's oil and natural gas reserves declined in 1969 to 1970 for the first time since their discovery. The decline initiated the exploration of resources further offshore. Throughout the 1990s deepwater discoveries and the development of new technology resulted in an industry rebound. Today the world record for deepwater drilling occurs off of the coast of Louisiana in 9,727 feet of water.

Louisiana's vast oil and natural gas reserves support one of the state's largest industries. Including offshore holdings, Louisiana ranks second in total energy produced, second in natural gas produced, and first in crude oil production (Louisiana Mid-Continent Oil and Gas Association 2002). Excluding offshore, Louisiana ranks seventh in total energy, third in natural gas and fourth in crude oil production (Louisiana Mid-Continent Oil and Gas Association 2002). In 2000 Louisiana produced over 75 million barrels of crude oil and over 1.4 billion metric cubic feet of natural gas (Louisiana Mid-Continent Oil and Gas Association 2000).

The following statistics were synthesized from Dr. Loren Scott's 1996 study, *The Energy Sector: A Giant Economic Engine for the Louisiana Economy*, and Louisiana Mid-Continent Oil and Gas Association's 1995 *Refinery Impact Study.* Louisiana had over 36,000 miles of above and underground pipelines that transported crude petroleum, natural gas, and condensate from fields to refineries and storage areas. Louisiana ranked number two in the nation in total refining capacity with 19 large-scale refineries that were able to process 2.76 million barrels of oil per day. The 19 refineries accounted for 15% of the nation's total refining capacity.

The Louisiana oil and gas industry is comprised of the exploration and production, refining, marketing, and transportation industries. In 2001 the oil and gas industry directly employed 82,408 persons (Louisiana Mid-Continent Oil and Gas Association 2001). In 1996 jobs in the energy sector and earnings were found in at least 54 of Louisiana's 64 parishes and through both their direct and multiplier effects the industry supported $65.2 billion in sales in Louisiana firms and over $8 billion in household earnings (Scott 1996).

Tourism

Tourism was an $8.7 billion industry in Louisiana in the year 2000, surpassing previous figures with increased visitation, visitor spending, employment, and payroll and travel generated tax revenue (Louisiana Department of Culture, Recreation and Tourism 2001). Approximately 23.7 million domestic and international travelers visited the state, generating $216.6 million locally, $397.3 million for the state, and $627.7 million for the federal government (Louisiana Department of Culture, Recreation and Tourism 2001). The increase in visitor spending is attributed to the promotion of Louisiana's diverse culture and to the opening of new attractions and hotel properties across the state (Louisiana Department of Culture, Recreation and Tourism 2001). Tourism in Orleans parish dominated the industry with nearly $4 billion in visitor spending, followed by Jefferson, East Baton Rouge, Caddo, and Bossier Parishes (Louisiana Department of Culture, Recreation and Tourism 2001). Catahoula, Natchitoches, Sabine, Evangeline, St. Landry, and East Baton Rouge Parishes recorded modest growth in visitor spending (Louisiana Department of Culture, Recreation and Tourism 2001). Travel spending directly generated 120,600 jobs and nearly $2 billion in wage and salary income in 2000 (Louisiana Department of Culture, Recreation and Tourism 2001).

Land Management and Ownership

Parks

Louisiana's State Parks, Historic Sites, and Preservation Area have been chosen for their scenery and historical, cultural, architectural, and/or archeological significance. The state manages 56 sites, of which 34 are operational and include 17 State Parks, 16 Historic Sites (State Commemorative Areas), and one Preservation Area. Total state holdings approximate 38,573 acres. This information and additional information on Louisiana's State Parks, Historic Sites, and Preservation Area is available from the LCRT, Office of State Parks.

The USDOI, NPS operates three National Historical Parks/Preserves/Heritage Areas and one National Monument in Louisiana. The Jean Lafitte National Historical Park and Preserve consists of six units. Established in 1978, the six units include sites of natural, historical, cultural, and archeological significance in the Mississippi River deltaic region. The Cane River Creole National Historical Park and Heritage Area is significant for its rural, agricultural landscape and associated plantations, structures, people, and culture. The New Orleans Jazz National Historical Park was established to celebrate and to preserve information and resources associated with the origins and evolution of jazz. The Poverty Point National Monument is managed by the State of Louisiana and commemorates an advanced "prehistoric" culture that thrived during the first and second millennia BC. This information and additional information is available from the USDOI, NPS.

The USACE manages lakeside recreational areas that are generally moderate in size and offer a full range of facilities such as campgrounds, picnic areas, boat ramps, marinas, and hiking trails. Corps projects in Louisiana include the 520-acre Bayou Bodcau Dam and the Ouachita-Black Rivers Navigation Project, which consists of 17 recreational areas along the 322-mile navigation system. The Columbia Lock 8 Dam Pool, Jonesville Lock and Dam Pool, and Pearl River Lock Number 1 are sites within the Ouachita-Black Rivers Navigation Project. This information and additional information is available from the USACE.

Refuges

The LDWF is responsible for the establishment and development of the Wildlife Management Area (WMA) system throughout the state. The department presently manages 48 WMAs in seven regions, comprising a total of 1,231,913 acres. Initiated in the early 1950s, the state's management areas represent every habitat type found throughout the state; coastal marshes, bottomland hardwoods, cypress tupelo swamps, mixed pine hardwoods, longleaf pine savannahs, upland hardwood forests, upland longleaf pine forests, and shortleaf pine/oak/hickory forests. This information and additional information on Louisiana's WMAs is available from the LDWF, WMA Program.

