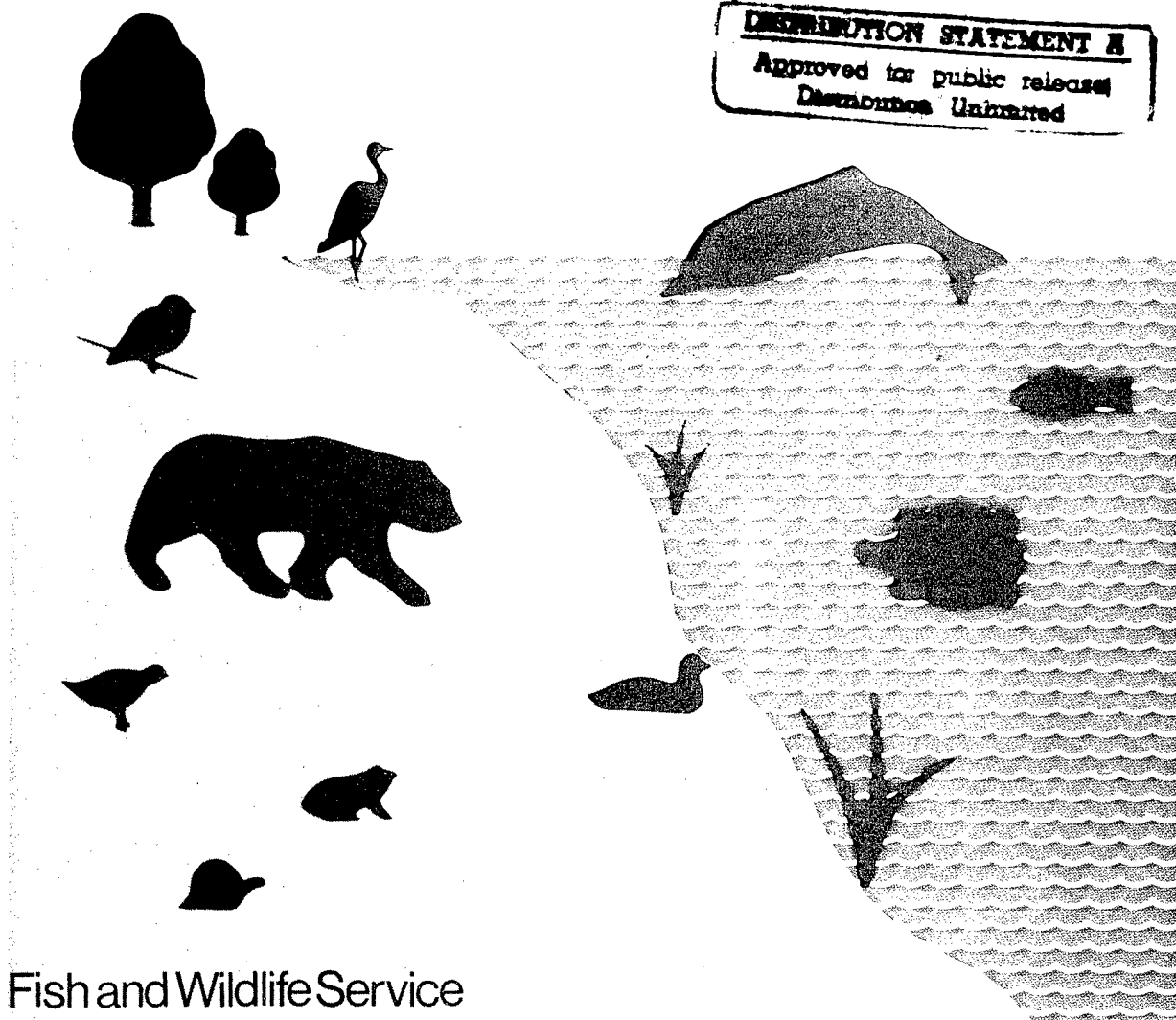


FWS/OBS-83/19
May 1983

Lower Mississippi Valley Ecological Inventory

USER'S GUIDE
AND INFORMATION BASE

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May 1983

LOWER MISSISSIPPI VALLEY ECOLOGICAL INVENTORY
USER'S GUIDE AND INFORMATION BASE

by

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PREFACE

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

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

The objective is to produce an inventory of those important ecological resources along the lower Mississippi River on which siting of major industrial facilities and land clearing operations could have an impact.

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

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ACKNOWLEDGEMENTS

The U.S. Fish and Wildlife Service (FWS) would like to thank Bill Jones and Bruce Palmer of the U.S. Geological Survey for their assistance in the design and quality control in producing the maps for this study. We would also like to thank Dr. J. Albert Sherk (FWS) for his role in coordinating the inventory effort at the Washington, DC, office level.

Valuable resource information, which was key to the accomplishments of this inventory effort, was contributed by numerous Federal and state agencies, and private individuals and groups. These included biologists and other experts from the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Memphis, Nashville, and Vicksburg Districts, Tennessee Valley Authority, Arkansas Game and Fish Commission, Arkansas Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Mississippi Department of Wildlife Conservation, Mississippi Natural Heritage Program, Tennessee Water Resources Administration, Tennessee Wildlife Resources Agency, Tennessee Natural Heritage Program, and the Association of Systematics Collections, University of Kansas.

Special thanks to the personnel at the FWS Office of Endangered Species, in particular, K. Dodd, L. Hurley, B. MacBryde, J. Paradiso, and J. Williams, for their assistance in the standardization of species' names in the Master Species List.

PART 1

INTRODUCTION

1.1 BACKGROUND

Recent developments, such as a new Federal emphasis on the deregulation of industries, have increased the need for advanced planning in siting energy facilities. The U.S. Department of the Interior and the Fish and Wildlife Service (FWS) have played major roles in issues involving the regional extent and distribution of our Nation's valuable natural resources. Given the projected needs for energy related facilities along the lower Mississippi River, as well as the likelihood of future Department involvement in siting issues, the FWS has conducted an ecological inventory to assist industry in advanced planning and evaluation procedures. FWS's intent was to lessen the chance for serious disputes during the later permit review evaluation process.

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

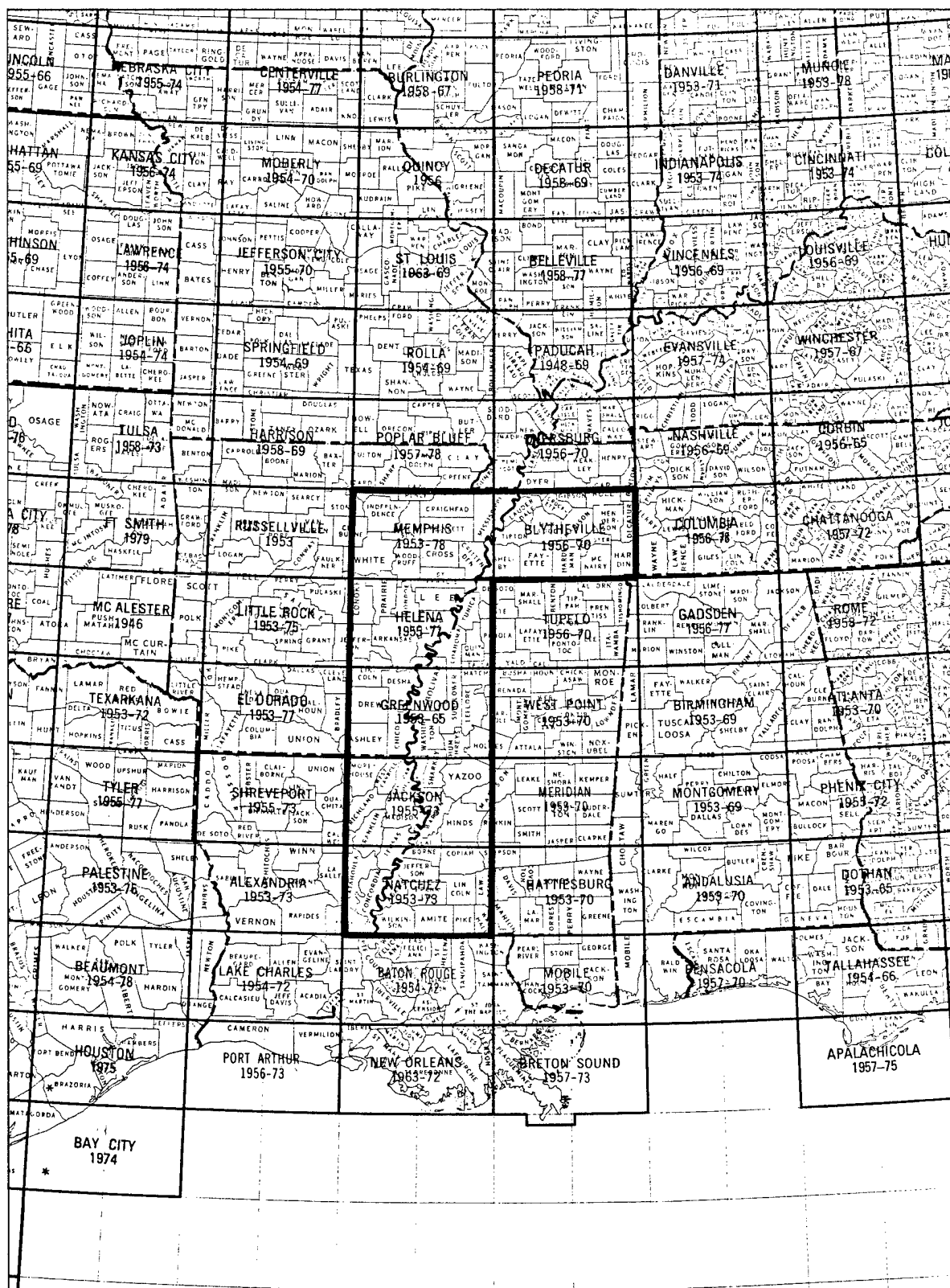
Although the value of the inventory maps is somewhat restricted by their scale and the availability of fish, wildlife, and habitat information, this report and the maps provide a comprehensive inventory of the natural resources of the Lower Mississippi Valley. These resource maps have been sought by planners to help ensure more informed decisionmaking at all levels of government and industry. The FWS already has produced ecological inventories for the U.S. Atlantic, Pacific, and Gulf coasts.

1.2 PURPOSE AND SCOPE

The purpose of the User's Guide and Information Base report and the inventory maps is to establish the extent of natural resources, as well as their location and value. The report supplements the maps with biological descriptions and lends support and credence to the map inventories. The maps identify significant natural resource areas and fish and wildlife resource concentrations along the lower Mississippi River which are vulnerable to the construction and operation of energy related facilities and transportation systems. The focus of this inventory is on the ecological resources subject to the provisions of the Fish and Wildlife Coordination Act, the Endangered

Species Act, and other related legislation. The area covered by the inventory includes the Lower Mississippi Valley and addresses the entire aquatic and terrestrial area depicted on six U.S. Geological Survey (USGS) 1:250,000-scale topographic maps, as shown in Figure 1. The study region encompasses approximately 126,200 square kilometers (48,700 square miles) and comprises portions of Louisiana, Mississippi, Arkansas, Tennessee, and thin sections of Missouri and Alabama.

The maps provide an inventory of important fish and wildlife species and their habitats. Other land use designations, such as wildlife refuges and parks, also are included. The maps and this report do not designate areas where energy facilities or transportation systems should be located, but rather they identify areas of significant concern. The maps are not intended to be the only source of resource information for the Lower Mississippi Valley. Due to the maps' small scale and schedule constraints on data collection, only significant species' locations and distributions are presented. When an area of concern is identified, more detailed information may be obtained from the appropriate Federal and state agencies.



PART 2

METHODOLOGY

2.1 DATA COLLECTION AND REPORTING

The data used to compile the habitat inventory maps and the supporting narrative report were collected from numerous organizations; Federal agencies included the FWS, the Army Corps of Engineers (COE), the National Park Service (NPS), the Tennessee Valley Authority (TVA), and the Environmental Protection Agency (EPA). The water, natural resource, and parks and recreation divisions of the six states provided much of the information, as did private organizations, such as nature conservancies, commercial fishing associations, and universities. The sources acquired from these agencies were reviewed and analyzed for each geographic area; information on major habitats and fish and wildlife resource groups was abstracted. For a complete listing of all information sources contacted, and the type of resource data each provided, see the List of Sources included at the end of this report. Major emphasis was placed on information that was accurate, useful, and applicable to the inventory maps.

Because the base map scale was relatively small (1:250,000), the amount of information shown on each inventory map was selected carefully to avoid excessive detail and confusion. If more detailed information on specific biological resources is required, the user is advised to refer to the List of Sources at the end of this report as well as to contact the appropriate Federal and state agencies.

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

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

Major categories shown on the inventory maps were species with special status (e.g., the endangered pink mucket pearly mussel), valuable resources (e.g., catfish), migratory routes (e.g., waterfowl), and seasonal habits (e.g., overwintering). Additional information about distribution, density, and life history of a particular species or group was incorporated in part 4 of this report.

2.2 DATA REVIEW AND ANALYSIS

Most of the information in this report was obtained by telephoning Federal, state, local, and private groups familiar with the resources of a particular area and by requesting appropriate reports and data. The data and literature search included cataloging, reviewing, and analyzing a large amount of ecological data. This review was a major task, and deciding what data should be included on the maps required considerable judgment.

A list of most of the important plants and animals (and their scientific names) in the Lower Mississippi Valley study area (185 species) is given in Table 1. Unlike previous species keys, the numbers are not consecutive because this key was drawn from a master species list, developed for FWS's nationwide ecological mapping program. Data were compiled for each species which had a special status designation (endangered or threatened) and for groups (e.g., fish or birds) and types of habitat (e.g., swamps or marshes). When available, resource statistics also were compiled. The types and amount of detail shown on each map were dependent on the types and amount of information available.

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

The data are only as reliable as the source material. Certain information was not included on the maps if reports were not readily available, if the reports contained proprietary information, if the data were ambiguous, or if the source material was difficult to obtain. Because of time constraints, a comprehensive review of published and unpublished reports was not possible. Nonetheless, the information presented on the inventory maps and in this report represents the most reliable information available as of January 1983 for the Lower Mississippi Valley.

2.3 INVENTORY GRAPHICS

2.3.1 The Maps and Grid System

The base maps used in this study are the USGS National Topographic Map Series with a scale of 1:250,000. These maps contain the Universal Transverse Mercator (UTM) grid system. The six Lower Mississippi Valley ecological inventory maps are shown in Figure 1 and listed in Table 2.

Table 1. Species or groups of organisms (with identifying numbers)
in the Lower Mississippi Valley ecological inventory.*

AQUATIC ORGANISMS	
INVERTEBRATES	
67	Unicolor mussel (<i>Obovaria unicolor</i>)
101	Mainstream river snail (<i>Leptoxis</i> (= <i>Anculosa</i>) <i>praerosa</i>)
F 113	Pink mucket pearly mussel (<i>Lampsilis orbiculata</i>)
F 123	White wartyback pearly mussel (<i>Plethobasus cicatricosus</i>)
F 123	Orange-footed pearly mussel (<i>Plethobasus cooperianus</i>)
F 127	Rough pigtoe pearly mussel (<i>Pleurobema plenum</i>)
F 129	Fat pocketbook pearly mussel (<i>Potamilus capax</i>)
152	Hubricht's snail (<i>Pleurocera hubrichti</i>)
153	Freshwater pearly mussels (<i>Unionidae</i>)
154	Verrucose river snail (<i>Io verrucosa</i>)
155	Rugged river snail (<i>Io salebrosa</i>)
156	Genticulate river snail (<i>Io geniculata</i>)
FISHES	
75	Rainbow trout (<i>Salmo gairdneri</i>)
104	Catfishes (<i>Siluriformes</i>)
106	Sunfishes and basses (<i>Centrarchidae</i>)
121	Blue catfish (<i>Ictalurus furcatus</i>)
123	Channel catfish (<i>Ictalurus punctatus</i>)
124	Yellow bullhead (<i>Ictalurus natalis</i>)
126	White crappie (<i>Pomoxis annularis</i>)
127	Black crappie (<i>Pomoxis nigromaculatus</i>)
128	Largemouth bass (<i>Micropterus salmoides</i>)
129	Spotted bass (<i>Micropterus punctulatus</i>)
133	Bluegill (<i>Lepomis macrochirus</i>)
134	Redear sunfish (<i>Lepomis microlophus</i>)
147	Gars (<i>Lepisosteus</i> spp.)
148	Buffalos (<i>Ictiobus</i> spp.)
149	Freshwater drum (<i>Aplodinotus grunniens</i>)
150	Bowfin (<i>Amia calva</i>)
151	Common carp (<i>Cyprinus carpio</i>)
195	Sunshine bass (<i>Morone saxatilis</i> x <i>M. chrysops</i> hybrid)
205	Chain pickerel (<i>Esox niger</i>)
208	Striped bass (<i>Morone saxatilis</i>)
S 209	Atlantic sturgeon (<i>Acipenser oxyrinchus</i>)
S 223	Crystal darter (<i>Ammocrypta asprella</i>)
226	Flathead catfish (<i>Pylodictis olivaris</i>)
227	White bass (<i>Morone chrysops</i>)
228	Yellow bass (<i>Morone mississippiensis</i>)
S 230	Blue sucker (<i>Cyplestus elongatus</i>)
S 231	Frecklebelly madtom (<i>Noturus munitus</i>)
232	Rock bass (<i>Ambloplites rupestris</i>)
238	Bluntnose minnow (<i>Pimephales notatus</i>)
239	Bluntnose shiner (<i>Notropis camurus</i>)
240	Rainbow darter (<i>Etheostoma caeruleum</i>)
S 241	Paddlefish (<i>Polyodon spathula</i>)
277	Grass pickerel (<i>Esox americanus vermiculatus</i>)
F 295	Bayou darter (<i>Etheostoma rubrum</i>)
346	River carpsucker (<i>Carpionodes carpio</i>)
366	Smallmouth bass (<i>Micropterus dolomieu</i>)
375	Walleye (<i>Stizostedion vitreum vitreum</i>)
401	Suckers (<i>Catostomidae</i>)
416	Black bullhead (<i>Ictalurus melas</i>)
427	Sauger (<i>Stizostedion canadense</i>)
S 451	Southern redbelly dace (<i>Phoxinus erythronaster</i>)
481	Shovelnose sturgeon (<i>Scaphirhynchus platyrhynchus</i>)
482	Temperate basses (<i>Percichthyidae</i>)
483	Carp suckers (<i>Carpionodes</i> spp.)
484	Grass carp (<i>Ctenopharyngodon idella</i>)
REPTILES AND AMPHIBIANS	
F 9	American alligator (<i>Alligator mississippiensis</i>)
S 23	Ringed map turtle (<i>Graptemys oculifera</i>)
46	Aquatic turtles (<i>Testudines</i>)

continued

Table 1 (continued).