The USDOI, USFWS manages 24 National Wildlife Refuges (NWR) in Louisiana. Management ranges from preservation to active manipulation of habitats and population. Hunting, fishing, wildlife observation, photography, interpretation, and education, when compatible, are legitimate and appropriate uses of the refuge system. This information and additional information is available from the USDOI, USFWS.

Forests

The LDAF, Office of Forestry, is mandated "…to protect, conserve, and replenish the natural resources of the state" (Louisiana Revised Statutes 3:4271). Forestland comprises 48% of the state's total area, or approximately 13.8 million acres. There are 148,000 owners of Louisiana forestland, of which private, non-industrial landowners own

62%, forest products industries own 29%, and the general public owns nine percent. The Office of Forestry operates and maintains the Alexander State Forest and associated Indian Creek Recreation Area. The Alexander State Forest is Louisiana's only state owned demonstration forest and is managed under the multiple-use concept; providing timber production, improved wildlife habitat, hunting, recreational opportunity, water and soil conservation, forest management research, and endangered species habitat. The Alexander State Forest was established in 1923. Nine subsequent purchases of adjacent properties have expanded the forest to its present size of approximately 8,000 acres. This information and additional information on the Alexander State Forest is available from the LDAF, Office of Forestry.

The U.S. Department of Agriculture (USDA), Forest Service, manages Louisiana's only National Forest (NF), the Kisatchie National Forest. The forest is located in central and northern Louisiana and is comprised of five managed Ranger Districts totaling approximately 604,000 acres. Forest management practices emphasize natural resource restoration and conservation. Two National Wildlife Preserves (Catahoula and Red Dirt) are located within the Kisatchie National Forest. This information and additional information is available from the USDA, Forest Service.

Large Private Land Holdings

Forest statistics for the State of Louisiana were derived from data obtained during a 1991 inventory of the 64 parishes by Vissage et al. (1992). Of the state's 26,265,400 acres, 4,472,100 acres were owned by the forest industry, defined as lands owned or leased by companies or individuals operating wood-using plants (either primary or secondary). Farmer-owned lands, defined as lands operated as a unit of 10 acres or more and from which the sale of agricultural products totals $1,000 or more annually, totaled 724,900 acres. Nonindustrial private land (corporate), defined as lands privately owned by private corporations other than forest industries and incorporated farms, totaled 2,064,100 acres. Nonindustrial private land (individual), defined as lands privately owned by individuals other than forest industries, farmers, or miscellaneous private corporations, totaled 5,282,800 acres.

Farm statistics for the State of Louisiana were obtained from the 1997 Census of Agriculture compiled by the USDA, National Agricultural Statistics Service (NASS) and the Louisiana Agricultural Statistics Service. In 1997, land in farms totaled 7,876,528 acres. The average size of farms was 331 acres. Full time farms numbered 11,281.

Approximately 80% of the Louisiana Coastal Zone is privately owned (Hinds, personal communication 2002).

Tribal Lands

The four federally recognized American Indian Tribal Reservations are: the Chitimacha Tribe of Louisiana (Charenton); the Coushatta Tribe of Louisiana (Elton); the Jena Band of Choctaw Indians (Jena); and the Tunica-Biloxi Indians of Louisiana (Marksville). The five state recognized American Indian Tribal Service Areas are: Caddo Adai Indians of Louisiana (Robeline); the Choctaw-Apache Tribe of Ebarb (Zwolle); the Clifton Choctaw Tribe of Louisiana (Clifton); the Four-Winds Cherokee (Slagle); and the United Houma Indians (Golden Meadow). The Apalachee Tribe of Louisiana is recognized as an Indian Tribal Community. Additional information is available from the State of Louisiana, Office of the Governor, Office of Indian Affairs.

Recreation and Tourism

Parks, Wildlife Management Areas/Refuges, and Forests

Louisiana's State and National Parks (State Historic Sites, State Preservation Area, and National Preserve/Heritage Areas) provide for the recreational use of and/or preservation of the state's abundant natural and cultural resources. State and National Parks provide fishing, boating, swimming, hiking, biking, birding, camping, and picnicking opportunities. State Historic Sites, the State Preservation Area, and National Preserve/Heritage Areas educate visitors through structures, museums, artifacts, outdoor displays, and interpretive programs. This information and additional information on Louisiana's State Parks, Historic Sites, and Preservation Area is available from the LCRT, Office of State Parks. This information and additional information is available from the USDOI, NPS.

A press release by the Louisiana Office of State Parks in July 2001, reported a record number of visitors for the fiscal year 2000 to 2001. The 1.9 million visitor total broke the previous year's record of 1.7 million (Louisiana Department of Culture, Recreation and Tourism 2001). The increase is attributed to the acquisition of additional properties and the improvement of park facilities and the park system's central reservation system (Louisiana Department of Culture, Recreation and Tourism 2001).

The USACE manages lakeside recreational areas that are generally moderate in size and offer a full range of facilities such as campgrounds, picnic areas, boat ramps, marinas, and hiking trails. In Louisiana, the Bayou Bodcau Dam is a waterfowl and hunting area open to the public. The Ouachita-Black Rivers Navigation Project consists of two navigation pools with 17 recreational areas that provide river access, day-use facilities, and activities such as picnicking, swimming, hunting, fishing, boating, and bird watching. This information and additional information is available from the USACE.

Louisiana's State WMAs and NWRs provide recreational use of habitat types located throughout the state. All state areas are presently open. Annually, state areas provide approximately 1 million outdoor trips to hunters, fisherman, boaters, campers, bird watchers, and outdoor enthusiasts. This information and additional information on Louisiana's WMAs is available from the LDWF, WMA Program. This information and additional information is available from the USDOI, USFWS.

The Alexander State Forest is Louisiana's only state owned demonstration forest and is managed under the multiple-use concept. Approximately 75 percent of the forest's 8,000 acres are managed for hunting and other recreational activities. The Indian Creek Lake and Recreation Area is located within the forest and is comprised of a 2,250-acre lake, 100 acres of developed recreational facilities, and a 250-acre primitive camping area. The lake offers freshwater fishing and developed recreational facilities include campsites, picnic sites, a covered pavilion, beaches for swimming, bath houses, and a boat launch. A hiking trail provides access to and viewing of a variety of habitats supporting numerous plant and animal species. This information and additional information on the Alexander State Forest is available from the LDAF, Office of Forestry.

The Kisatchie National Forest is Louisiana's only National Forest and is comprised of five Ranger Districts throughout central and northern Louisiana. Recreational opportunities include fishing and hunting on four lakes and within an 8,700-acre wilderness, and 355 miles of trails for camping, picnicking, hiking, mountain biking, horseback riding, and/or off road vehicle riding. This information and additional information is available from the USDA, Forest Service.

Natural and Scenic River Systems

The LDWF is responsible for the administration of the Natural and Scenic Rivers and Historic and Scenic Rivers System as mandated by the Louisiana Scenic Rivers Act (Acts 1998, No. 947, Section 1, effective July 27, 1988, or L.R.S. 56:1840, et seq.). Regulations "establish procedures and provide a mechanism whereby the Department of Wildlife and Fisheries can preserve, protect, develop, reclaim and enhance the wilderness qualities, scenic beauties and ecological regime of rivers and streams or segments thereof included within the Louisiana Natural and Scenic Rivers and Historic and Scenic Rivers System and for the further purposes of preserving aesthetic, scenic, recreational, fish, wildlife, ecological, archaeological, geological, botanical and other natural and physical features and resources found along these rivers and streams or segments thereof" (Louisiana Scenic Rivers Act [Acts 1998, No. 947, Section 1, effective July 27, 1988, or L.R.S. 56:1840, et seq.]). The LDWF manages 52 natural, undeveloped rivers and streams.

The National Wild and Scenic Rivers Act (P.L.90-542 as amended; 16 USC1271-1278) was passed by Congress in 1968 so "that certain selected rivers of the Nation which, with their immediate environments, posses outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations." Saline Bayou is Louisiana's only designated national wild and scenic river and is located within the Kisatchie National Forest unit. The U.S. Forest Service (USFS) is responsible for managing the 6,030-acre Saline Bayou.

Hunting

Louisiana's diverse habitat types support an abundance of wildlife and provide for hunting on both public and private lands. The LDWF manages approximately 1.4 million acres of land in WMAs and refuges throughout the state with the goals of providing quality examples of Louisiana's habitats, insuring viability of these lands' wildlife populations, and providing the opportunity for a quality outdoor recreational experience. The department's Deer Program was established with the objectives to manage and maintain a healthy population of whitetail deer (*Odocoileus virginianus*) in Louisiana and to provide quality outdoor recreation and a harvest of 200,000 deer annually. A game harvest survey dated 1996 to 1997 indicated 180,200 deer hunters spent more than 3.7 million days afield during the deer season and harvested 234,700 deer (Louisiana Department of Wildlife and Fisheries 2000). Within the past five years, values cited have remained relatively stable to slightly increasing (Louisiana Department of Wildlife and Fisheries 2000). Yearly managed hunts to allow for the harvest of surplus deer and to prevent the overbrowsing of habitats are conducted in state WMAs and on USFS, USFWS, and USACE designated lands.

Common small game species include squirrel, rabbit, wild turkey (*Meleagris gallopavo*), bobwhite quail (*Colinus virginianus*), mourning dove (*Zenaida macroura*), woodcock (*Scolopax minor*), ring-necked pheasant (*Phasianus colchicus*), and snipe (*Gallinago gallinago).* In order to meet public demands, the LDWF established a Small Game Program and a Turkey Program for the purposes of species management, research and population monitoring, restoration, and habitat improvement.

Louisiana is an important waterfowl wintering area due in part to its semitropical climate and geographical position. Louisiana is located in the Mississippi and Central flyways, by

which waterfowl migrate from northern nesting grounds to Louisiana and locations south thereof. Migrants winter in coastal marshes, freshwater swamps, and agricultural fields. Waterfowl provide economically important activities. In order to meet public demands, the LDWF has established a Waterfowl Program with the objectives to manage waterfowl resources and wetlands and to provide for optimum wildlife benefits and quality outdoor experiences.