TERRESTRIAL ORGANISMS	
PLANTS	
30	Timberland
51	Overmature and original growth trees
65	Unique vegetation association
112	Baldcypress (<u>Taxodium distichum</u>)
S 116	Purple fringed orchid (<u>Habenaria peramoena</u>)
280	Relict prairie flora
281	Bottomland hardwoods
319	Spanish moss (<u>Tillandsia usneoides</u>)
320	Tupelo-gum swamp (<u>Nyssa</u> sp.)
321	Cherrybark oak (<u>Quercus falcata pagodaefolia</u>)
S 322	Scarlet woodbine (<u>Schisandra glabra</u>)
323	Corkwood (<u>Leitneria floridana</u>)
324	Hairy spicebush (<u>Lindera melissaefolium</u>)
S 325	Little glade-crest (<u>Leavenworthia exigua exigua</u>)
S 326	Ginseng (<u>Panax quinquefolius</u>)
S 327	Compass-plant (<u>Salpiglosson laciniatum</u>)
S 328	Water-purslane (<u>Didymopanax diandra</u>)
S 329	Golden seal (<u>Hydrastis canadensis</u>)
BIRDS	
1	Small wading birds
2	Sandpipers (<u>Scolopacidae</u>)
5	Plovers (<u>Charadriidae</u>)
11	Phalaropes (<u>Phalaropodinae</u>)
15	Upland sandpiper (<u>Bartramia longicauda</u>)
20	Common snipe (<u>Gallinago gallinago</u>)
26	Rails (<u>Rallidae</u>)
38	American woodcock (<u>Scolopax minor</u>)
39	Yellowlegs (<u>Tringa</u> spp.)
1	Long-legged wading birds
2	Egrets (<u>Ardeidae</u>)
3	Wood stork (<u>Mycteria americana</u>)
4	Great blue heron (<u>Ardea herodias</u>)
9	Snow egret (<u>Casmerodius albus</u>)
10	Snowy egret (<u>Egretta thula</u>)
S 12	Black-crowned night-heron (<u>Nycticorax nycticorax</u>)
13	Little blue heron (<u>Egretta caerulea</u>)
14	Cattle egret (<u>Bubulcus ibis</u>)
16	Yellow-crowned night-heron (<u>Nycticorax violaceus</u>)
28	Heron (<u>Ardeidae</u>)
1	Waterfowl (Swimmers)
8	Mallard (<u>Anas platyrhynchos</u>)
11	Dabbling ducks (<u>Anatini</u>)
12	Diving ducks (<u>Aythia</u>)
13	Geese (<u>Anserini</u>)
15	Canvasback (<u>Aythya valisineria</u>)
16	Northern shoveler (<u>Anas clypeata</u>)
17	Northern pintail (<u>Anas acuta</u>)
18	Wood duck (<u>Aix sponsa</u>)
19	Ruddy duck (<u>Oxyura jamaicensis</u>)
20	Snow goose (<u>Chen caerulescens</u>)
21	Canada goose (<u>Branta canadensis</u>)
26	Greater white-fronted goose (<u>Anser albifrons</u>)
27	Common loon (<u>Gavia immer</u>)
28	Teals (<u>Anas</u> spp.)
29	Lesser scaup (<u>Aythya affinis</u>)
30	American coot (<u>Fulica americana</u>)
31	American wigeon (<u>Anas americana</u>)
51	Gallinules (<u>Rallidae</u>)
53	Purple gallinule (<u>Porphyrio martinica</u>)
54	Mergansers (<u>Mergus</u> spp.)
57	Double-crested cormorant (<u>Phalacrocorax auritus</u>)

continued

Table 1 (continued).

Table 1 (continued).	
61 Grebes (Podicipedidae)	
65 Pied-billed grebe (<u>Podilymbus podiceps</u>)	
1 Raptors	
2 American swallow-tailed kite (<u>Elanoides forficatus</u>)	
3 Mississippi kite (<u>Ictinia mississippiensis</u>)	
S 5 Owls (Strigiformes)	
S 6 Northern harrier (<u>Circus cyaneus</u>)	
F 7 Bald eagle (<u>Haliaeetus leucocephalus</u>)	
F 9 Peregrine falcon (<u>Falco peregrinus</u>)	
S 12 Osprey (<u>Pandion haliaetus</u>)	
S 16 Sharp-shinned hawk (<u>Accipiter striatus</u>)	
S 25 Cooper's hawk (<u>Accipiter cooperii</u>)	
S 29 Golden eagle (<u>Aquila chrysaetos</u>)	
F 43 American peregrine falcon (<u>Falco peregrinus anatum</u>)	
F 44 Arctic peregrine falcon (<u>Falco peregrinus tundrius</u>)	
(Seabirds (Aerialists))	
9 American white pelican (<u>Pelecanus erythrorhynchos</u>)	
26 Gulls and terns (Laridae)	
34 Least tern (<u>Sterna antillarum</u>)	
1 Perching birds (Passeriformes)	
4 Acadian flycatcher (<u>Empidonax virens</u>)	
5 Scissor-tailed flycatcher (<u>Tyrannus forficatus</u>)	
7 Flycatchers (Tyrannidae)	
S 21 Grasshopper sparrow (<u>Ammodramus savaannarum</u>)	
S 26 Bachman's sparrow (<u>Amphispiza aestivalis</u>)	
32 Wood warblers (Parulidae)	
38 Swainson's warbler (<u>Limothlypis swainsonii</u>)	
S 58 Bewick's wren (<u>Thryomanes bewickii</u>)	
S 66 Cliff swallow (<u>Hirundo pyrrhonota</u>)	
67 Bank swallow (<u>Riparia riparia</u>)	
(Non-perching land birds)	
1 Woodpeckers (Picinae)	
4 Pileated woodpecker (<u>Dryocopus pileatus</u>)	
5 Red-headed woodpecker (<u>Melanerpes erythrocephalus</u>)	
8 Mourning dove (<u>Zenaidura macroura</u>)	
F 9 Red-cockaded woodpecker (<u>Picoides borealis</u>)	
(Fowl-like birds)	
2 Wild turkey (<u>Meleagris gallopavo</u>)	
3 Northern bobwhite (<u>Colinus virginianus</u>)	
REPTILES AND AMPHIBIANS	
1 Reptiles	
S 22 Northern pine snake (<u>Pituophis melanoleucus melanoleucus</u>)	
S 147 Western pigmy rattlesnake (<u>Sistrurus miliarius streckeri</u>)	
MAMMALS	
S 1 Black bear (<u>Ursus americanus</u>)	
3 Bobcat (<u>Felis rufus</u>)	
6 White-tailed deer (<u>Odocoileus virginianus</u>)	
8 Beaver (<u>Castor canadensis</u>)	
9 Mink (<u>Mustela vison</u>)	
S 11 River otter (<u>Lutra canadensis</u>)	
12 Gray fox (<u>Urocyon cinereoargenteus</u>)	
13 Nutria (<u>Myocastor coypus</u>)	
14 Muskrat (<u>Ondatra zibethicus</u>)	
15 Wild boar (<u>Sus scrofa</u>)	
17 Coyote (<u>Canis latrans</u>)	
18 Swamp rabbit (<u>Sylvilagus aquaticus</u>)	
20 Tree squirrels (<u>Sciurus</u> spp., <u>Tamiasciurus</u> spp., <u>Glaucomys</u> spp.)	
21 Raccoon (<u>Procyon lotor</u>)	

Table 1 (concluded).

F	27	Gray myotis (<u>Myotis grisescens</u>)
F	28	Indiana myotis (<u>Myotis sodalis</u>)
F	35	Florida panther (<u>Felis concolor coryi</u>)
	37	Skunks (<u>Spilogale</u> spp., <u>Mephitis</u> spp.)
	38	Eastern cottontail (<u>Sylvilagus floridanus</u>)
	39	Red fox (<u>Vulpes vulpes</u>)
	46	Fox squirrel (<u>Sciurus niger</u>)
	48	Virginia opossum (<u>Didelphis virginiana</u>)
	53	Bats (<u>Chiroptera</u>)
	58	Evening bat (<u>Nycticeius humeralis</u>)
	65	Nine-banded armadillo (<u>Dasypus novemcinctus</u>)
	149	Aquatic furbearers

*Species numbers are not consecutive, but were drawn from a master species list, developed for FWS's nationwide ecological mapping program.

F = Federally listed threatened or endangered species.

S = State-listed threatened or endangered species.

Table 2. USGS maps (1:250,000) used in the Lower Mississippi Valley ecological inventory and corresponding states.

Quadrangle Name	State(s)
Natchez	Mississippi, Louisiana
Jackson	Mississippi, Louisiana
Greenwood	Mississippi, Arkansas, Louisiana
Helena	Arkansas, Mississippi, Tennessee
Memphis	Tennessee, Arkansas, Missouri
Blytheville	Arkansas, Tennessee, Alabama, Missouri

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

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

2.3.2 Cartographic Discussion

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

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

All linework and map unit boundaries were prepared by scribing to ensure consistent line weights and close tolerance. The resulting scribe plates subsequently were used to make press-ready negatives for printing by contact photographic methods. In addition, the scribe plates provided the capability for applying special colors to specific map unit boundaries. For example, this process made it possible to separate and portray aquatic map unit boundaries in blue, terrestrial map unit boundaries in brown, and species with special status

map unit boundaries in red. The peel coat process allowed large areas to be portrayed with special tints. For example, yellow highlights the land areas, blue defines the water areas, and light green shows the extent of special land use areas.

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

2.3.3 Inventory Map Development

The inventory maps are the major data source for the location of important biological and ecological resources along the lower Mississippi River. Prior to preparing the final set of inventory maps, draft copies of the inventory graphics were reviewed by various field offices of Federal, state, and local agencies. The respective comments on the accuracy and reliability of the mapped resource data were evaluated and screened; suggestions were incorporated onto the appropriate draft compilation manuscript. The individual map sheets then were revised and format registered prior to the preparation of press-ready negatives.

PART 3

USER'S GUIDE

3.1 THE INVENTORY MAPS

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

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

The frame portion of each map contains a comprehensive legend and supplemental information, showing symbols, colors, patterns and lines, and alphanumeric descriptors, each representing a specific biological resource, habitat, or special land use feature. The base map information from the standard 1:250,000-scale National Topographic Map Series also has been retained for this inventory. Table 3 summarizes the types of cultural and ecological information shown on the inventory maps.

3.2 HOW TO USE THE INVENTORY MAPS

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

The Lower Mississippi Valley ecological inventory includes the total area shown on each map sheet. Land portions of the map sheet are printed in yellow and water portions are printed in light blue. The ecological information shown on the inventory maps may be divided into three general categories (see Table 3): land use/land cover, aquatic organisms, and terrestrial organisms. Figure 2 is a portion of the Jackson, Mississippi, sheet from the Lower Mississippi Valley ecological inventory, reproduced in black and white.

3.2.1 Land Use/Land Cover

Special land use areas, such as national wildlife refuges, national parks, state parks, and state wildlife management areas, always are shown with a gray boundary and light green tint. Depending upon its size, a special land use area can appear as either a small circle centered over the area's location or as the official boundary of the area. A special land use area always is identified on the inventory maps by its official name, for example, Vicksburg

Table 3. Summary of information shown on Lower Mississippi Valley ecological inventory maps.

Base Map

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

Land Use/Land Cover

- Special land use areas (refuges, wildlife management areas, national or state parks, etc.)
- Marsh or Swamp

Aquatic Organisms

- Riverine areas, indicated by dotted lines
- Point and area boundaries showing locations and concentrations of aquatic organisms, including species that are threatened or endangered
- Symbol, number, and letter designators identifying general class, species or group, and habitat use for aquatic organisms
- Species list tailored to the Lower Mississippi Valley study and keyed to five general classes of aquatic organisms (plants, invertebrates, fish, reptiles and amphibians, and mammals)

Terrestrial Organisms

- Point and area boundaries showing locations and concentrations of terrestrial organisms, including species that are threatened or endangered
- Symbol, number, and letter designators identifying general class, species or group, and habitat use for terrestrial organisms

continued

Table 3 (concluded).

Terrestrial Organisms (cont'd)

- Species list tailored to the Lower Mississippi Valley study and keyed to five general classes of terrestrial organisms (plants, invertebrates, birds, reptiles and amphibians, and mammals), including eight subclasses of birds (small wading birds, long-legged wading birds, waterfowl, raptors, seabirds, perching birds, non-perching land birds, and fowl-like birds)

Notebox

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

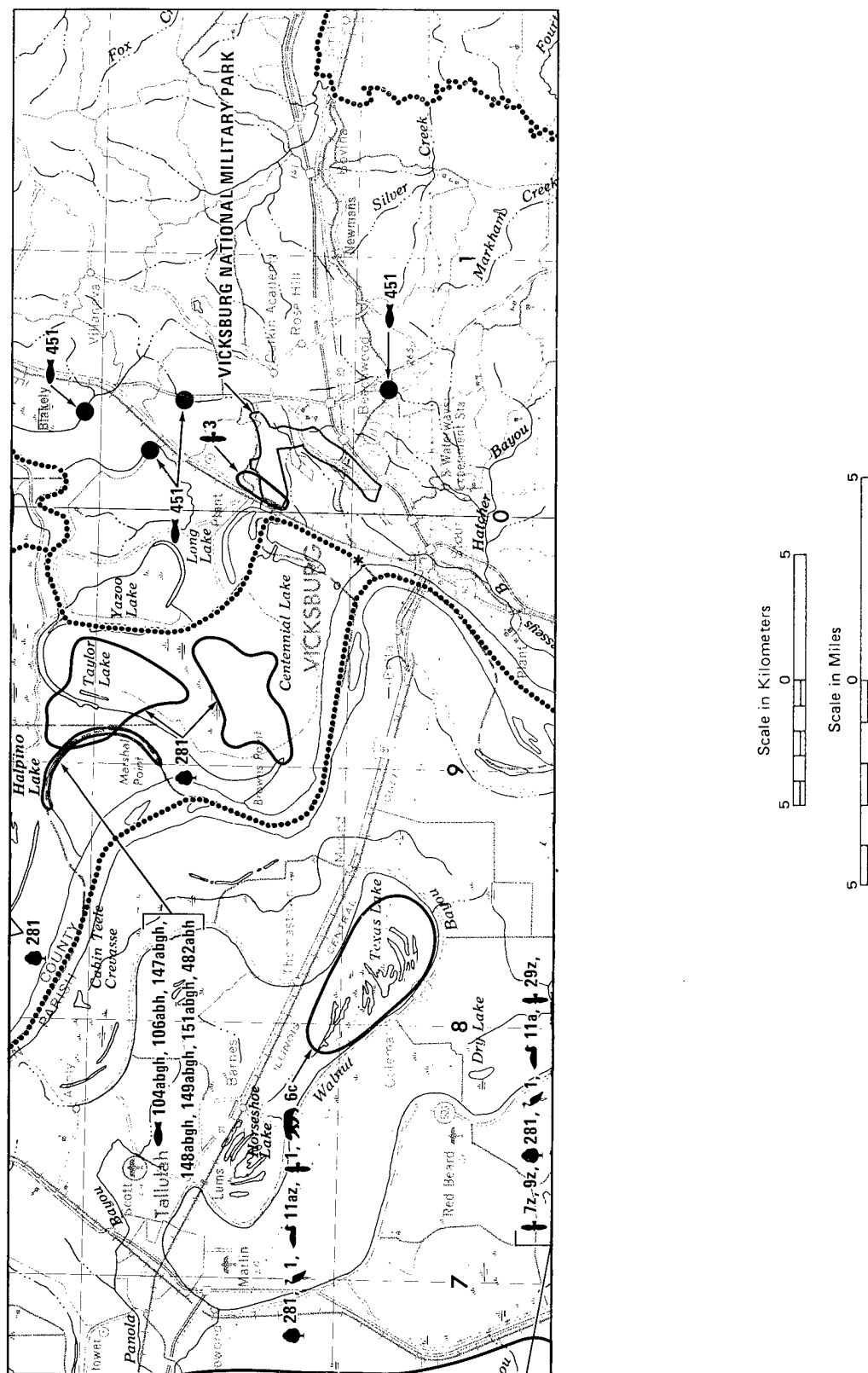


Figure 2. Portion of the Lower Mississippi Valley ecological inventory map of Jackson, Mississippi.