The LDWF issued 589,234 hunting licenses and 9,673 lifetime licenses in 2000 to 2001 (Hinds, personal communication 2002).

The number of landowners leasing land for recreational hunting, primarily of Whitetail Deer, in 2000 was 5,653 for a total of 6,872,351 acres (Calhoun 2002).

The Fur and Refuge Division of LDWF is responsible for the management and supervision of indigenous furbearer species and alligator, reptile, and amphibian resources. The division manages a total of approximately 428,000 acres of coastal marsh on five refuges and four WMAs, all of which are open for various forms of public recreation. Pelts of the muskrat (*Ondatra zibethicus*), nutria (*Myocastor coypus*), raccoon (*Procyon lotor*), mink (*Mustela vison*), and otter comprise the bulk of the fur harvest. Raccoon, opossum, fox, bobcat (*Lynx rufus*), and coyote (*Canis latrans*) are important upland habitat furbearer species. The LDWF issued 982 trapping licenses in 2000 to 2001 (Hinds, personal communication 2002).

Fishing

Numerous accessible waterways and abundant freshwater and marine game fish species has made the waters of Louisiana the destination of choice for fresh and saltwater fishermen. During the 2000 to 2001 season, 815,180 recreational fishing licenses were sold in the State of Louisiana (Hinds, personal communication 2002).

The freshwater regions of Louisiana include over 40,000 miles of rivers, bayous, and streams; nearly 450,000 acres of lakes and ponds; and over 3.5 million acres of marsh. Louisiana has 22 families and 148 species of freshwater fish. The following list of freshwater species includes only those which have significant sport fishing value: largemouth bass (*Micropterus salmoides*) (most highly prized recreational game fish), spotted bass (*Micropterus punctulatus*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), white bass (*Morone chrysops*), and the recently introduced stripped bass (*Morone saxatilis*).

Recreational fishing in Louisiana's coastal marshes and marine waters is extremely popular among residents and tourists alike. Along the Louisiana coastline, recreational fisherman land finfish, crustaceans, and benthos. Port Fourchon and Grand Isle are popular destinations for landing redfish (*Sciaenops ocellatus*), blacktip shark (*Carcharhinus limbatus*), speckled trout (*Cynoscion arenarius*), black drum (*Pogonias cromis*), and shrimp. Offshore recreational anglers fish artificial reefs created by oil and gas platforms, which support a large variety of marine life and big game fish such as the bluefish (*Pomatomus saltatrix*), dolphin (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri)*), red snapper (*Lutjanus campechanus*), bonita, jackfish, marlin, tuna, mackerel, and cobia/lemonfish/ling.

Bird Watching

Louisiana's semitropical climate and position at the southern terminus of the Mississippi and Central flyways provide habitat for both permanent and migratory bird species. Bird

watching is an economically important activity in coastal Louisiana. Louisiana State Park holdings, WMAs, and NWRs promote birding and conduct annual bird counts.

Boating

Louisiana's four million acres of water provide the public the opportunity to engage in numerous water-related activities. As of December 31, 2000, the LDWF had registered 330,293 boats (Hinds, personal communication 2002). Public launch ramps are located throughout the state.

Federal Facilities

Federal facilities are defined as lands owned, leased, held in trust or whose use is otherwise by law subject solely to the discretion of the federal government, its officers or agents. See Table B-14 for a list of federal facilities in Louisiana

Table B- 14: Federal Facilities in Louisiana

Department	Agency	Type	Name	Acres
USDOI	USFWS	National Wildlife Refuge	Texas Point National Wildlife Refuge	8996
	USFWS	National Wildlife Refuge	Saint Catherine Creek National Wildlife Refuge	10622
	USFWS	National Wildlife Refuge	Catahoula National Wildlife Refuge	10740
	USFWS	National Wildlife Refuge	Cameron Prarie National Wildlife Refuge	18132
	USFWS	National Wildlife Refuge	D'Arbonne National Wildlife Refuge	20593
	USFWS	National Wildlife Refuge	Grand Cote National Wildlife Refuge	22399
	USFWS	National Wildlife Refuge	Lacassine National Wildlife Refuge	34418
	USFWS	National Wildlife Refuge	Upper Ouachita National Wildlife Refuge	35227
	USFWS	National Wildlife Refuge	Bogue Chitto National Wildlife Refuge	36699
	USFWS	National Wildlife Refuge	Lake Ophelia National Wildlife Refuge	37476
	USFWS	National Wildlife Refuge	Bayou Sauvage National Wildlife Refuge	42521
	USFWS	National Wildlife Refuge	Delta National Wildlife Refuge	53519
	USFWS	National Wildlife Refuge	Atchafalaya National Wildlife Refuge	57064
	USFWS	National Wildlife Refuge	Breton National Wildlife Refuge	63323
	USFWS	National Wildlife Refuge	Tensas River National Wildlife Refuge	79760
	USFWS	National Wildlife Refuge	Sabine National Wildlife Refuge	145224
	BIA	Indian Reservation	Chitamacha Indian Reservation	24
	NPS	National Historical Park	Jean Lafitte National Historical Park and Preserve	15803
	NPS	National Monument	Poverty Point National Monument	931896
USDOD	Navy	N/A	New Orleans Naval Air Station	98
	USACE	N/A	Bonnett Carre Spillway	154
	Army	N/A	Louisiana Ordnance Plant	620
	Air Force	N/A	Barksdale Air Force Base	684
	Army	N/A	Fort Polk Military Reservation	4122
USDA	USFS	National Forest	Sabine National Forest	6136
	USFS	National Forest	Kisatchie National Forest	6981

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APPENDIX C: T AND E SPECIES, ESSENTIAL FISH HABITAT, AND OTHER RELATED INFORMATION

The following appendix includes information on federal threatened and endangered species (T&E) and essential fish habitat (EFH) throughout the coastal and upland regions of Louisiana. Threatened and endangered species are grouped by animal or plant and are listed in alphabetical order. Essential fish species and habitats are divided into specific areas of concern. This appendix separates those species and habitats managed under the Fisheries Management Plan for the Gulf of Mexico as well as the species managed under the federally implemented Fisheries Management Plan.

THREATENED AND ENDANGERED SPECIES (FEDERAL) as of February 26, 2003

ANIMALS (23)

Status	Listing
T(S/A)	Alligator, American (*Alligator mississippiensis*)
T(S/A)	Bear, American black (County range of LA b. bear) (*Ursus americanus*)
T	Bear, Louisiana black (*Ursus americanus luteolus*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
E	Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
T	Pearlshell, Louisiana (*Margaritifera hembeli*)
E	Pelican, brown (except U.S. Atlantic coast, FL, AL) (Pelecanus occidentalis)
T	Plover, piping (except Great Lakes watershed) (*Charadrius melodus*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
E	Sturgeon, pallid (*Scaphirhynchus albus*)
E	Tern, least (interior pop.) (*Sterna antillarum*)
T	Tortoise, gopher (W. of Mobile/Tombigbee Rs.) (*Gopherus polyphemus*)
T	Turtle, ringed map (*Graptemys oculifera*)
E	Vireo, black-capped (*Vireo atricapillus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

PLANTS (3)

Status	Listing
T	*Geocarpon minimum* (No common name)
E	Quillwort, Louisiana (*Isoetes louisianensis*)
E	Chaffseed, American (*Schwalbea americana*)

T = Threatened
E = Endangered
T(S/A) = Similarity of Appearance to a Threatened Taxon

ESSENTIAL FISH HABITAT

Fishery Management Plans and Managed Species for the Gulf of Mexico Managed by the Gulf of Mexico Fishery Management Council

Shrimp Fishery Management Plan
brown shrimp - *Penaeus aztecus*
pink shrimp - *P. duorarum*
royal red shrimp -*Pleoticus robustus*
white shrimp - *Penaeus setiferus*

Red Drum Fishery Management Plan
red drum - *Sciaenops ocellatus*

Reef Fish Fishery Management Plan
black grouper-*Mycteroperca bonaci*
gag grouper -*M. microlepis*
gray snapper -*Lutjanus griseus*
gray triggerfish -*Balistes capriscus*
greater amberjack -*Seriola dumerili*
lane snapper -*L. synagris*
lesser amberjack -*S. fasciata*
red grouper -*Epinephelus morio*
red snapper -*L. campechanus*
scamp grouper -*M. phenax*
tilefish - *Lopholatilus chamaeleonticeps*
yellowtail snapper -*Ocyurus chrysurus*
vermilion snapper -*Rhomboplites aurorubens*

Stone Crab Fishery Management Plan
stone crab - *Menippe spp.*

Spiny Lobster Fishery Management Plan
spiny lobster - *Panulirus argus*

Coral and Coral Reef Fishery Management Plan
varied coral species and coral reef communities
comprised of several hundred species

Coastal Migratory Pelagic Fishery Management Plan
bluefish - *Pomatomus saltatrix*
dolphin - *Coryphaena hippurus*
cobia - *Rachycentron canadum*
king mackerel -*Scomberomorus cavalla*
little tunny -*Euthynnus alleteratus*
Spanish mackerel -*S. maculatus*

National Marine Fisheries Service. 1999. Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies. http://galveston.ssp.nmfs.gov/efh/EFHprimer2.pdf

Species Managed under the Federally-Implemented Fishery Management Plans Managed by National Marine Fisheries Service

Billfish

blue marlin - *Makaira nigricans*
longbill spearfish - *Tetrapturus pfluegeri*
sailfish - *Istiophorus platypterus*
white marlin - *T. albidus*

Swordfish

swordfish - *Xiphias gladius*

Tuna

albacore - Thunnus alalunga
Atlantic bigeye - T. obesus
Atlantic yellowfin - T. albacares
skipjack - Katsuwonus pelamis
western Atlantic bluefin - *T. thynnus*