National Military Park in Mississippi, Pinson Mounds State Archaeological Area in Tennessee, and Hurricane Lake Wildlife Management Area in Arkansas.

Land cover features appearing on the inventory maps are marshes and swamps. Marshes and swamps are identified by a screen pattern and overprinted with light blue.

3.2.2 Aquatic Organisms

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

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

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

A representative example, showing the manner in which this classification scheme is used on the maps to identify a specific aquatic species and its habitat use designation, is shown below (see also Figure 2).

Shown in blue

└─Fish
└─Species: blue catfish
121abgh
└─Habitat use: breeding and nursery area, commercial and sportfishing area

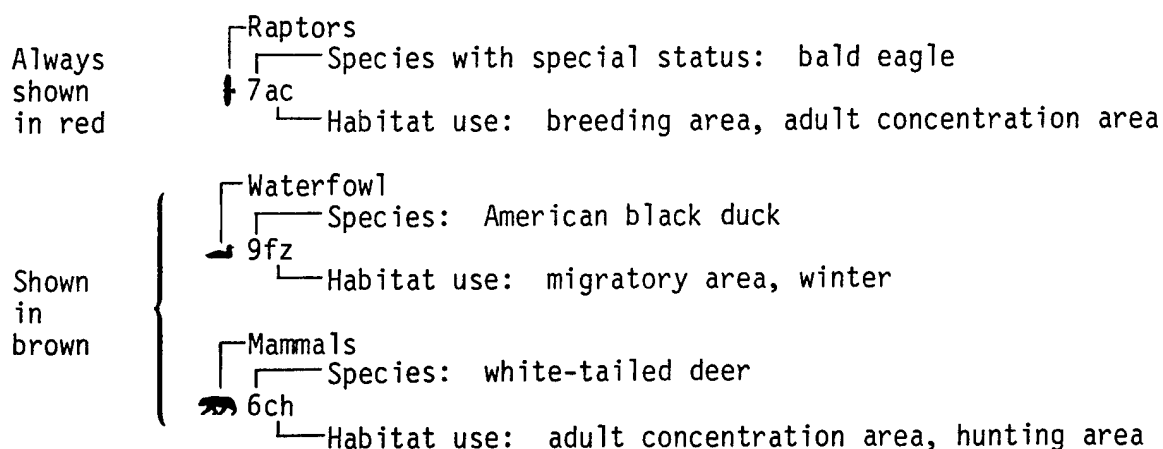
3.2.3 Terrestrial Organisms

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

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

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

Representative examples, showing the manner in which this classification scheme is used on the maps to identify a specific terrestrial species and its habitat, are shown below (see also Figure 2).



3.3 HOW TO USE THE GRID REFERENCE SYSTEM

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

In this inventory, the UTM grid reference system is used to identify the geographic location of biological resources. Specifically, the 10,000-meter grid lines, consisting of a series of alphanumeric reference points, provide the basic location system for describing the biological resources within discrete intervals, or swaths along the Lower Mississippi Valley. The east-west or horizontal grid lines are used to subdivide sections of the north-south trending Mississippi River. Two horizontal grid lines define a swath generally

perpendicular to the river. The swath locates geographically the biological resources to be described.

UTM grid locations are identified by their alphanumeric designators, consisting of two letters followed by two numbers (for example, grid reference YF08 or XF67). The two letters of the grid reference designator identify the appropriate 100,000-meter square in which the biological resource occurs; the two numbers refine the location of the feature to the nearest 10,000-meter square. The first number identifies the north-south or vertical grid line; the second number designates the intersecting east-west or horizontal grid line. The vertical grid line always is located to the left, or west, of the feature being described; the intersecting horizontal grid line always is located below, or south, of the feature of interest.

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

Example 1

Map: Natchez, MS

Species of interest: Sunfishes and basses

Identify appropriate 100,000-meter square (legend block): XF

Locate 10,000-meter vertical grid number (always to left of point): 4

Locate 10,000-meter horizontal grid number (always below point): 0

The location is identified in the report as grid reference XF40.

Example 2

Map: Helena, AR

The location is identified in the report as: grid reference XJ23

Consult UTM legend block to identify appropriate 100,000-meter square: XJ

Locate 10,000-meter vertical grid number (always to left of point): 2

Locate 10,000-meter horizontal grid number (always below point): 3

The grid reference refers to the best extant representative relict of the Grand Prairie of Arkansas.

PART 4

THE LOWER MISSISSIPPI VALLEY STUDY REGION

4.1 INTRODUCTION

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

4.1.1 Physiographic Description

The study region lies almost entirely within the Coastal Plain Province and includes two physiographic sections, the Mississippi Alluvial Plain and the East Gulf Coastal Plain (Figure 3). The extreme northeast portion of the study region lies within the Interior Low Plateaus Province, while the extreme northwest portion lies within the Ozark Plateaus and Ouachita Provinces.

The Mississippi Alluvial Plain section covers approximately 70 percent of the study region. This section is characterized by the meandering, silt-laden Mississippi River and its southerly flowing tributaries, including the Black, Tensas, Yazoo, Big Sunflower, White, and Saint Francis Rivers. This is an area consisting of nearly level to gently sloping, broad flood plains and low terraces developed on unconsolidated alluvial material. Relief is generally less than 15 meters (50 feet), although terraces and natural levees may rise several meters (tens of feet) above the adjacent bottomlands. Swamps and bottomland hardwood forests cover large areas, although much of the flood plain has been cleared for agriculture. Freshwater inflow is abundant. Drainage sloughs and oxbow lakes are numerous and streams meander widely. Another characteristic of this section is the presence of Yazoo-type tributaries, named after the Yazoo River of Mississippi. Such tributaries flow along the base of a natural levee, paralleling the main stream for a considerable distance before joining it. The Tensas, White, Arkansas, and Saint Francis Rivers all display Yazoo-type characteristics in their lower reaches.

The East Gulf Coastal Plain section covers approximately 25 percent of the study region and overlooks the Mississippi Alluvial Plain to the west. The western boundary of this section is formed by a band of loess hills, generally 8 to 24 kilometers (5 to 15 miles) wide. Loess, composed of angular, wind-blown, silt-sized particles, is permeable but erodes where water flows over its surface. It produces rugged topography characterized by the deep, narrow valleys of the numerous small streams which cross it. Bluffs overlooking the Mississippi River are 38 to 75 meters (125 to 250 feet) in height and are another distinctive feature of the loess hills. Natchez and Vicksburg, Mississippi, and Memphis, Tennessee, are located where the river is at the base of

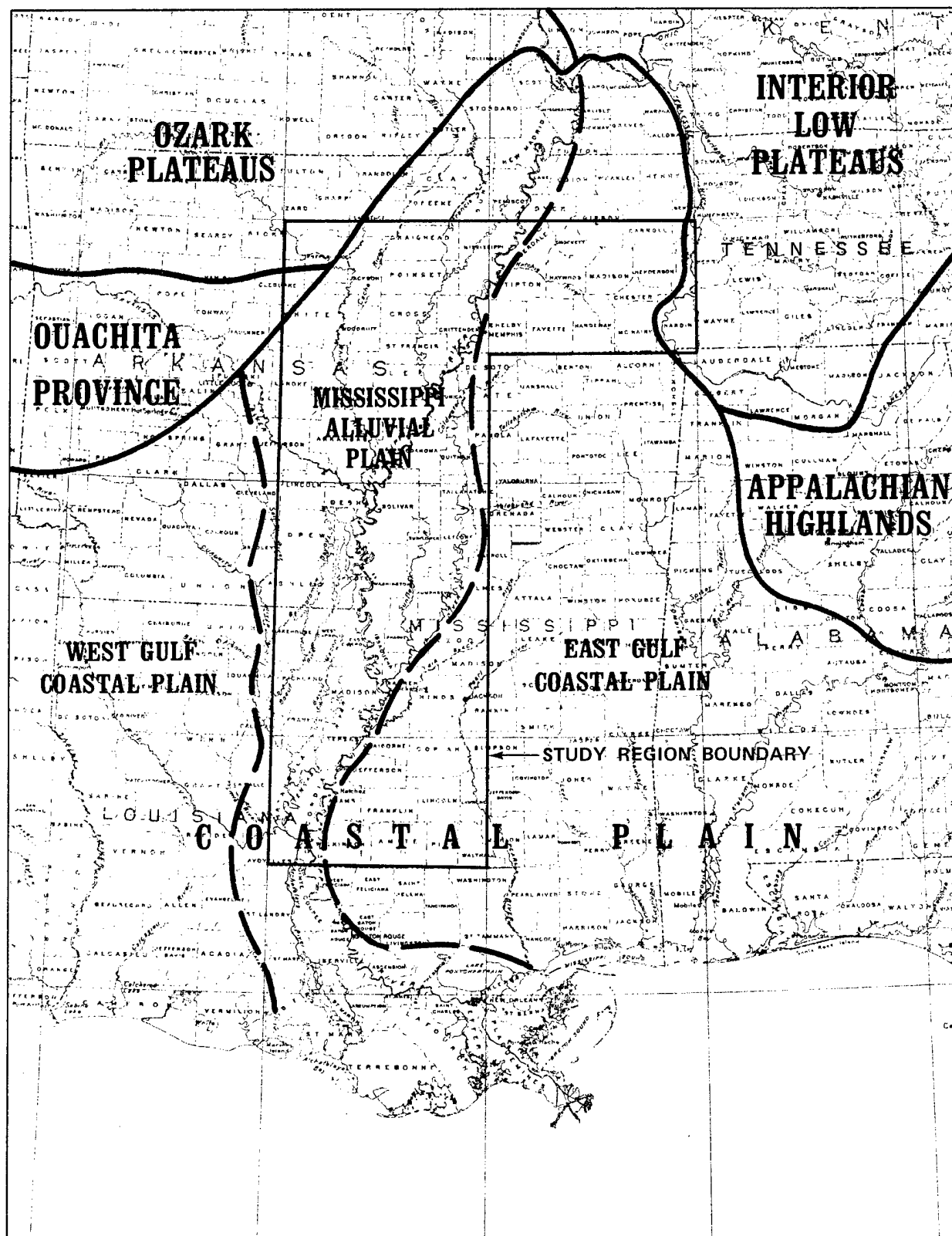


Figure 3. Physiography of the study region.

the bluffs, enabling the river and railroads to be linked with no connection subject to flooding. East of the loess hills lie areas of hilly, dissected upland and gently rolling lowland. The dissected areas are formed on sand and have local relief of 60 meters (200 feet) or more; clay underlies the lowlands where relief is generally less than 15 meters (50 feet). Mixed pine and hardwood forest characterizes the East Gulf Coastal Plain section.

The portion of the study region east of the Tennessee River is in the Interior Low Plateaus Province. The Tennessee River has cut 45 to 90 meters (150 to 300 feet) into the Paleozoic rock which forms the maturely dissected low plateau. Oak-hickory forest generally is found on ridgetops and southern slopes, while the central hardwood forest type is found on north slopes and in coves.

The northwest portion of the study region lies in the eastern fringe of the Ozark Plateaus and Ouachita Provinces. Within the study region, the topography of these provinces is moderately to strongly rolling with numerous steep slopes and local relief of 150 meters (500 feet). This topographic surface, with its forest and woodland, presents a marked contrast to the low relief of the croplands of the alluvial plain to the east.

4.1.2 Special Land Use Areas

The Lower Mississippi Valley includes diverse land uses ranging from forest and agricultural areas to small towns to the urban areas of Jackson, Mississippi, and Memphis, Tennessee. Many portions of the study region are held as public lands and 82 special land use areas have been depicted (Table 4).

Federal ownership has been identified for 20 of the special land use areas, ranging in size from the Arkansas Post National Memorial to Homochitto National Forest; no Class I air quality areas were included in the study region. State ownership was identified for the remaining 62 areas. Approximately 18 percent of the areas have historical significance while 66 percent are recreationally significant and 68 percent are significant for their natural and ecological values.

4.2 RESOURCES OVERVIEW

The following paragraphs summarize the locations and habitats of various species in the Lower Mississippi Valley. Only the more important species of the region have been shown on the inventory maps due to scale limitations.

4.2.1 Species with Special Status

Species with special status shown on the accompanying inventory maps include only those known to occur in the Lower Mississippi Valley which are designated as either threatened or endangered on published Federal and state lists (Table 5) and for which supporting data were available. Species proposed for consideration as endangered, threatened, rare, or other classification are discussed only when appropriate in the applicable aquatic or terrestrial sections of this report.

Table 4. Designated land use areas for the Lower Mississippi Valley.

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>NATCHEZ QUADRANGLE</u>						
MISSISSIPPI						
Clark Creek State Natural Area		X		X		X
Homochitto National Forest	X			X		
Sandy Creek Wildlife Management Area		X		X		X
Homochitto Wildlife Management Area		X		X		X
Percy Quin State Park		X				X
Natchez State Park		X				X
Copiah County Wildlife Management Area		X		X		X
LOUISIANA						
Three Rivers Wildlife Management Area		X		X		X
Pomme de Terre Wildlife Management Area		X		X		X
Spring Bayou Wildlife Management Area		X		X		X
Grassy Lake Wildlife Management Area		X		X		X

continued

Table 4 (continued).

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>NATCHEZ QUADRANGLE (cont'd)</u>						
LOUISIANA (cont'd)						
Red River Wildlife Management Area		X		X		X
Saline Wildlife Management Area		X		X		X
Concordia Wildlife Management Area		X		X		X
Boeuf Wildlife Management Area		X		X		X
Lake Bruin State Park		X				X
<u>JACKSON QUADRANGLE</u>						
LOUISIANA						
Winter Quarters State Commemorative Area		X			X	
Poverty Point State Commemorative Area		X			X	
Russell Sage Wildlife Management Area		X		X		X
Cities Service Wildlife Management Area		X		X		X
Georgia-Pacific Wildlife Management Area		X		X		X
Chemin-A-Haut State Park		X				X

continued

Table 4 (continued).

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>JACKSON QUADRANGLE (cont'd)</u>						
MISSISSIPPI						
Vicksburg National Military Park	X				X	X
Delta National Forest	X					
Sunflower Wildlife Management Area		X		X		X
and Greentree Waterfowl Area		X		X		X
Shipland Wildlife Management Area						
Anderson-Tully Wildlife Management Area		X		X		X
Indian Bayou Wildlife Management Area and Greentree Waterfowl Area		X		X		X
Panther Swamp National Wildlife Refuge	X			X		
Hillside National Wildlife Refuge	X			X		
<u>GREENWOOD QUADRANGLE</u>						
MISSISSIPPI						
Yazoo National Wildlife Refuge	X			X		
Leroy Percy State Park and Wildlife Management Area		X		X		X
Leflore County 16th Section Wildlife Management Area		X		X		X

continued

Table 4 (continued).

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>GREENWOOD QUADRANGLE (cont'd)</u>						
<u>MISSISSIPPI (cont'd)</u>						
Morgan Brake National Wildlife Refuge	X			X		
Mathews Brake National Wildlife Refuge	X			X		
Winterville Mounds Historic Site		X			X	
Florewood River Plantation		X			X	
Malmaison Wildlife Management Area		X		X		X
and Greentree Waterfowl Area		X				X
Great River Road State Park		X				
<u>ARKANSAS</u>						
Overflow National Wildlife Refuge	X			X		X
Lake Chicot State Park		X				
Cut-off Creek Wildlife Management Area		X		X		X
Trusten Holder Wildlife Management Area		X		X		X
White River National Wildlife Refuge	X			X		

continued

Table 4 (continued).

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>HELENA QUADRANGLE</u>						
ARKANSAS						
Arkansas Post National Memorial	X				X	
Bayou Meto Wildlife Management Area		X		X		X
Wattensaw Game Management Area		X		X		X
Dagmar Wildlife Management Area		X		X		X
Louisiana Purchase Historic State Park						
Saint Francis National Forest	X	X		X	X	X
MISSISSIPPI						
O'Keefe Wildlife Management Area and Greentree Waterfowl Area		X		X		X
Arkabutla Lake Recreation Area	X			X		X
<u>MEMPHIS QUADRANGLE</u>						
ARKANSAS						
Hurricane Lake Wildlife Management Area		X		X		X
Jacksonport State Park		X			X	

continued

Table 4 (continued).

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>MEMPHIS QUADRANGLE (cont'd)</u>						
<u>ARKANSAS (cont'd)</u>						
Shirey Bay-Rainey Brake Wildlife Management Area		X		X		X
Rex Hancock Wildlife Management Area		X		X		X
Bayou DeView Wildlife Management Area		X		X		X
Village Creek State Park		X				X
Lake Poinsett State Park		X				X
Lake Frierson State Park		X				X
Saint Francis Sunken Lands Wildlife Management Area		X		X		X
Wapanocca National Wildlife Refuge	X			X		
Hampson Museum State Park		X			X	
Herman Davis Historical Monument		X			X	
Big Lake National Wildlife Refuge	X			X		
Big Lake Wilderness	X			X		
Big Lake Wildlife Management Area		X		X		X
<u>TENNESSEE</u>						
T.O. Fuller State Recreational Park		X			X	X
Meeman-Shelby Forest State Recreational Park		X				X

continued

Table 4 (concluded).

Name	Ownership/Administration			Special significance		
	Federal	State	Private/ Local	Natural/ Ecological	Historic/ Cultural	Recreational
<u>BLYTHEVILLE QUADRANGLE</u>						
TENNESSEE						
Lower Hatchie National Wildlife Refuge	X			X		
Fort Pillow State Historical Area		X			X	
Moss Island Wildlife Management Area		X		X		X
Tigrett Wildlife Management Area		X		X		X
Hatchie National Wildlife Refuge	X			X		
Big Hill Pond State Environmental Educational Area		X		X	X	
Chickasaw State Rustic Park and Forest		X		X		X
Pickwick Landing State Resort Park		X				X
Shiloh National Military Park	X				X	
Pinson Mounds State Archaeological Area		X			X	
Natchez Trace State Resort Park and Forest		X				
Tennessee National Wildlife Refuge	X			X		
Mousetail Landing State Rustic Park		X				X

Table 5. Species with special status in the Lower Mississippi Valley.

Species	Federal			State	
	Endangered	Threatened	Endangered	Threatened	Threatened
<u>AQUATIC INVERTEBRATES</u>					
Pink mucket pearly mussel	X			TN	
White wartyback pearly mussel	X			TN	
Orange-footed pearly mussel	X			TN	
Rough pigtoe pearly mussel	X			TN	
Fat pocketbook pearly mussel	X			AR	
<u>FISHES</u>					
Atlantic sturgeon			MS		
Crystal darter			MS		TN
Blue sucker					
Frecklebelly madtom			MS		
Bayou darter		X	MS		
Southern redbelly dace			MS		
<u>AQUATIC REPTILES AND AMPHIBIANS</u>					
American alligator					LA
Ringed map turtle	X		AR, MS		MS
<u>TERRESTRIAL PLANTS</u>					
Purple fringeless orchid					TN
Scarlet woodbine					TN

continued

Table 5 (continued).

Species	Federal			State	
	Endangered	Threatened	Endangered	Threatened	Threatened
<u>TERRESTRIAL PLANTS (cont'd)</u>					
Little glade-cress					TN
Ginseng					TN
Compass-plant					TN
Water-purslane					TN
Golden seal					TN
<u>BIRDS</u>					
Black-crowned night-heron					TN
Mississippi kite			TN		
Northern harrier					TN
Bald eagle	X		MS, LA, AR, TN		
Peregrine falcon	X		MS, LA, AR, TN		
Osprey					TN
Sharp-shinned hawk					TN
Cooper's hawk					TN
Golden eagle			TN		
Grasshopper sparrow					TN
Bachman's sparrow			TN		
Bewick's wren					TN
Cliff swallow					MS
Red-cockaded woodpecker	X		MS, LA, AR, TN		

continued

Table 5 (concluded).

Species	Federal		State	
	Endangered	Threatened	Endangered	Threatened
<u>TERRESTRIAL REPTILES AND AMPHIBIANS</u>				
Northern pine snake				TN
Western pygmy rattlesnake				TN
<u>TERRESTRIAL MAMMALS</u>				
Black bear				MS
River otter				TN
Gray myotis	X		MS, LA, AR, TN	
Indiana myotis	X		MS, LA, AR, TN	
Florida panther	X		MS, LA, AR	

Species with special status that are known to occur in the Lower Mississippi Valley include 5 aquatic invertebrates, 6 fish, 2 aquatic reptiles, 7 terrestrial plants, 14 birds, 2 terrestrial reptiles, and 5 terrestrial mammals.

Freshwater bivalve mollusks, listed as species with special status and found within the study region, comprise the pink mucket, white wartyback, orange-footed, rough pigtoe, and fat pocketbook pearly mussels. These pearly mussels, also known as naiads, are found in riffles and shoals of large rivers with strong current and sand or gravel substrate. As with all naiads, the larvae of these species are obligate parasites of aquatic vertebrates, mainly fish. The fat pocketbook pearly mussel is found in the Saint Francis River, and the remaining four are found in the Tennessee River.

The pink mucket pearly mussel becomes gravid in August and the larvae, which first appear in the females in September, are released the following June. Host fish include the sauger and freshwater drum. The white wartyback and orange-footed pearly mussels are believed to breed during the summer, while the rough pigtoe is believed to breed during late spring and early summer. Host fish for the white wartyback include the rosefin shiner and bluegill. Pollution, siltation, channelization, and damming of rivers are contributing to the decline of these species by affecting the mussels directly or by destroying the habitat of the host fish.

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

The crystal darter, one of the larger darter species, is found in the large rivers of the Gulf coast, including the Pearl River system and the Mississippi River valley. Little is known of its life history, although it occupies large sand or gravel bars and riffles as well as flowing pools of large rivers. Its numbers have been depleted due to habitat destruction.

The blue sucker generally inhabits the main channels and flowing pools of major rivers and their larger tributaries. This species prefers relatively silt-free substrate, but is somewhat tolerant of turbidity. Adults probably winter in deep pools and in early spring migrate upstream to spawn in riffle areas. Siltation and dams have contributed to the decline of this species.

The frecklebelly madtom is found chiefly in riffles and rapids of major rivers and their larger tributaries. The species occurs in the Pearl River and the Mobile River drainage. Nothing is known of its life history.

The bayou darter is the only fish in the study region on the Federal list of threatened or endangered species. This threatened species is found only in the Bayou Pierre drainage in Copiah and Claiborne Counties, Mississippi. It

prefers clean, silt-free, gravel and rock riffle areas with shallow, moderately to swiftly flowing water. During the summer, the adults aggregate in riffle heads. It is assumed that reproduction takes place in these areas from mid to late summer into the fall.

The southern redbelly dace generally is found in small upland streams of the Mississippi River drainage. However, relict populations occur in isolated upland-like habitats along Crowleys Ridge, Arkansas, and along the eastern rim of the Mississippi River flood plain in Mississippi. The species occurs in permanent streams with clear water; it spawns in the spring over shallow gravel riffles.

The American alligator occurs in almost all types of freshwater habitat, including swamps, marshes, rivers, lakes, bayous, and backwaters. Mating and nesting occur during the spring and the eggs hatch during August and September. Clutch sizes range from 20 to 60 eggs. Most alligator populations have been steadily increasing for a number of years. The best available data for Louisiana, where the species is considered threatened by similarity of appearance, indicate a minimum population of 750,000. Estimates for Mississippi and Arkansas are 12,000 and 1,300 respectively, with a plus or minus 50 percent error. Alligator populations previously extirpated from their historic Arkansas range have been restored to some extent through restocking. From 1972 to 1981, over 2,600 surplus alligators obtained from Louisiana were released into much of the southern and east-central portions of Arkansas.

The ringed map turtle is restricted to the Pearl River system of Mississippi and Louisiana. It occurs in narrow-channeled, fast-moving rivers with sand and clay substrates and abundant brush snags and logjams. Nesting occurs on sandbars in early June and a second clutch probably is deposited later in the season.

The black-crowned night-heron is an uncommon to rare, resident species in Tennessee, where it is considered threatened by the state. It occasionally nests in colonies, particularly in pine stands. Nesting activities begin as early as March and some young may remain in the colony into August. Nocturnal for the most part, it occasionally forages during the day, feeding in marshes, swamps, creeks, and wooded streams.

Mississippi kites are summer residents throughout the Lower Mississippi Valley. In Tennessee, they are state endangered, but fairly common in summer, nesting in western counties along the Mississippi River. The birds usually arrive near the end of April and leave the area in early September. Nesting extends from late May to August. Their preferred habitat is open woodland and mixed scrub near water, where they feed on large insects.

The northern harrier, also called the marsh hawk, is listed as threatened in Tennessee. It may be found as an uncommon to rare migrant in spring and fall and as a visitor in winter; it does not breed in Tennessee. The northern harrier feeds mostly on small rodents in open grasslands and marshes.

Bald eagles are uncommon to rare wintering birds and transients primarily from August to May throughout the Lower Mississippi Valley. They concentrate along the river systems, especially the Mississippi, as well as lakes.

Two subspecies of peregrine falcon, the American and the Arctic, are uncommon to rare transients in spring and fall and very rare wintering birds in the Lower Mississippi Valley. They require open country near large lakes and rivers, especially with overhanging bluffs. Peregrines feed on other birds ranging in size from songbirds to ducks. The subspecies were differentiated on the maps where data were available; otherwise, the more general term "peregrine falcon" was used.

The osprey is mainly a transient species in the Lower Mississippi Valley, and is listed as endangered in Tennessee. It is a fairly common spring and fall migrant, but a very rare wintering species. It feeds primarily on fish around large lakes and rivers.

The sharp-shinned hawk is an uncommon to rare permanent resident in the northern part of the Lower Mississippi Valley, but is a winter visitor throughout the study region. Passing through the region from September to November and March to April, many migrants can be found in any wooded habitats; breeding birds, however, almost always nest in conifers. Nesting occurs from mid-April through early July.

The Cooper's hawk is an uncommon to rare permanent resident throughout the Lower Mississippi Valley. It prefers deciduous forests where it feeds mostly on songbirds and sometimes on small mammals, amphibians, reptiles, and insects. From September through November, migrants join the permanent population. Breeding occurs from late April to early August.

In Tennessee, the golden eagle is an endangered species and an uncommon winter visitor and migrant. It may be found in many habitats during migration and often winters in open fields and near wetlands. It feeds on rabbits, groundhogs, small mammals, and carrion. Golden eagles do not nest in the study region, but migrate in winter from the northwest United States and Canada.

The grasshopper sparrow is an uncommon to rare nester and winter visitor in the northern portion of the Lower Mississippi Valley. Farther south, it is mostly a winter resident. It can be found in grassy and weedy fields, pastures, hay fields, and adjacent to airport runways. Nesting birds usually arrive to breed in mid-April and leave in late August.

Bachman's sparrow is a very rare to uncommon and local summer resident in the Lower Mississippi Valley; it winters chiefly in the south Atlantic and Gulf coast states. Nesting birds arrive in late March and remain until mid-August. The species has been reported in two main habitats: dry open pine stands or open oak woods with grassy cover and some shrubs, and over-grown weedy fields. Although its summer nesting habitat remains plentiful, its population has been declining; it is one of the rarest nesting songbirds in Tennessee, where it is listed as endangered.

The Bewick's wren is an uncommon permanent resident in the northern portion of the study region, and is listed as threatened in Tennessee; it is a winter visitor farther south. It usually is found in thickets, brush piles, and fencerows in open country, as well as in second growth scrub areas. Eggs are laid from mid-March through early August. Populations have declined drastically from the 1940's for unknown reasons.

The northern portion of the study region overlaps the southern edge of the cliff swallow's distribution. Cliff swallows are very rare over most of the Lower Mississippi Valley and are listed as threatened in Mississippi. They nest colonially on cliffs and barns and require open to semi-open land, farms, cliffs, river bluffs, and lakes.

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

The northern pine snake rarely has been encountered in the Lower Mississippi Valley, which lies to the east of the species normal breeding range; it is listed as threatened in Tennessee. It usually is found in sandy pine woods, where it apparently is a nocturnal burrower. The northern pine snake eats mostly small mammals, eggs, lizards, and other snakes. Adults breed after hibernation in early April. Hibernation begins in September.

While the western pygmy rattlesnake is found throughout most of the Lower Mississippi Valley, it is rare in Tennessee, which lists it as a threatened species. It is found near water in river flood plains, swamps, marshes, and also in drier upland woods. The species is nocturnal, but may be active during cloudy or rainy weather. Although probably not lethal to man, this snake is venomous and feeds on small animals.

Black bears are listed as threatened in Mississippi. In the Lower Mississippi Valley, they occur in small, widely scattered populations in the immediate vicinity of large swamps and forests. They are primarily nocturnal, but occasionally forage during the day. Black bears are solitary except for females with cubs. Temporary breeding pairs are formed and usually two young are produced per litter in January or February. Young may stay with their mother for one year.

River otters occur throughout the Lower Mississippi Valley, but are listed as threatened in Tennessee. They are found in streams, rivers, and lakes, usually bordered by woods. River otters are predators, feeding on fish and any other small animals they can catch. Breeding occurs in late winter or early spring. Young generally are born between January and May. Individuals may range over 80 to 160 kilometers (50 to 100 miles) of shoreline a year. Their home range may be 5 to 16 kilometers (3 to 10 miles) during any one season.

Gray myotis colonies roost only in caves and cave-like habitats, and the population has experienced a marked decline in numbers. These bats have very specific requirements for the caves they inhabit, and they utilize different caves in summer and winter. Mating occurs in the fall; the young are born in June, when the colonies have migrated to their summer range.

The Indiana myotis occurs in the northern portion of the Lower Mississippi Valley and uses certain caves for breeding and winter hibernation. Breeding seems to occur only during the first 10 days of October. Hibernating colonies disperse in late March; migration to the wintering caves usually begins in August. These bats forage near riparian and flood plain trees in summer within areas of about 4.5 hectares (11 acres).

Occasional reports of Florida panthers have been made in the Lower Mississippi Valley south of Tennessee. Most of these have been unconfirmed and many are erroneous. Still, some of the larger wild areas may contain a few panthers. Florida panthers prefer large, unbroken tracts of land, such as bottomland hardwoods. They range over 65 square kilometers (25 square miles) in search of deer, the principal food. Other prey are sometimes taken, including livestock. Apparently there is no particular breeding season, but individuals are believed to be 2 or 3 years old before they begin breeding.

4.2.2. Aquatic Resources

The Lower Mississippi Valley study region contains numerous aquatic habitats which support a variety of commercially, recreationally, and ecologically important species, the more important of which are described briefly below. These habitats include upland streams, reservoirs, and rivers, bayous, sloughs, oxbow lakes, borrow pits, and wetlands occupying alluvial flood plains. Perhaps the most productive aquatic habitats are those which occur in alluvial flood plains. These seasonally flooded environments, including marshes, bottomland hardwood swamps, backwaters, oxbow lakes, and manmade borrow pits, receive vast amounts of nutrients from the main stem river and provide spawning, nursery, and feeding grounds for many species of fish. However, many rivers, bayous, and oxbows have become severely degraded due to channelization, dredging, dams, siltation, and agricultural pollution from extensive soybean and cotton farming.

Invertebrates

Freshwater pearly (naiad) mussels are found throughout the Lower Mississippi Valley region and are commercially harvested from the White and Saint Francis Rivers in Arkansas and the Tennessee River in Tennessee. These mussels occupy riverine habitats with good current and sand or gravel substrate. The larvae of these species are obligate parasites of aquatic vertebrates, predominantly fish. Major commercial species include the black, washboard, pigtoe, maple leaf, three-ridge, and white pimpleback mussels. Historically, the shells of these species were used in the manufacture of pearl buttons. The development of plastics after World War II marked the demise of the pearl button industry; however, in the early 1950's it was discovered that small pellets from these thick-shelled mussels provided excellent nuclei for Japanese cultured pearls. Today, most mussel shells are harvested for this purpose, although the yield has declined over the past several years due to overfishing.