Sharks

Atlantic angel shark - *Squatina dumerili*
Atlantic sharpnose shark - *Rhizoprionodon terraenovae*
basking shark - Cetorhinus maximus
bigeye sand tiger - Odontaspis noronhai
bigeye sixgill shark - Hexanchus vitulus
bigeye thresher shark - Alopias superciliosus
bignose shark - Carcharhinus altimus
blacknose shark - C. acronotus
blacktip shark - C. limbatus
blue shark - Prionace glauca
bonnethead - *Sphyrna tiburo*
bull shark - *C. leucas*
Caribbean reef shark - *C. perezi*
Caribbean sharpnose shark - *R. porosus*
common thresher shark - *A. vulpinus*
dusky shark - *C. obscurus*
finetooth shark - *C. isodon*
Galapagos shark - *C. galapagensis*
great hammerhead - *S. mokarran*
lemon shark - *Negaprion brevirostris*
longfin mako shark - *Isurus paucus*
narrowtooth shark - *C. brachyurus*
night shark - *C. signatus*
nurse shark - *Ginglymostoma cirratum*
oceanic whitetip shark - *C. longimanus*
porbeagle shark - *Lamna nasus*
sandbar shark - *C. plumbeus*
sand tiger shark - *O. taurus*
scalloped hammerhead - *S. lewini*
sharpnose sevengill shark - *Heptranchias perlo*
shortfin mako shark - *I. oxyrinchus*
silky shark - *C. falciformis*
sixgill shark - *H. griseus*
smalltail shark - *C. porosus*
smooth hammerhead - *S. zygaena*
spinner shark - *C. brevipinna*
Tiger shark - *Galeocerdo cuvieri*
whale shark - *Rhinocodon typus*
white shark - *Carcharodon carcharias*

National Marine Fisheries Service. 1999. Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies. http://galveston.ssp.nmfs.gov/efh/EFHprimer2.pdf

Essential Fish Habitat Identified in Fishery Management Plan Amendments of he Gulf of Mexico, South Atlantic, Caribbean and Mid-Atlantic Fishery Management Councils. (Generally, EFH for species managed under the NMFS Billfish and Highly Migratory Species plans falls within the marine and estuarine water column habitats designated by the councils)

Estuarine areas

Estuarine emergent wetlands
Mangrove wetlands
Submerged aquatic vegetation
Algal flats
Mud, sand, shell, and rock substrates
Estuarine water column

Marine areas

Water column
Vegetated bottoms
Non-vegetated bottoms
Live bottoms
Coral reefs
Artificial reefs
Geologic features
Continental Shelf features
West Florida Shelf
Mississippi/Alabama Shelf
Louisiana/Texas Shelf
South Texas Shelf

National Marine Fisheries Service. 1999. Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies. http://galveston.ssp.nmfs.gov/efh/EFHprimer2.pdf

Geographically Defined Habitat Areas of Particular Concern Identified in Fishery Management Plan Amendments Affecting the Southeast and Caribbean Areas.

Texas/Louisiana

Flower Garden Banks National Marine Sanctuary

National Marine Fisheries Service. 1999. Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies. http://galveston.ssp.nmfs.gov/efh/EFHprimer2.pdf

APPENDIX D: PROJECT SOLICITATION FORM

NRDA-RRP RESTORATION PROJECT INFORMATION SHEET

Organization:				**Project Name:**	
Organization Web Page:				**Project Location:**	
Contact Name:				**Parish & Watershed:**	
Contact Title:				**Latitude/Longitude:**	
Contact Address:					
Contact Phone:		**Contact Fax:**		**Contact E-Mail:**	

Restoration Activity

Resource/Habitat/Service	☐ Marine/Estuarine Wetland ☐ Freshwater Wetland ☐ Reef ☐ Biological (Fish, Birds, Wildlife) ☐ Upland ☐ Recreational ☐		
Restoration Result	☐ Creation ☐ Rehabilitation ☐ Enhancement ☐ Protection ☐	**Project Size:**	**Affected Area:**

Project Status (please provide as much information as is currently available)

Activity	**Funded?**	**Completed?**	**Additional Notes**
Planning/Design/Permitting:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Property or Resource Acquisition:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Construction:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Maintenance and Future Activities:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Future Construction & Oversight:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Restoration Monitoring:	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	
Other (_____):	☐ **Yes** ☐ **No** ☐ **n/a**	☐ **Yes** ☐ **No** ☐ **n/a**	

Restoration Description and Benefits

Project Partners

Organization	**Contact Information**	**Project Involvement**

Please return this form to the Louisiana Oil Spill Coordinator's Office, Attn: Chuck Armbruster, 150 Third Street, Suite 405, Baton Rouge, LA 70801, Fax: (225) 219-5802

RESTORATION PROJECT INFORMATION SHEET

Guidelines for Completion

Please complete all of the information requested with the best information that you have available. Limited attachments are acceptable if they are necessary to adequately describe the project, however every effort should be made to have all pertinent information included on the Restoration Project Information Sheet. Below are specific guidelines for completion.

Organization: The name of the organization or agency submitting the information.

Organization Web Page: The web page of the above organization or agency.

Contact Name: The name of a person who can be contacted for additional information.

Contact Title: The title of the above individual.

Contact Address: The mailing address of the above individual.

Phone/Fax/Email: The Phone number, Fax and E-mail of the above individual.

Project Name: The common name of the project, usually a combination of location and restoration activity, for example the Cross Bayou Mangrove Restoration.

Project Location: The location where the restoration activity will take place, for example East Timbalier Island.

Parish & Watershed: The Parish and Watershed where the project will be completed.

Latitude/Longitude: The project location in Degrees/Minutes/Seconds or Decimal Degrees

Resource/Habitat/Service: The type of resource, habitat, and/or service that will be restored.