Fish

The aquatic habitats of the Lower Mississippi Valley study region yield several important commercial and recreational fish species, including catfish,

buffalo, carp, freshwater drum, gar, bowfin, paddlefish, and suckers. In addition, freshwater and temperate basses, crappie, sunfish, and sauger are fished strictly for sport.

The channel, flathead, and blue catfish are the major commercial and recreational catfish species and compose the most valuable commercial fisheries resource in the study region. All three species are found in medium to large rivers. The channel catfish prefers clear, swift water over sand or gravel-rock, although it has adapted well to natural and artificial lakes. Spawning occurs during the spring and summer. The male selects and cleans a nest site, usually in a hollow log under rocks, cut banks, or other dark places, and then guards the nest after spawning. Channel catfish may weigh 14 kilograms (30 pounds) or more, but are usually 0.9 to 4.5 kilograms (2 to 10 pounds). The flathead catfish characteristically is associated with deep holes in the riverbed, although the young sometimes move into riffle areas. Spawning occurs from late May through August, with behavior similar to that of the channel catfish. Flathead catfish grow to an average of 0.9 to 9 kilograms (2 to 20 pounds), although 41- to 45-kilogram (90- to 100-pound) specimens are not uncommon. Blue catfish inhabit deep areas with moving water. They spawn in May and June, exhibiting behavior similar to the channel catfish. Blue catfish commonly grow to 1.4 to 9 kilograms (3 to 20 pounds), although those weighing more than 45 kilograms (100 pounds) occasionally are caught.

Three species of bullhead catfish, yellow, black, and brown, are pursued recreationally. These small catfish, averaging 0.5 kilograms (1 pound), are found in sluggish, vegetated waters. Their spawning habits are similar to the larger catfish described previously.

Buffalos, composed of the bigmouth, smallmouth, and black buffalo, are the largest fishery by weight in the Lower Mississippi Valley study region. They inhabit a wide variety of large rivers and lakes. The smallmouth buffalo often is found in clear waters with modest current; the bigmouth is common in shallows of large sluggish rivers, oxbows, bayous, and lakes; and the black often occurs in strong currents of large rivers. Spawning occurs in the spring and the eggs are deposited randomly over weed beds or mud bottoms. Adult buffalo normally weigh 0.9 to 9 kilograms (2 to 20 pounds), but may weigh up to 23 kilograms (50 pounds).

The common carp is another major component of the commercial fisheries in the region. The species is widespread, occurring in rivers, streams, and natural and manmade lakes, over all types of bottoms and in clear or turbid waters. Adults spawn in very shallow water in the spring, often in large, thrashing schools; the eggs are broadcast randomly throughout the shallows. Adults weigh between 0.9 and 4.5 kilograms (2 and 10 pounds), but may weigh more than 23 kilograms (50 pounds).

The freshwater drum, another important commercial species, is the only North American representative of the generally marine and estuarine drum family. It prefers large, silty lakes and rivers, but occurs in a wide variety of freshwater habitats. Freshwater drum spawn in large groups, with the eggs broadcast over gravel or clay bottoms. Adults from 1.4 to 2.3 kilograms (3 to 5 pounds) are common, but individuals may grow to 11 to 14 kilograms (25 to 30 pounds).

Gars are represented by four species within the region: the alligator, spotted, longnose, and shortnose gar. In many places, gar are considered nuisance fish, although they are sought commercially and for sport throughout the region. Gar are common in slow-moving streams and rivers, oxbow lakes, backwaters, and bayous. Spawning occurs in the spring and the adhesive eggs are deposited in weeds or debris. The alligator gar is by far the largest member of the gar family, often exceeding 68 kilograms (150 pounds); the other gars usually weigh between 0.5 and 5 kilograms (1 and 10 pounds).

Other species of lesser commercial importance include the paddlefish, bowfin, and suckers. The paddlefish prefers large, free-flowing rivers rich in zooplankton. Spawning occurs from March through June in fast-flowing water over gravel or sand bars; males and females gather in schools and the eggs are broadcast. Paddlefish commonly reach a size of 18 to 27 kilograms (40 to 60 pounds).

The bowfin inhabits swamps, sloughs, oxbow lakes, and slow-moving streams. During the spring, the male builds a circular nest in shallow vegetated areas and protects the eggs and schooling young. Bowfin average 0.5 to 2.3 kilograms (1 to 5 pounds), but occasionally weigh 7 kilograms (15 pounds) or more.

Two sucker species contribute to the commercial fishery in the region: the river carpsucker and the quillback. The former species is abundant in quiet, silt-bottomed pools of rivers with low to moderate gradients and frequently is found in impoundments. Spawning occurs in late spring over submerged logs and brush. This species rarely exceeds a weight of 2.3 to 2.7 kilograms (5 to 6 pounds). The quillback occurs in turbid rivers and clear lakes. The adults are migratory during the spring spawning season and spawn over sand, silt, or mud in streams and overflow bayous. The quillback attains a weight of 3.6 kilograms (8 pounds).

Several members of the sunfish family, including sunfishes, crappies, and basses, provide a substantial sport fishery throughout the region. The largemouth bass is the most sought-after sport species in the region. Although found in a variety of habitats, the largemouth bass prefers clear quiet water with aquatic vegetation. Spawning occurs in early spring when water temperatures reach 18°C (65°F). Nests are built by the male, who guards the eggs and young until the school of juveniles disperses. Early spring and fall are the best bass fishing seasons, although they are caught throughout the year.

The spotted bass may be found in the same waters as the largemouth, but is more commonly a stream fish. This bass species is also a nest builder and spawns in late winter and early spring. There is some evidence that the spotted bass migrates upstream to small tributaries to spawn.

The black crappie typically is found in quiet clear water amongst dense vegetation. This sport species spawns in the spring. The adults construct nests and the early stage larvae are guarded in their nest by the adult male. As the young develop, they move from the nest into more open water. The white crappie is present in a wide variety of freshwater habitats including ponds, lakes, streams, and slow-moving areas of large rivers and is more tolerant of turbidity than the black crappie. White crappie usually build nests in large

colonies on gravel or other hard bottoms near vegetation or other protective objects. Spawning occurs in the spring and the males guard the nests. Both young and adults usually are found in schools. Crappie are caught all year, although spring is the best season.

Several sunfishes, collectively known as bream, are excellent panfish species. The bluegill and redear sunfish are the most popular species in the study region, while the warmouth, longear sunfish, and green sunfish are of secondary importance. All sunfishes construct nests which the male guards during egg and larval development. The bluegill and redear spawn over an extended period when water temperatures reach 21°C (70°F). Generally, the nests are congregated into colonies. The bluegill inhabits shallow, warm lakes, ponds, and slow-moving rivers and creeks with abundant vegetation. The redear is common near the bottom of warm, clear, quiet waters with vegetation and other cover.

The warmouth inhabits slow-moving, vegetated waters. Its spawning season is similar to the bluegill, although its nests tend to be solitary. The longear sunfish, one of the smaller bream, spawns in late spring in colonial nesting sites in shallow water. It is most common in small, clear streams. The green sunfish is tolerant of many habitats and has a spawning behavior similar to that of the bluegill.

Two temperate basses, the white and yellow bass, are popular sport species whose ranges include the study region. The white bass occurs in rivers, clear lakes, and reservoirs. During the spring, the white bass migrates upstream in unisexual schools, to join and spawn in running water over gravel or other hard bottom shoals. Growth is rapid and adults always are found in schools in open water. The yellow bass inhabits quiet pools and backwaters of large streams, lakes, and reservoirs. It moves into tributary streams in April and May to spawn over gravel bottoms. As adults, yellow bass often are found in schools.

The sauger inhabits large, often turbid, free-flowing streams, lakes, rivers, and impoundments. In late winter and early spring, the sauger spawns over shoals of gravel to rubble in large, turbid lakes or streams; the eggs develop unattended. Most sauger are caught in turbulent waters below dams during the autumn.

Chain pickerel generally are found in slow-moving streams and vegetated bayous and lakes. They spawn in late winter and early spring, depositing their adhesive eggs over vegetation and detritus. Average size is 0.5 to 0.9 kilograms (1 to 2 pounds). Sportfishing occurs mainly from fall through early spring.

Aquatic Reptiles and Amphibians

Aquatic turtles, mainly the alligator snapping turtle, the smooth soft-shell, and the spiny softshell, provide a minor commercial fishery in the study region. The alligator snapper inhabits deep rivers, lakes, oxbows, and sloughs. It is highly aquatic and only nesting females are known to leave the water. Mating occurs underwater during the late winter and early spring. One clutch of 10 to 52 eggs is laid in spring in an earthen cavity a short distance from the water.

The smooth softshell prefers rivers and large streams with moderate to fast currents and sandy or muddy bottoms. It rarely is seen away from water, although it basks on sandbars within 3 meters (10 feet) of the waterline. Nesting occurs on sandbars from May to July. One to three clutches of 4 to 33 eggs are laid.

The spiny softshell inhabits small marshy creeks, farm ponds, lakes, and large fast-flowing rivers. It often is found basking on banks, logs, and floating debris. Nesting occurs from May to August in sand or gravel banks exposed to full sunlight. More than one clutch of 4 to 32 eggs may be laid in a season.

The bullfrog also is harvested commercially within the study region. This species, the largest frog in North America, is sought for its leg meat. It prefers vegetated ponds, lakes, and slow-moving streams and usually is found on the bank at water's edge. Breeding occurs from late winter to early fall and egg masses are attached to submerged vegetation. The tadpole stage may last almost two years.

4.2.3 Terrestrial Resources

The Lower Mississippi Valley study region contains a variety of habitats important to terrestrial plants and animals, including marshes, swamps, bottomland hardwoods, upland forests, and prairies. While development and agricultural activities have seriously reduced the amount of pristine habitat within the region, that which remains is highly productive. All of the wooded bottomland within the levees of the Mississippi River in the Mississippi Valley are significant for migratory waterfowl, migratory passerines, wild turkey, white-tailed deer, black bear, and many other wildlife species. The entire valley is known as the Mississippi Flyway, a major migratory route for millions of birds each year.

Historically, the Lower Mississippi Valley proper has been dominated by the Southern Flood Plain Forest Association containing broadleaf, deciduous and evergreen trees and shrubs such as tupelo, oaks, and baldcypress. The uplands in the southern half of the study region are part of the Southeastern Mixed Forest Province in which pines are associated with hardwoods. In the northern half of the study region, the Oak-Hickory Forest predominates, with a diversity of hardwood species. A vast amount of the original forests has been converted to croplands, especially within the Mississippi River flood plain, and the rate of loss has been accelerating.

Plants

In addition to the seven plant species officially listed by Tennessee as threatened, which were mapped in the Lower Mississippi Valley study region, a number of plant categories were included on the maps because they are ecologically unique in distribution or association. In some cases, exceptionally large and original growth trees were mapped, as were some commercial timber lands.

Of major importance in the Lower Mississippi Valley are the remaining stands of bottomland hardwoods, many of which have been mapped. Originally,

the valley supported vast expanses of these forests containing baldcypress, tupelo, various oaks, water hickory, and others. Today, few forests remain, having been replaced by farmlands or second-growth trees. Bottomland hardwoods generally refer to forests occurring in flood plains or on saturated soils. They constitute some of the most productive wildlife and fish habitats in the United States, and include seasonally flooded flats and basins as well as wooded swamps. These forests provide vital food and cover for a great diversity of game and nongame animals. In 1977, only 23 percent of the Lower Mississippi Valley was forested, and currently, conversion to croplands is continuing at a rate of about 105,222 hectares (260,000 acres) annually.

Often, baldcypress and tupelo occur together; where exceptional stands of one or the other occur, they were mapped separately. Major stands of over-mature and original growth trees also were mapped where known. Such stands contain very large trees, and usually have not been cut or otherwise disturbed over long periods.

Before farming developed in the Lower Mississippi Valley, the only unforested areas were the several thousand square kilometers (few thousand square miles) of natural prairies. These treeless areas are unique in a region of high precipitation. Only a couple of hundred hectares (few hundred acres) remain unplowed (pristine) in Arkansas; some of their locations have been mapped in the study region. These areas support tall grasses and a wealth of wild flowers.

Birds

Many bird species occur within the Lower Mississippi Valley study region, including a wide variety of permanent residents and breeding species, a good representation of spring and fall migrants, and a large influx of winter visitants. Birds occupy all habitat types, although different species may be present in various seasons. Typically, birds are one of the most conspicuous terrestrial animals throughout the Lower Mississippi Valley. Species from all avian categories were mapped, including small wading birds, long-legged wading birds, waterfowl, raptors, seabirds, perching birds, non-perching land birds, and fowl-like birds.

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

a. Small wading birds. Small wading birds comprises species usually thought of as shorebirds, as well as small birds that typically forage along marshy edges or mudflats for invertebrates. The most common small waders in the Lower Mississippi Valley include rails, sandpipers, phalaropes, and plovers. Most small waders are migrants or summer residents, although some are permanent residents. Principal migratory flights occur from April 15 to May 20 and August 10 to October 15.

The sora, Virginia, and king rails are primarily migrants in the study region, although the king rail may breed in small numbers. These species

utilize shallow marshy areas surrounding oxbow lakes, borrow pits, and other wetlands.

Among other important small waders are the common snipe and American woodcock. The common snipe is a prevalent migrant throughout the study region and also winters in southern portions of the area. It is a game bird which prefers open, moist margins of marshes and oxbows. The American woodcock is also a game bird, but it is a permanent resident of moist forest floors in the study region. It is not common in the southern part of the region during summer. Bottomland hardwoods offer excellent habitat for this bird.

b. Long-legged wading birds. Long-legged waders are more common in southern parts of the study region than in the northern portion. Several species of herons and egrets are common summer residents in the Lower Mississippi Valley, utilizing shallow areas of marshes, rivers, and various other bodies of water. The principal species are the great blue heron, little blue heron, yellow-crowned night-heron, and cattle, snowy, and great egrets. Although most long-legged waders are diurnal, the black-crowned and yellow-crowned night-herons are nocturnal.

Long-legged wading birds nest in a wide range of habitats, including cypress swamps, freshwater marshes, and along inland lake and river margins. They often form large colonies and are very susceptible to nesting disturbance. Usage of nesting sites may vary considerably from one year to the next; nesting is most intense from March through July.

c. Waterfowl. Within the Lower Mississippi Valley, the marshes, swamps, lakes, and oxbows constitute a large and important waterfowl wintering area of the United States. The area encompasses the Mississippi Flyway and normally provides wintering ground for millions of ducks and geese annually. Additional millions of ducks use the marshes for staging, resting, and feeding before continuing across the Gulf of Mexico to wintering grounds in Central and South America. Main migratory flights occur from February 20 to April 1, and from October 20 to December 15.

Dabbling ducks, 80 percent of which are mallards, constitute the largest group of waterfowl utilizing the region during migration. Approximately one-third of the 2,500,000 dabblers using the Mississippi Flyway winter along the lower Mississippi River. In addition to being the most abundant migrant and wintering waterfowl, mallards may breed in very low densities in the region.

Bottomland hardwoods are prime seasonal habitat for migrating and wintering species of dabblers, because they provide acorns and hickory nuts when inundated. Some wildlife management areas flood such forests, creating green-tree reservoirs to attract dabblers.

The wood duck is a permanent resident throughout the region, but is not common in the north during winter. It is the most important summer nesting waterfowl species and requires large trees in swamps or bottomland hardwoods for cavity nesting. Wood ducks also forage extensively in these habitats for nuts. Other common dabbling ducks are the gadwall, northern pintail, American wigeon, green-winged teal, northern shoveler, and American black duck.

The Lower Mississippi Valley is also a major migratory route for up to 550,000 diving ducks annually, 90 percent of which are lesser scaups. These birds use the open water of the Mississippi River and other deep-water habitats. Two other diving ducks which commonly migrate along the Mississippi River corridor are the ring-necked duck and canvasback. In addition, more than 400,000 snow geese use the region as a migratory flyway, but only some 20,000 Canada geese do so.

All waterfowl are important game species and are hunted extensively. Though not all waterfowl species were individually mapped, it may be assumed that, unless otherwise noted, most waterfowl areas mapped contain combinations of these common species.

d. Raptors. Raptors include hawks, falcons, kites, eagles, vultures, and owls. Owls are generally permanent residents of wooded areas, although many other raptors are migrants or summer or winter residents. Most raptors mapped are species with special status in portions of the region, and were discussed previously. These species include the bald eagle, golden eagle, osprey, northern harrier, Mississippi kite, peregrine falcon, Cooper's hawk, and sharp-shinned hawk.

Other raptors have not been identified individually on the maps, but include hawks, such as the red-tailed, red-shouldered, and broad-winged hawks, turkey and black vultures, and owls like the long-eared, great horned, barred, and common barn-owls.

Broad-winged hawks are summer residents only, and they breed in forests of the region. They usually migrate in spring and fall in large groups. Other raptors are year-round residents and breed in the Lower Mississippi Valley in summer, although their populations increase in spring and decrease in fall as migrants temporarily stopover. The red-shouldered hawk and black vulture are less common in the northern part of the study region than in the southern portion.

e. Seabirds. For the purposes of this study, seabirds comprises species which spend most of their time in the air. In the Lower Mississippi Valley, mapped seabirds included gulls, terns, and American white pelicans.

Herring and ring-billed gulls are the only regularly occurring gulls in the region. Both species are spring and fall migrants and winter residents, mainly in the Mississippi River flood plain. They concentrate around lakes, rivers, garbage dumps, and fish farms. Franklin's gull migrates mainly west of the Mississippi River and sometimes enters the study region.

Forster's terns occasionally are found in the study region, mostly in the southern portion in summer. Black terns migrate through the Lower Mississippi Valley in spring and fall, and least terns are summer breeders along the major rivers.

American white pelicans are also migrants along the Lower Mississippi Valley, especially in fall.

f. Perching birds. This category comprises medium to small land birds having feet well adapted for perching. A wide diversity of perching birds occurs in the Lower Mississippi Valley; most are common throughout the United States. Consequently, few individual species were mapped unless their occurrence was somewhat unusual. As a group, these birds are important aesthetic, recreational, and ecological resources, because they are sought out by bird-watchers and photographers.

Insectivorous species tend to be permanent residents, while fruit and seed eaters are typically migratory. Resident species breed in the spring and early summer. Migratory species are generally fall and spring transients or visitors during summer or winter. Principal migrations occur from March 25 to May 10 and September 10 to November 5.

Flycatchers, kinglets, vireos, and nearly all the warbler species breeding north of the Lower Mississippi Valley concentrate in wooded slopes and bottomlands of the study region during migrations. Throughout the winter, hardy species remain, finding shelter in protected areas.

g. Non-perching land birds. Similar in size and habits to perching birds, non-perching land birds are composed of species such as doves, swifts, woodpeckers, nighthawks, and hummingbirds. The yellow-billed cuckoo, chuck-will's widow, and ruby-throated hummingbird are common summer inhabitants. The yellow-bellied sapsucker is a winter resident only. Permanent residents include the mourning dove, belted kingfisher, and woodpeckers such as red-headed, pileated, northern flicker, red-bellied, downy, hairy, and red-cockaded. Woodpeckers inhabit forested areas, and are especially abundant in bottomland hardwoods.

The mourning dove is the only game bird in this category mapped in the region, but it is a very important one; large numbers of doves are harvested annually. Mourning doves occupy open and edge habitats throughout the region, where there is an abundance of weed seeds and grain; they rely heavily on cultivated crops.

h. Fowl-like birds. These land birds are heavy-bodied and chicken-like; all have a short heavy bill and spend most of their time on the ground, where they are strong runners. Only two species of fowl-like birds regularly occur in the Lower Mississippi Valley: the wild turkey and northern bobwhite. Both are permanent residents throughout the region and are hunted extensively. Northern bobwhites are found in brushy grasslands, open pine woods, farmlands, and other open areas. Wild turkeys are most common in the northern part of the study region in mature deciduous forests, and depend heavily on bottomland hardwoods for food.

Reptiles and Amphibians

A fair variety of permanent resident reptiles and amphibians are found within the Lower Mississippi Valley. Although many of these species are very abundant, some species are being threatened by destruction of their limited habitat or by steady or increased removal of individuals by reptile and amphibian collectors. Two species have experienced decreasing populations and have special status; these were the only individual species mapped. Some

species, especially the snakes, may have fairly extensive home ranges, but most are relatively sedentary. Most reptiles and amphibians do not migrate extensively; aquatic habitats, especially freshwater areas, are extremely important as spring and summer breeding and feeding areas to many of these animals. The box turtle is the only terrestrial turtle in the region and it prefers bottom land hardwood forests.

Mammals

The Lower Mississippi Valley is one of the most productive game habitats on the North American continent. The bottomland hardwood forests, especially, have long been known for their abundance of wildlife. Most mammals are year-round residents, generally found in pairs or small family groups, which breed from late winter to spring.

The white-tailed deer is the only deer and the most important game animal in the study region. The bottomland hardwoods along the Mississippi River have a higher deer carrying-capacity, and generally higher deer populations, than any other forest type in the southeast. These forests, as compared to upland types, provide much better protection against free-ranging dogs and poachers, because of the diversity of escape cover available. In the northern region deer are more scarce, primarily because of habitat destruction.

Gray and fox squirrels also are important game species throughout the region. Both occupy flood plain forests and woodlands, although the fox squirrel prefers more mature stands.

The other major game mammals in the Lower Mississippi Valley are rabbits. Only two species occur here: the eastern cottontail and the swamp rabbit. The eastern cottontail prefers agricultural and brush lands, while the swamp rabbit is found in large, unbroken forest stands such as bottomland hardwoods and swamps.

Many furbearers inhabit the study region including: large carnivores (coyote, bobcat); medium-size carnivores (red fox, gray fox); bottomland furbearers (raccoon, skunks); and aquatic furbearers (mink, nutria, beaver, river otter, muskrat). All these furbearers are commercially trapped or hunted.

a. Large and medium-size carnivores. Coyotes are uncommon in the study region in general; where they are found, they prefer brush lands, particularly along forest edges, and open farmlands.

The bobcat is fairly common in the midreaches of the Lower Mississippi Valley, where it prefers heavily wooded areas interspersed with openings, as well as swamps. It is an important nocturnal predator, which feeds on a wide variety of small mammals and birds.

Both fox species are common in the region, but they require different habitats. The gray fox occurs in brushy and wooded areas, while the red fox inhabits open and brushy lands. Foxes are largely nocturnal, but sometimes are active in early morning or evening.

b. Bottomland furbearers. The raccoon is a common resident everywhere in the Lower Mississippi Valley. It habitually forages the waterways, requiring or preferring hardwoods or other forest bordering wet areas.

Skunks also are commonly encountered in the study region, but were not mapped as to species. The striped skunk occupies a variety of habitats, but seems to prefer farmland, borders, fence rows and forest edge, especially in conjunction with grassy areas. The spotted skunk is an animal of open grasslands interspersed with mixed timber types. It prefers prairie situations, but can be found in cultivated areas and brushy sites with good cover between heavily used areas. It is uncommon in the study region.

c. Aquatic furbearers. The mink occurs along the larger tributaries everywhere within the study region. The mink utilizes banks and tree root masses as den sites and feeds on aquatic, semi-aquatic, and terrestrial organisms.

The beaver is found in and along streams, rivers, and lowlands in wooded areas. The beaver is uncommon to common in most of the study region. While the beaver creates water bodies as it builds its dams, it destroys trees by cutting and by flooding.

River otters once were distributed across the United States. While they are now scarce in the study region, they occasionally are found along streams and lake borders in marshland and semi-aquatic terrain. River otters are sociable animals and usually travel in pairs.

The muskrat, a rodent, generally is associated with marshes along the entire length of the study region. It prefers quietly moving or still water. In the study region, most dens are dug into the banks of the river and tributaries. Some wildlife biologists consider the Mississippi River poor habitat for muskrat because it fluctuates too much.

The nutria was introduced into Louisiana as a potential furbearer. It subsequently became well established and flourished. Generally, the wild nutria fur is of poor quality and the animals compete with the valuable native muskrat, a smaller species, for food and habitat. However, in Louisiana, the nutria fur is of moderate to good quality and it is the state's most valuable furbearer, not by individual pelt price, but in total take. The nutria occurs from the mouth of the Arkansas River south.

The Virginia opossum was not separately mapped, but is very common around human settlements and occurs throughout the area in a variety of habitats. It appears to prefer mixed wooded areas near streams, particularly if interspersed with farming activities or a variety of old field and other successional habitat types.

4.3 THE NATCHEZ QUADRANGLE

4.3.1 Aquatic Resources

Widespread Species

The aquatic systems depicted on the Natchez quadrangle encompass a wide variety of habitats including upland "Florida Parish" streams; rivers and bayous; flood plain borrow pits, oxbow lakes, swamps, and backwaters; and reservoirs. These habitats support many fish species of commercial and recreational importance including catfish; buffalo; gar; freshwater drum; carp; bowfin; paddlefish; white and black crappie; largemouth, spotted, yellow, and white bass; and several sunfish species. Turtles and bullfrogs also are important.

The American alligator is distributed widely in this area, especially in the swamps, rivers, lakes, bayous, and backwaters of the Mississippi alluvial plain.

Geographic Inventory

A portion of the Bogue Chitto (grid reference YE63 to YE46) supports several unique species including the Atlantic sturgeon and frecklebelly madtom. The Atlantic sturgeon has been known to migrate along this river from spring through fall.

The Tangipahoa River (grid reference YE43 to YE37), Tickfaw River (grid reference YE23 to YE34), Amite River (grid reference YE03 to YE27), Comite Creek (grid reference XE83), Thompson Creek (grid reference XE73 to XE83), and Bayou Sara (grid reference XE53 to XE64), known as the Florida Parish rivers, are swift, clear, spring-fed, streams. As a result, they support rock bass, a popular species that is not common in other streams in the study region. The latter two streams harbor the bluntnose minnow, which is at the southern end of its range. Thompson Creek also supports bluntface shiner and rainbow darter, both of which are at the southern end of their ranges and disjunct from most other populations.

One of the most important aquatic features on the Natchez quadrangle is the Mississippi River and its associated flood plain (grid reference XE33 to XF84), in particular the wetlands lying within the flood plain. The main stem river generally has low productivity due to high turbidity, high current velocities, and shifting substrate. In addition, the fast and variable currents make sport and commercial fishing dangerous. However, the main stem littoral areas, chutes, and especially backwaters, flood plain lakes, and numerous borrow pits, formed during construction of manmade levees, are highly productive and are the sites for most commercial and sport fisheries. These habitats are particularly productive during spring flooding.

Mississippi River oxbow lakes within the levees, such as Glasscock Lake and Rodney Lake (grid references XE37 and XF62), support a large commercial and sport fishery. Oxbow lakes outside the levees, such as Lake Concordia (grid reference XF40), Lake Saint John (grid reference XF40 to XF41), and Lake Bruin (grid reference XF63 to XF73), are not as productive; however, these three

lakes are managed by the Louisiana Department of Wildlife and Fisheries and provide for good sportfishing.

The tributaries and their associated flood plains within the Mississippi River alluvial plain also support major commercial and recreational fisheries. The Three Rivers area, where the Red, Mississippi, and Atchafalaya Rivers meet (grid reference XE23), is one of the most important freshwater commercial fishing areas in Louisiana. Other major fisheries occur in the Red River (grid reference XE13 to WE95), and in the Black River (grid reference XE15 to XE19) and Ouachita River (grid reference XE19 to WF94), especially where they meet with the Tensas River at Jonesville, Louisiana (grid reference XE19).

Larto Lake (grid reference XE07), which receives flood waters from the Red River, is managed by the Louisiana Department of Wildlife and Fisheries for sportfishing.

A portion of Bayou Cocodrie (grid reference XE27 to XE29) is part of the Louisiana Natural and Scenic Rivers system.

Tributaries to the Mississippi River on the east bank harbor several unique species. A disjunct population of the southern redbelly dace, endangered in Mississippi, is found in a small upland stream system at grid reference XE33 to XE43.

The Homochitto River (grid reference XE45 to YF21) delimits the southern range of northern species and the northern range of southern species. As a result, it harbors some unique fish species, such as the rainbow, naked sand, and johnny darters, northern hog sucker, and least madtom. Sportfishing is an important activity along the river.

Bayou Pierre (grid reference XF73 to YF30) is one of the few remaining free-flowing rivers in Mississippi. The only breeding population in the world of the bayou darter, a fish listed as threatened by the Federal government, is a common inhabitant of a portion of the main stem of Bayou Pierre (grid reference XF84 to YF33) and occurs in Foster Creek (grid reference YF23 to YF22) and the Turkey Creek system (grid reference YF33). These areas of the Bayou Pierre system, with the exception of Turkey Creek, also harbor the Mississippi-endangered crystal darter.

The Pearl River (grid reference YE87 to YF64), which flows directly into Mississippi Sound and is not part of the Mississippi River system, harbors several state-listed threatened or endangered species: the Atlantic sturgeon, which migrates along the river; crystal darter; frecklebelly madtom; and ringed map turtle, which is unique to the Pearl River basin. Additionally, one of the southernmost sea runs of a natural striped bass population occurs in the Pearl River.

Lake Mary Crawford (grid reference YE69) is managed by the Mississippi Department of Wildlife Conservation for sportfishing.

The Strong River (grid reference YF72 to YF82), a tributary to the Pearl River and one of the few remaining free-flowing streams in Mississippi, harbors the Mississippi-endangered Atlantic sturgeon during spring through fall migrations and the frecklebelly madtom.

4.3.2 Terrestrial Resources

Widespread Species

Birds from every category inhabit the region depicted on the Natchez quadrangle at one season or another, and many breed here. Marshes, swamps, and bottomland hardwoods in the region provide essential wintering habitat for many species of waterfowl, such as mallards, northern pintails, teals, and snow and greater white-fronted geese. American woodcocks and wood ducks are permanent residents and breed here in significant numbers. Second to water birds, perching birds compose the most abundant and diverse group. In addition, bald eagles and peregrine falcons, both species with special status, are widely distributed in this region during migrations and in winter. Mourning doves are abundant summer residents in agricultural areas, as are northern bobwhite.

Furbearers such as bobcats, minks, white-tailed deer, river otters, rabbits, squirrels, skunks, foxes, raccoons, and Virginia opossums, are found throughout this region in suitable habitat. All of these widespread species are heavily hunted or commercially trapped. Areas where widespread species are particularly abundant were mapped and are discussed below.

Geographic Inventory

Some of the best overall wildlife habitat and hunting in Louisiana is found in the District IV wildlife management areas between grid references XE33 and WF94. These areas include Three Rivers, Red River, Saline, Concordia, and Boeuf. High populations of many game species abound, but most of the hunting emphasis is on white-tailed deer.

Unlike much of the Lower Mississippi Valley, the western portion of the Natchez quadrangle has a considerable amount of bottomland hardwoods remaining (grid reference XE24 to XF32). Along with typical bottomland plants, these areas provide important habitat for many wildlife species common to the region, such as wild turkey, white-tailed deer, rabbits, and squirrels.

The Coco Lake--Fish Bayou Lake area (grid reference XE03) has been considered to be fourth in habitat quality for waterfowl among 14 areas in Louisiana studied by the FWS. The area is especially valuable for breeding ducks. Wintering bald eagles also utilize the area, as do white-tailed deer and long-legged wading birds.

Red River Bay at grid reference XE24 contains 2,100 hectares (5,189 acres) of open water, swamp, and bottomland hardwoods valuable to waterfowl for breeding and wintering. Bald eagles have been known to use the area, which also contains high populations of white-tailed deer and long-legged wading birds.

Lake Ophelia swamp (grid reference XE05) with its 25,500 hectares (63,000 acres) of privately owned land, is one of a few remaining large, intact tracts of bottomland hardwoods in the Mississippi River valley of Louisiana. Open water in the form of lakes, bayous, rivers, and sloughs occupies 800 hectares (2,000 acres); the rest is woodland consisting of baldcypress, tupelo, red gum, and mixed hardwoods such as oaks and hickories. Bald eagles

are transients here, but ospreys and wood storks are summer residents. Black bears and an abundant and diverse fauna utilize the area year-round, including wild turkeys, white-tailed deer, squirrels, rabbits, river otters, beavers, and coyotes.

Between grid references XE14 and WE93 are three state-owned wildlife management areas: Spring Bayou, Grassy Lake, and Pomme de Terre. Together they occupy some 16,000 hectares (39,500 acres) of bottomland hardwood and wetland habitat heavily used for hunting; most hunting pressure is on white-tailed deer and tree squirrels. Even so, wildlife abundance is excellent; eastern cottontail populations are high and substantial populations of northern bobwhite, American woodcock, and mourning dove also are found here.

The area at grid reference XE45 is a large sump dominated by baldcypress and bottomland hardwoods. Its 2,833 hectares (7,000 acres) provide prime waterfowl habitat, especially for breeding wood ducks.

Saint Regis natural area at grid reference XE85 contains 28 hectares (70 acres) of virgin loblolly pine surrounded by timbered land. It has been considered as a potential National Natural Landmark.