Restoration Result: The type of activity that will be completed as part of the restoration
Creation: Creation of a habitat, resource, or service in a area where it did not previously exist.
Rehabilitation: The reestablishment or rehabilitation of an area that once provided, but does not currently, the resource, habitat, or service in which you are trying to restore.
Enhancement: The enhancement of an existing resource, habitat, or service.
Preservation/Protection: The removal of a threat to a resource, habitat, or service.

Project Size: The size of the area where restoration activities will be completed.

Affected Area (Size): The size of the area that will be affected by the restoration activity.

Project Status: Please check the appropriate boxes concerning whether certain aspects of the project have funding from an outside source allocated to them, and/or if certain activities have been completed. Additionally if a certain activity is not required for completion of the project check the box "n/a" for not applicable.

Project Description And Benefits A 1-2 paragraph description of the project and the restoration activities to be completed, along with information on the benefits of this project to public and environment. In addition feel free to attach other information, maps, or diagrams concerning your project.

Project Partners: Please provide the name, contact, and involvement (equipment, matching funds, design, etc.) of other organizations or agencies involved with the restoration activity.

After completion, please mail or fax this form to:

Louisiana Oil Spill Coordinator's Office
Attn: Chuck Armbruster
150 Third Street, Suite 405
Baton Rouge, LA 70801
(225) 219-5802 (fax)
(225) 219-5800 (voice)
carmbruster@losco.state.la.us (e-mail)

APPENDIX E: NRDA PRELIMINARY ASSESSMENT WORKSHEET

NRDA PRELIMINARY ASSESSMENT WORKSHEET

Incident Name:		**Responsible Party:**	
RP Contact:		**RP Contact Number:**	
Parish:		**City:**	
Incident Date/Time:		**Investigation Date/Time:**	
Incident Location:			
Latitude:	°	**Longitude:**	°
Product Released:		**Amount Spilled:**	

Habitat Affected:	**Check all that apply**	**Oiling**			**Estimated size of impacted area:**	**Expected exposure time?: (hours, days, months)**
		L	**M**	**H**		
	Open Water					
	Bottom Sediments					
	Bay					
	River/stream					
	Gulf					
	Shoreline					
	Beach					
	Developed					
	Other					
	Marsh					
	Saline					
	Brackish					
	Fresh					
	Flotant					
	Mangrove					
	Woodland					
	Swamp					
	Bottomland Hardwood					
	Shrub/scrub					
	Pine					
	Other: (specify)					

Samples Collected? Yes No	**Sample Type/#:**	**Investigator:**
Photo Doc.? Yes No	**35 MM/ digital/ video**	**Contact #:**

Observed faunal mortality?: Yes No **Observed oiled fauna?:** Yes No

Carcasses? (species/number/disposition):

Response Impacts?: Yes No **Do you anticipate additional impacts?:** Yes No

NOTES:

Please complete upon site visit and FAX to 225-219-5802

NRDA PRELIMINARY ASSESSMENT WORKSHEET

Guidelines for Completion

This worksheet is to be completed when an oil spill is investigated on-site. The information is to be faxed to the Louisiana Oil Spill Coordinator's Office at 225-219-5802. The data derived from this effort will be used to determine if further investigation that may lead to a Natural Resource Damage Assessment is warranted.

Incident Name: Usually comprised of the responsible party name and the location (e.g., Exxon Paradis, Chevron Dixon Bay, Apache Freshwater City, etc.). This is not a critical data field, but is used for reference purposes.
Responsible Party: Company responsible for the release.
RP Contact: Contact person with the responsible company.
RP Contact Number: Phone number of the above contact person.
Parish/City: Self-explanatory. Use the name of the nearest incorporated municipality for "city".
Incident Date/Time: Date/Time when the release occurred.
Investigation Date/Time: When the investigator arrived on-scene.
Incident Location: Description of how a reader can find the incident.
Latitude/Longitude: If the information is available and you are reasonably sure it is accurate.
Product Released: What was spilled?
Amount Spilled: How much was spilled?
Oiling: For each habitat type selected, indicate the degree of oiling by checking "L" (lightly), "M" (moderately) or "H" (heavily).
Habitat Affected: Specify the habitat type if "**Other**" is selected.
Estimated size of impacted area: For each habitat type selected, use your best professional judgment to estimate area of impact.
Expected exposure time: For each habitat type selected, use your best professional judgment to estimate amount of time necessary for all but trace amounts of hydrocarbons to be removed from the subject habitat.
Samples collected? Self-explanatory. Include the number and type of samples collected in the subsequent field.
Photo documentation? Self-explanatory**.** Include what type of photo record you took.
Investigator: Person investigating the incident and filling out the form.
Contact #: Investigator's phone number.
Observed faunal mortality?: Did the investigator see any animals dead as a result of the spill?
Observed oiled fauna?: Did the investigator see any animals oiled, but not dead, as a result of the spill?
Carcasses?: If dead animals were observed, how many of what species were observed and were there any attempts to collect, catalogue, or preserve them?
Response Impacts?: Are response activities resulting in additional impacts to the area? (e.g., clearing trees for staging areas)
Do you anticipate additional impacts?: Use your best professional judgment to determine whether additional oiling or response impacts will occur from this incident
Notes: Give a brief narrative of your observations, touching on pertinent information that may have not been included in the checklist.

When the form is completed, FAX the document to LOSCO at 225-219-5802.