Homochitto National Forest (grid reference XE95 to YF21) is a major forested tract in the Lower Mississippi Valley and provides habitat for an abundance of common plants and animals native to the region. High populations of white-tailed deer and wild turkey inhabit the forest along with 80 to 100 colonies of red-cockaded woodpeckers.

At grid reference YE35, Percy Quinn State Park supports wildlife such as wild turkeys, squirrels, red foxes, Virginia opossums, nine-banded armadillos, and high populations of white-tailed deer.

Great egrets have been known to nest at grid reference YE89. Nesting consistency varies from year to year however, since colonial nesters such as herons and egrets are highly susceptible to disturbance.

Copiah County Wildlife Management Area at grid reference YF12 preserves habitat for hunting of American woodcock, mourning dove, wild turkey, northern bobwhite, white-tailed deer, squirrels, and rabbits.

The flood plains and forested swamps near grid reference XF21 have important breeding and wintering value for waterfowl. White-tailed deer populations also are high, and river otter, wild turkey, and herons find food and cover here.

Similarly, the bottomland hardwoods around grid reference XF61 provide essential tree cavities for nesting wood ducks to brood and rear their young, as well as habitat for white-tailed deer, long-legged wading birds, and raptors.

Among the most important unpreserved areas for waterfowl in the Lower Mississippi Valley of Louisiana is Big Hog Glade (grid reference XF43). Its 4,110 hectares (10,155 acres) of mostly swamp and bottomland hardwoods is valuable for breeding and wintering ducks. White-tailed deer populations are high and a diversity of other animals utilize the area, including raptors.

4.4 THE JACKSON QUADRANGLE

4.4.1 Aquatic Resources

Widespread Species

The aquatic resources depicted on the Jackson quadrangle include several large river systems such as the Pearl, Mississippi, Yazoo, and Ouachita. A variety of aquatic habitats occurs within these systems: upland streams; reservoirs; and rivers, bayous, oxbow lakes, borrow pits, chutes, swamps, and backwaters occupying alluvial flood plains. These habitats support commercially and recreationally important fish species, including catfish; buffalo; gar; freshwater drum; carp; bowfin; paddlefish; white and black crappie; largemouth, spotted, yellow, and white bass; sauger; and several sunfishes. Turtles and bullfrogs also are caught.

Many of the aquatic habitats depicted on the Jackson quadrangle have been degraded due to agricultural pollution, sedimentation, and channelization. In general, those aquatic systems delineated on the map are of relatively good quality as fish habitat; those which are labelled with species are particularly notable either for their commercial or recreational importance.

The American alligator is distributed widely in this area, especially in the swamps, lakes, bayous, and backwaters of the flood plains.

Geographic Inventory

The Pearl River (grid reference YF64 to YF78), which flows directly into Mississippi Sound and is not part of the Mississippi River system, harbors several state-listed threatened or endangered species: the Atlantic sturgeon, which migrates along the river; frecklebelly madtom; and ringed map turtle, which is found only in the Pearl River basin. Additionally, one of the southernmost sea runs of a natural striped bass population occurs in the Pearl River and concentrates in the tailrace of Ross Barnett Reservoir.

Ross Barnett Reservoir (grid reference YF78 to YF89), a COE impoundment, provides a major portion of the public fishing opportunity in the area. It receives approximately 200,000 to 400,000 person-days of use per year.

Lake Dockery (grid reference YF56) is a small impoundment on a tributary to the Pearl River. It is managed by the Mississippi Department of Wildlife Conservation for sportfishing.

Bayou Pierre (grid reference XF94 to YF14) is one of the few remaining free-flowing rivers in Mississippi. It contains the only breeding population of the bayou darter in the world. This fish, on the Federal list of threatened species, is a common inhabitant in the main stem of Bayou Pierre and in White Oak Creek (grid reference YF14 to YF24). The Mississippi-endangered crystal darter also is found in the main stem Bayou Pierre.

One of the most significant aquatic features on the Jackson quadrangle is the Mississippi River and its associated flood plain (grid reference XF84 to XG75), in particular the wetlands lying within the flood plain. The main stem

river generally has low productivity due to high turbidity, high current velocities, and shifting substrate. In addition, the fast and variable currents make sport and commercial fishing dangerous. However, the main stem littoral areas, chutes, and especially backwaters, flood plain lakes, and numerous borrow pits, formed during construction of manmade levees, have been highly productive sites for most commercial and sport fisheries, particularly during spring flooding. Currently, however, the Mississippi River is stressed by the elimination of backwater flooding and direct connections to the river. The river also is carrying a very heavy load of pesticides and other pollutants.

Mississippi River oxbow lakes within the levees, such as Yucatan (grid reference XF74), Palmyra (grid reference XF75 to XF86), Halpino (grid reference XF98 to XF89), Albemarle (grid reference XG80 to XG81), and Gassoway (grid reference XG74 to XG75), support a large commercial and sport fishery. Oxbow lakes outside the levees, such as Lake Bruin (grid reference XF64), Lake Saint Joseph (grid reference XF74 to XF64), and Lake Providence (grid reference XG63) are not as productive; however, these three lakes are managed by the Louisiana Department of Wildlife and Fisheries and provide for good sportfishing. Eagle Lake (grid reference XF89), also outside the levees, is a nationally known sportfishing lake.

The Big Black River (grid reference XF84 to YG83) and the Yazoo (grid reference XF97 to YG45) - Sunflower (grid reference YG11 to YG05) River system, tributaries to the Mississippi, support commercial fisheries which are of secondary importance to the Mississippi River, described above. The streams of the Yazoo River basin once supported an excellent fishery, but high turbidity from soybean and cotton fields and pollution from pesticides and fertilizers have reduced the habitat suitability. Native and stocked populations of the American alligator are increasing in the lower Yazoo River and Hubricht's snail, a rare species, has been reported in the Big Black River (grid reference YF28).

Disjunct populations of the southern redbelly dace, endangered in Mississippi, have been found in small upland streams near Vicksburg, Mississippi (grid reference YF07 to YF09).

The Ouachita River (grid reference WF94) provides a major freshwater fishery in Louisiana.

Bayou Bartholomew (grid reference WG92 to XG25) is part of the Louisiana Natural and Scenic Rivers system.

4.4.2 Terrestrial Resources

Widespread Species

The widespread species found in the region depicted on the Jackson quadrangle are essentially the same as those shown on the Natchez sheet, including many species of waterfowl, game birds, bald eagles, songbirds, white-tailed deer, and small furbearers such as rabbits and squirrels. These species are common throughout the Lower Mississippi Valley wherever appropriate natural habitat remains. Marshes, swamps, and bottomland hardwoods are found primarily on the western portion of this map, while forested uplands occur to the east. Agriculture is a major land use throughout.

Geographic Inventory

Regions containing major tracts of remaining unprotected bottomland hardwoods occur primarily west of and along the Mississippi River; large tracts occur in the vicinities of grid references XF57, XF38, and XG09. This habitat type and associated wildlife constitute the most important ecological resource of this sheet, as well as the entire Lower Mississippi Valley.

The tract at grid reference XF67 covers about 30,350 hectares (75,000 acres) and may represent the finest bottomland hardwood tract, together with its diversity of wildlife, remaining in North America. One of the last reported sightings of the ivory-billed woodpecker occurred here, and numerous, but unconfirmed, reports of Florida panthers have been made. Bald eagles and peregrine falcons winter in this area. The only peregrine falcon nest known from Louisiana occurred here, although the species currently does not nest in the state. Except for the Atchafalaya basin, this area is among the last remaining homes of the black bear in Louisiana. This site also has the highest white-tailed deer carrying capacity in the state. Unfortunately, timbering and agricultural activities threaten the site.

Recent reports of cliff swallow nesting have been indicated for grid references YF04 and YF26. The species is considered threatened in Mississippi.

Russell Sage Wildlife Management Area at grid reference XF09 is a popular hunting area of 6,936 hectares (17,140 acres) containing extensive bottomland hardwoods. White-tailed deer are the most hunted species, but populations of rabbits, ducks, and squirrels also are high.

Nearby (grid reference WG91) are the 6,764 hectares (16,714 acres) of the Cities Service Wildlife Management Area, with its pine forest and hardwood flats. White-tailed deer is the only game species present in numbers considered excellent for hunting. Other numbers of game species are fair; wild turkeys are being restocked.

To the east, along Coulee Ditch and Bayou Coulee (grid reference XG01), is an area considered by some to be the most important unprotected site for waterfowl in the Louisiana portion of the Lower Mississippi Valley. It comprises 1,619 hectares (4,000 acres) of mostly marsh with some bottomland hardwood forest. Although much of the area has been cleared, it remains valuable for wintering and breeding waterfowl.

Steel Bayou sump (grid reference XF99) contains one of the largest contiguous blocks of bottomland hardwood wildlife habitat left in the Lower Mississippi Valley. It is the only remaining large tract of forest land in Mississippi close to the Mississippi River. The area supports an outstanding diversity of wildlife common to the bottomland hardwood habitat type. Bald eagles and black bears have been known to inhabit the area.

A significant area for various bird species near Jackson, Mississippi, is at Ross Barnett Reservoir (grid reference YF89). Overlooks along the dam provide viewing for loons, grebes, diving ducks such as lesser scaup, gulls, and terns from October to April. Bald eagles occasionally winter here.

The only bottomland hardwood forest in the National Forest system, and one of the few very large, protected areas in the Lower Mississippi Valley, is Delta National Forest (grid reference YG00 to YG14). Nearly restricted to this area is a unique color phase of the fox squirrel, which is 90 percent black. Some half million waterfowl winter here, 90 percent of which are mallard and wood duck. Within this national forest are three very rare remnants of virgin bottomland hardwoods; together, these tracts constitute about 600 hectares (1,500 acres) of the 23,472 hectares (58,000 acres) in this national forest. Some of the oldest stands are composed of sweetgum, green ash, and overcup oak and are 250 to 300 years old. Important wildlife species here, besides waterfowl, include American woodcock, mourning dove, wild turkey, northern bobwhite, white-tailed deer, rabbits, and aquatic furbearers.

The hunting for white-tailed deer, wild turkey, and northern bobwhite is good on the Georgia-Pacific Wildlife Management Area (grid reference WG93). Squirrels, rabbits, mourning doves, and ducks also are hunted, but population levels are only moderate for these species. The area encompasses 11,332 hectares (28,000 acres) of mixed pine and hardwoods.

The low-lying area near grid reference XG63 is the last significant block of bottomland hardwoods remaining in East Carroll Parish, Louisiana; currently, the site contains less than 6 percent bottomland hardwoods.

A proposed botanical area and research natural area is located within grid reference YG01. The area comprises 6 hectares (15 acres) of overcup oak and water hickory.

Another research natural area is found at grid reference YG03, which contains 24 hectares (60 acres) of American hackberry, American elm, and green ash.

At grid reference YG14 are 16 hectares (40 acres) of virgin timber consisting of overcup oak and water hickory. This area is managed as a green-tree reservoir for waterfowl in fall, whereby the forest is flooded to create temporary habitat for ducks with excellent food availability in the form of nuts and acorns.

Along the Sunflower River at grid reference YG04 and YG13 the Mississippi-threatened cliff swallow has been recorded.

A research natural area containing 16 hectares (40 acres) of sweetgum, nuttall oak, and willow oak occurs at grid reference YG14. The hairy spicebush, a rare plant species, also has been reported from this vicinity.

Black bear sightings have been made in a number of areas of Mississippi, where the species is listed as threatened. Although many of these sightings were not mapped on the Jackson quadrangle, most occurred in the northern portion of this sheet; one of these was depicted at grid reference YG13. Two sightings were mapped farther south at grid references YF15 and XF84.

Panther Swamp National Wildlife Refuge (grid reference YG23) is a 6,070-hectare (15,000-acre) bottomland hardwood swamp with good white-tailed deer and waterfowl populations. Mallards nest, as well as winter, here. Other

species inhabiting the refuge include mourning doves, beavers, squirrels, raccoons, and Virginia opossum.

4.5 THE GREENWOOD QUADRANGLE

4.5.1 Aquatic Resources

Widespread Species

The aquatic resources depicted on the Greenwood quadrangle include several large river systems: the Yazoo, Sunflower, Mississippi, Saline, Arkansas, and White Rivers and Bayou Bartholomew. In addition, upland streams occur in the eastern areas depicted on the map. Within the alluvial flood plains are a number of aquatic habitats, including main stem rivers, bayous, oxbow lakes, borrow pits, chutes, swamps, and backwaters. These habitats support commercially and recreationally important fish species including catfish; buffalo; gar; freshwater drum; carp; bowfin; paddlefish; white and black crappie; largemouth, spotted, yellow, and white bass; sauger; and several sunfishes. Turtles and bullfrogs also are sought.

Many of the aquatic habitats depicted on the Greenwood quadrangle have been degraded due to agricultural pollution, sedimentation, and channelization. Additionally, limited access inhibits fishing activity. In general, those aquatic systems delineated on the map are of relatively good quality as fish habitat; those which are labelled with species are particularly notable either for their commercial or recreational importance.

The American alligator is widely distributed in this area, especially in the swamps, rivers, lakes, bayous, and backwaters. American alligator populations may be either native or transplanted from Louisiana.

Geographic Inventory

The Yazoo-Tallahatchie River (grid reference YG45 to YH56) and the Big Sunflower River (grid reference YG05 to YH16) provide most of the riverine commercial fishery within the State of Mississippi portion of the Greenwood quadrangle. However, they are of secondary importance to the Mississippi River oxbow lakes, discussed below.

The Yalobusha River (grid reference YH61 to YH74) contains the tailwaters of Grenada Lake (located on the adjacent West Point quadrangle). These cooler, clearer waters tend to have a higher fish productivity than surrounding rivers.

The Sixmile Lake-McIntyre Lake area (grid reference YH62 to YH63), between the Yalobusha and Tallahatchie Rivers, is one of only a few natural tracts left in the Yazoo River basin and supports an important sportfishery.

One of the major aquatic resources on the Greenwood quadrangle is the Mississippi River and its associated flood plain (grid reference XG75 to XH86), in particular the wetlands lying within the flood plain. The main stem river generally has low productivity due to high turbidity, high current velocities, shifting substrate, and poor water quality. In addition, the fast and variable currents make sport and commercial fishing dangerous. However, the main stem

littoral areas, chutes, and especially backwaters, flood plain lakes, and numerous borrow pits, formed during construction of manmade levees, are highly productive and are the sites for most commercial and sport fisheries. These habitats are particularly productive during spring flooding.

Mississippi River oxbow lakes within the levees, such as Port (grid reference XG77 to XG78), Lee (grid reference XG87 to XG78), Ferguson (grid reference XG79 to XH70), Paradise (grid reference XH60), Whittington (grid reference XH72 to XH73), Beulah (grid reference XH83), and Old River (grid reference XH86), support a large commercial and sport fishery. Oxbow lakes outside the levees, such as Lake Washington (grid reference XG85 to XG76), Lake Jackson (grid reference XG75 to XG76), Grand Lake (grid reference XG65 to XG66), and Lake Chicot (grid reference XG68 to XG69), provide a less productive sport fishery. Lake Chicot is managed by the State of Arkansas for sportfishing.

One of the major fisheries resources in Arkansas, the Arkansas River (grid reference XH74 to XH46) has produced 30 to 40 percent of the state's commercial fishery revenues over the past several years. Major species include the flathead, channel, and blue catfish and bigmouth, smallmouth, and black buffalo.

White River system (grid reference XH75 to XH76) yields form the second most valuable fishery in Arkansas. The White River also contains one of the two major mussel fisheries in the state.

The oxbow lakes identified along Bayou Bartholomew (grid references XG35, XG38, and XH40) have been upgraded by the Arkansas Game and Fish Commission to improve their sportfishing potential.

4.5.2 Terrestrial Resources

Widespread Species

The widespread species found in the area depicted on the Greenwood quadrangle include mourning doves, wild turkeys, northern bobwhites, nutria, muskrats, skunks, rabbits, and many species of birds, as well as other wildlife common to the Lower Mississippi Valley. Open land wildlife occur throughout this map, but woodland wildlife are most abundant in the western half where a greater amount of forest land remains. Common woodland species are white-tailed deer, bobcat, raccoon, and squirrels. Bald eagles and peregrine falcons occasionally are found near water.

Geographic Inventory

A remnant of the Grand Prairie of Arkansas is located at grid reference XG06. The area comprises 8 hectares (20 acres) and contains plants native to the once vast tall grass prairies. Indian paintbrush is especially abundant. Although the site has experienced some disturbance, it should be preserved because of the scarcity of prairies in Arkansas.

The highest concentration of red-cockaded woodpeckers in Arkansas occurs in the southwest portion of the Greenwood quadrangle, roughly between grid reference XG05 and XH00. The areas delineated represent the densest colonies of this endangered species.