APPENDIX F: COMPLIANCE STATUS OF LOUISIANA REGIONAL RESTORATION PROGRAM WITH RELEVANT FEDERAL LAWS, REGULATIONS AND PROGRAMS

LAW	SCOPE	LEAD AGENCY	COMPLIANCE REQUIREMENTS
Anadromous Fish Conservation Act, 16 USC 757	Conservation and restoration of anadromous fish resources and habitat.	NMFS, USFWS	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Clean Water Act , 33 USC 1251 et seq.; Sections 404 and 301	Regulates discharge of dredge and fill materials in waters of the U.S.; protection of wetlands.	USACE, USEPA	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies. Project-specific permit may be required.
Clean Water Act, Sections 401 and 402	Establishes state water quality standards.	USEPA	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies. Project-specific permit may be required.
Coastal Wetlands Planning, Protection and Restoration Act of 1990 (CWPPRA)	Establishes regime for protection and enhancement of wetlands.	CWPRRA, USACE, etc.	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Coastal Zone Management Act (CZMA)	Establishes protection measures for coastal zone.	NOAA, LA	Draft PEIS sent to LA CZMA Program Office for review and programmatic consistency determination. Project specific consistency determinations will also be required, as will coastal use permits if the state or a private entity is lead on project-specific implementation.
Essential Fish Habitat, Section 303(a) of the amended Magnuson-Stevens Act	Identifies and establishes protective measures for essential fish habitat.	NOAA (NMFS)	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Endangered Species Act	Identifies and establishes protective measures for endangered, and threatened species.	USFWS, NMFS	Programmatic Section 7 consultation being performed to assess consistency. Project-specific coordination will also be necessary with responsible agencies at time of implementation.
Fish and Wildlife Coordination Act	Establishes protection of fish and wildlife. Applies to federal actions only.	USFWS, NMFS	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
National Environmental Policy Act	Requires survey and disclosure of environmental impacts of proposed federal projects.	Federal lead agency, USEPA	Phased compliance in effect. Program currently in compliance. PEIS finalization and further project-specific consultation as necessary.
National Historic Preservation Act	Establishes protective regime for historic properties. Applies to federal actions.	USDOI (Registry of Historic Places)	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Oil Pollution Act of 1990	Establishes measures for prevention and response to oil spills.	All federal and state agencies involved in oil spill prevention and response.	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Rivers and Harbors Act	Restricts obstruction or alterations of navigable waterways.	USACE	Program currently in compliance. Project-specific coordination, and additional permit, may be necessary with responsible agencies at time of implementation.
Archeological Finds on State Lands R.S. 41:1605	Permitting on sites with archaeological importnace.	LCRT	Program currently in compliance. Project-specific coordination may be necessary with responsible agencies at time of implementation.

REGULATION	SCOPE	LEAD AGENCY	COMPLIANCE STATUS
NOAA's 1996 Final Rule on Natural Resource Damage Assessments	Describes procedures for performing natural resource damage assessment in accordance with OPA.	NOAA	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Executive Order 12898 B AEnvironmental Justice	Requires assessment of project impact on minority and low-income populations.	Lead federal agency.	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Executive Order 11988 B AFloodplain Management	Requires federal agencies to protect and conserve floodplain resources.	Lead federal agency	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Executive Order 11990 B AProtection of Wetlands	Requires federal agencies to protect and conserve wetland resources.	Lead federal agency	Program currently in compliance. Project-specific coordination will be necessary with responsible agencies at time of implementation.
Executive Orders 13007 B ASacred Indian Sites and 13175 B AConsultation with Tribal Governments	Requires consideration and consultation with Indian tribes over actions that may have tribal implications.	Lead federal agency	Program currently in compliance. Project-specific coordination may be necessary with Tribal Governments at time of implementation.
Louisiana Surface Water Quality Standards LAC 33.IX, Chapter 11	Permitting of wastewater discharge into state waters.	LDEQ	Program currently in compliance. Project-specific coordination may be necessary with Tribal Governments at time of implementation.
Louisiana Coastal Resources Program LAC 43:700 et seq.	Establishes state coastal program.	Various state agencies.	Program currently in compliance. Project-specific coordination may be necessary with Tribal Governments at time of implementation.
PROGRAM	**SCOPE**	**LEAD AGENCY**	**COMPLIANCE REQUIREMENTS**
Barataria-Terrebonne National Estuary Project	Conservation and protection of the Barataria-Terrebonee estuary ecosystem.	USACE, LA	Project-specific coordination, as appropriate, at the time of site-specific restoration implementation.
COAST 2050	Enhanced protection and conservation of Louisiana coastal resources	USACE, LDNR/CZM, others	Project-specific coordination, as appropriate, at the time of site-specific restoration implementation.
Oyster Lease Relocation Program LAC 43: I, 850-859, Subchapter B	Reduces conflicts between public coastal restoration projects and private oyster leases.	LDWF	Project-specific coordination, as appropriate, at the time of site-specific restoration implementation.
Tensas River Basin Initiative	Modeling and protection of Tensas River Watershed	USEPA, USDA, LDEQ, the Nature Conservancy, others	Project-specific coordination, as appropriate, at the time of site-specific restoration implementation.
Wetlands Reserve Program	Protection and enhancement of wetland resources	USDA (NRCS)	Project-specific coordination, as appropriate, at the time of site-specific restoration implementation.