Lake Enterprise (grid reference XG35) is one of the few lakes in Arkansas having large quantities of Spanish moss draped over baldcypress trees. This location is near the northern limit for Spanish moss. Many of the baldcypress trees are large; indicating that the stand has not been cut in the recent past.

The northwestern and southwestern ends of Lake Washington (grid reference XG86) are shallow, marshy, and bordered by willows, baldcypress, and cottonwoods. During the late spring and summer, many birds can be found there. Among them are a number of heron and egret species, gallinules, and perching birds.

Nearby is the Yazoo National Wildlife Refuge at grid reference XG86. Wood ducks are particularly abundant here, where they nest and produce over 12,000 young annually. Of the 150,000 ducks that winter in the refuge, most are mallards. Sometimes 6,500 snow and greater white-fronted geese spend the winter here also. Perhaps the largest population of the endangered Florida panther in any refuge is believed to permanently reside here; it is estimated that a half dozen individuals may inhabit this area. Mississippi kites are common in spring and summer in large numbers, and the wild turkey population numbers around 300.

Up to 64,000 ducks and geese spend the fall and winter on the 6,070-hectare (15,000-acre) Hillside National Wildlife Refuge (grid reference YG56). Ducks are mostly mallards, northern pintails, northern shovelers, and teals. Canada geese with some snow geese number up to 2,000. Pied-billed grebes and great blue herons also are present, as well as a few transient bald eagles during the winter. Northern harriers are common, as are beaver and white-tailed deer. Bobcat and coyote are present, but in low numbers.

Cut-off Creek Wildlife Management Area (grid reference XH30) is one of the few state-owned public hunting areas in southeast Arkansas and, consequently, receives considerable hunting pressure. The area is flooded in the fall and winter to attract ducks to the bottomland hardwoods. Good populations of white-tailed deer, squirrels, and furbearers exist on this 3,485-hectare (8,612-acre) reserve.

Lake Chicot (grid reference XG68), an oxbow of the Mississippi River, is lined with baldcypress trees. This area, along with adjacent Lake Chicot State Park, provides habitat for a variety of bird species. Ruddy ducks are common in fall along with migrating tree, bank, barn, and cliff swallows. Many perching birds can be found here in summer.

Leroy Percy State Park and Wildlife Management Area (grid reference XG97) contains bottomland hardwoods and game species common to this type of habitat, including waterfowl, mourning dove, wild turkey, white-tailed deer, squirrels, and swamp rabbits. The same can be said for Leflore County 16th Section Wildlife Management Area (grid reference YG48) and for Morgan Brake National Wildlife Refuge (grid reference YG68).

When flooded, Lake Bolivar (grid reference XH72) occupies 485 hectares (1,200 acres). From late October to March, nearly all species of ducks using the Mississippi Flyway may be found on the lake. In March, there are frequently large flocks of snow geese.

The threatened black bear has been recorded from grid reference YH10, one of only a few sightings in the area depicted on the Greenwood quadrangle.

Mathews Brake National Wildlife Refuge (grid reference YG59) has a high white-tailed deer population, but is of more importance to wintering and breeding waterfowl. It also has some value for long-legged wading birds and raptors. Good winter waterfowl habitats are found in several nearby areas between grid references YH40 and YG69.

Good winter waterfowl habitat at Old Orchard Lake (grid reference YH61) also attracts wintering bald eagles, long-legged wading birds, ospreys, and many white-tailed deer.

Just northward, at grid reference YH62, is one of only a few remaining areas in the Yazoo River basin containing relatively undisturbed habitat used by a wide diversity of wildlife. This hardwood area is an island amid a sea of soybean fields. Bald eagles sometimes migrate through, as do osprey. Other inhabitants include long-legged wading birds, dabbling ducks, wild turkey, reptiles, amphibians, white-tailed deer, bobcat, and river otter. Adjacent Sixmile Lake also attracts bald eagles in winter, as well as breeding and wintering dabbling ducks.

Good hunting for typical game species can be found at Malmaison Wildlife Management Area (grid reference YH73). Most sought species include ducks, mourning doves, wild turkeys, northern bobwhites, white-tailed deer, squirrels, and eastern cottontails.

The 1,367 hectares (3,378 acres) surrounding grid reference YH75 encompass one of the most important waterfowl wintering sites in the Mississippi portion of the Lower Mississippi Valley. The area is mostly low flood plain and swamp, and supports a high white-tailed deer population in addition to the waterfowl.

Big Island (grid reference XH74 to XH75) provides important habitat for black bears and wintering bald eagles. It contains the highest white-tailed deer and wild turkey populations per hectare (acre) in Arkansas. It also is valuable to furbearers, and some use is made by waterfowl.

The woods adjacent to Legion Lake at grid reference XH84 consist mostly of baldcypress and pecan. In May and early June, many birds nest here, including vireos and warblers. Pied-billed grebes nest in the aquatic vegetation. In May and September, great numbers of shorebirds or small waders, mostly consisting of several sandpiper species, gather on the mudflats.

4.6 THE HELENA QUADRANGLE

4.6.1 Aquatic Resources

Widespread Species

The aquatic resources depicted on the Helena quadrangle include several large river systems: the Tallahatchie-Coldwater, Big Sunflower, Mississippi, Saint Francis, White, and Arkansas Rivers. Within these river basins are a

number of aquatic habitats including main stem rivers, bayous, and flood plain oxbow lakes, borrow pits, chutes, swamps, and backwaters. These habitats support commercially and recreationally important warm water fish species including catfish; buffalo; gar; freshwater drum; carp; bowfin; paddlefish; white and black crappie; largemouth, spotted, yellow, and white bass; sauger; and several sunfishes. Turtles and bullfrogs also are important.

Many of the aquatic habitats depicted on the Helena quadrangle have been degraded due to agricultural pollution, sedimentation, and channelization. Additionally, limited access inhibits fishing activity. In general, those aquatic systems delineated on the map are of relatively good quality as fish habitat; those which are labelled with species are particularly notable either for their commercial or recreational importance.

The American alligator is widely distributed in this area, especially in the swamps, rivers, lakes, bayous, and backwaters. American alligator populations may be either native or transplanted from Louisiana.

Geographic Inventory

The Yacona (grid reference YH58 to YH78), Old Little Tallahatchie (grid reference YH58 to YJ70), and the upper Coldwater (grid reference YJ52 to YJ64) Rivers contain the tailwaters of Enid, Sardis, and Arkabutla Lakes (grid reference YJ64 to YJ74); the former two lakes are depicted on the adjacent Tupelo quadrangle. These cooler, clearer, riverine waters tend to have a higher fish productivity than the surrounding rivers.

Arkabutla Lake (grid reference YJ74 to YJ65) is a COE reservoir, with relatively turbid water. It provides good crappie and moderately good bass sportfishing.

One of the most significant aquatic features on the Helena quadrangle is the Mississippi River and its associated flood plain (grid reference XH86 to YJ47), in particular the wetlands lying within the flood plain. The main stem river generally has low productivity due to high turbidity, high current velocities, and shifting substrate. In addition, the fast and variable currents make sport and commercial fishing dangerous. However, the main stem littoral areas, chutes, and especially backwaters, flood plain lakes, and numerous borrow pits, formed during construction of manmade levees, have been highly productive sites for most commercial and sport fisheries, particularly during spring flooding. Currently, however, the Mississippi River is stressed by the elimination of backwater flooding and direct connections to the river. The river also is carrying a very heavy load of pesticides and other pollutants.

Mississippi River oxbow lakes within the levees, such as those at grid reference XH98 to YH08 and grid reference XH98 to XH99, Horseshoe Lake in Mississippi (grid reference YH19 to YJ10), Tunica Lake (by Hardin Point, grid reference YJ23 to YJ34), Council Lake (grid reference YJ35 to YJ36), and Horn Lake (grid reference YJ57), support a large commercial and sport fishery. Oxbow lakes outside the levees, such as Old Town Lake (grid reference YJ00 to YJ01), Moon Lake (grid reference YJ21), and Horseshoe Lake in Arkansas (grid reference YJ46), support a less productive fishery. The commercial fishery of

the Mississippi River in Shelby County, Tennessee (grid reference YJ47), currently is closed due to chlordane pollution; this closure soon may extend into Mississippi.

A major commercial fishery exists on the Saint Francis River (grid reference YJ23 to YJ17). In particular, this river is one of the two rivers in Arkansas that supports a large mussel harvest; the other river with a major mussel harvest is the White River, described below. Probably the only remaining viable population of the fat pocketbook pearly mussel, which is on the Federal list of endangered species, is found on a portion of the Saint Francis River (grid reference YJ17 and continuing onto the adjacent Memphis quadrangle).

The White River system (grid reference XH76 to XJ37), including the Cache River (grid reference XJ54 to XJ57), produces the second most valuable fishery in Arkansas. The White River is one of the only two rivers in Arkansas that supports a major commercial mussel harvest. The endangered fat pocketbook pearly mussel historically was found in the White River, last being sampled 20 years ago; however, sampling during 1981 and 1982 along the White River from the mouth to Newport, which includes the entire stretch of river depicted on the Helena quadrangle, yielded no individuals. As a result, it is presumed that the species has been extirpated from this reach of the White River.

Lake Greenlee, just southeast of Brinkley (grid reference XJ66), is managed by the Arkansas Game and Fish Commission for recreational fishing, primarily for crappie and sunfish. The levees around this rectangular lake prevent the entrance of silt and pesticides from farming operations, which have degraded the fishing in most of the natural lakes in this portion of Arkansas.

The Arkansas River (grid reference XH56 to WH99) provides one of the major fisheries resources in Arkansas, having produced 30 to 40 percent of the state's commercial fishery revenues during the past several years. Major species include the flathead, channel, and blue catfish, and the bigmouth, smallmouth, and black buffalo.

Commercial fishing on Bayou Meto (grid reference XH47 to WJ94), a tributary to the Arkansas River, has been closed above State Highway 11 (grid reference XH38) due to pesticide contamination of fish tissues.

Halowell Reservoir (grid reference XH29) is managed by the Arkansas Game and Fish Commission for recreational fishing.

4.6.2 Terrestrial Resources

Widespread Species

The widespread species found in the area depicted on the Helena quadrangle include mourning doves, northern bobwhites, nutria, muskrats, skunks, rabbits, and many species of birds, as well as other wildlife common to the Lower Mississippi Valley. Open land wildlife occur throughout this map, but woodland wildlife are most abundant west of the Mississippi River where a greater amount of forest land remains. Common woodland species are wild turkey, white-tailed deer, bobcat, raccoon, and squirrels. Bald eagles and peregrine falcons occasionally are found near water.

Geographic Inventory

The Arkansas River levee system around grid reference XH27 offers productive habitat for many birds. From mid-April through May, woods and thickets concentrate migrating and nesting perching bird species, including flycatchers, kinglets, vireos, and warblers. Migrating species pass through again in fall; nesting species breed and occupy the area during summer. Swallows, raptors, herons, and egrets are numerous, and in fall American white pelicans travel down the river. Gulls and many species of sparrows spend the winter here.

The 4,050-hectare (10,000-acre) Bayou Meto Wildlife Management Area (grid reference XH38 to XJ10) is flooded each fall to attract ducks. The bottomland hardwoods here are among the most significant stands remaining on the Helena quadrangle. Squirrel hunting usually is excellent and hunting for swamp rabbit, furbearers, and white-tailed deer also is good.

White River National Wildlife Refuge (grid reference XH76 to XJ71) attracts one of the largest concentrations of wintering waterfowl in the lower Mississippi Flyway. Over 400,000 ducks and 6,000 geese winter on the 45,326-hectare (112,000-acre) refuge, containing bottomland hardwoods, lakes, and bayous. These bottomland hardwoods are among the last significant stands in the area depicted on the Helena quadrangle. Within the refuge, a 394-hectare (973-acre) site provides an excellent example of a mature bottomland forest containing a number of large, uncut specimens, which have been recommended for inclusion in the National Natural Landmark program. White-tailed deer and wild turkey are especially abundant. One of the largest populations of black bear in the eastern United States is here, estimated at 125. The Florida panther probably inhabits the area, and approximately a half dozen golden and bald eagles stop over in winter. Also in winter, great flocks of robins often arrive; in one recent year, 8 million were estimated.

O'Keefe Wildlife Management Area (grid reference YH58) provides hunting for a number of game specimens such as American woodcock, ducks, northern bobwhite, wild turkey, white-tailed deer, swamp rabbit, squirrels, and furbearers.

On Moon Lake (grid reference YJ21) during winter, a variety of water birds and waterfowl can be found, including horned grebe, mallard, and several other species of ducks, as well as many kinds of perching birds.

Near Turner, Arkansas, is a flooded tupelo-gum swamp on Big Cypress Creek (grid reference XJ81). It is the only swamp of its kind in the area. Some lumbering has occurred in the past and threatens the site in the near future.

Red-cockaded woodpeckers have been found at grid reference XJ72.

Low-lying areas along the White River and its tributaries, in the vicinity of grid reference XJ53, have over 40,000 hectares (a hundred thousand acres) of low and high flood plain habitat of breeding and wintering value for waterfowl. In addition, bald eagles use the area in winter, and wild turkey and white-tailed deer are present year-round.

The 28 hectares (70 acres) of prairie at grid references XJ23 is essentially virgin prairie, meaning it has never been plowed. There are very few such sites remaining, and this site is the best extant representative relict of the Grand Prairie of Arkansas. Although it has been hayed annually, it supports most of the plant species native to the Grand Prairie. The site also has contained the only known nesting population of flycatchers in the area.

The many ponds around the fish hatchery at grid reference XJ04 attract a diversity of shorebirds and ducks during spring and fall migrations, especially from mid-July through September. During this period, the ponds are thick with transient plovers, sandpipers, yellowlegs, phalaropes, gulls, and terns.

The largest remnant of the Grand Prairie in Arkansas lies along the right-of-way of the Rock Island Railroad at grid reference XJ25. Some of the area has been disturbed, but sites north of the tracks tend to be least disturbed of any sites of this vegetation type remaining in existence. The area has been recommended for the National Natural Landmark program.

During winter, the woodlands on Dagmar Wildlife Management Area (grid reference XJ56) often are flooded to attract ducks, mostly wood ducks and mallards. Other common game species include squirrels rabbits, and white-tailed deer.

Wintering and breeding habitat for ducks, as well as permanent habitat for wild turkey and white-tailed deer, is found along the L'Anguille River (grid reference XJ97 to YJ13).

Saint Francis National Forest (grid reference YJ13) covers nearly 8,500 hectares (21,000 acres). It is managed for multiple uses, including cattle grazing, timber, recreation, and wildlife. The area was lumbered heavily during the early part of this century and is now in an even-aged condition. Today's stands of hardwoods are among the finest in Arkansas.

Large numbers of ducks are present in winter on Horseshoe Lake in Arkansas and adjacent lakes (grid reference YJ46). Over 10,000 ruddy ducks have been counted, as well as substantial numbers of species such as mallard, gadwall, American wigeon, ring-necked duck, and American coot. Up to 6,000 coots have been seen at one time.

4.7 THE MEMPHIS QUADRANGLE

4.7.1 Aquatic Resources

Widespread Species

The aquatic resources depicted on the Memphis quadrangle include several large river systems: the Mississippi, Saint Francis, and White Rivers. Within these river basins are a number of aquatic habitats including main stem rivers, bayous, impoundments, and flood plain oxbow lakes, borrow pits, chutes, swamps, and backwaters. The western portion of the quadrangle contains several upland streams characterized by relatively cool, clear, fast-flowing water. Some, such as the Little Red and upper White Rivers, contain the tailwaters of

large reservoirs. These aquatic systems support commercially and recreationally important fish species including catfish; buffalo; gar; freshwater drum; carp; bowfin; paddlefish; white and black crappie; largemouth, spotted, yellow, and white bass; sauger; and several sunfishes. Turtles and bullfrogs also are sought.

Many of the aquatic habitats depicted on the Memphis quadrangle have been degraded due to agricultural pollution, sedimentation, and channelization. In general, those aquatic systems delineated on the map are of relatively good quality as fish habitat; those which are labelled with species are particularly notable either for their commercial or recreational importance.

The northern end of the American alligator's range occurs in this area. The species is found mainly in the swamps, rivers, lakes, bayous, and backwaters of flood plains. American alligator populations may be either native or transplanted from Louisiana.

Geographic Inventory

The Mississippi River and its associated flood plain lying within the levees (grid reference YJ47 to YK73) provide several habitat types for aquatic species. The main stem river generally has low productivity due to high turbidity, high current velocities, and shifting substrate. In addition, the fast and variable currents make sport and commercial fishing dangerous. The main stem littoral areas, chutes, and especially backwaters, flood plain lakes (for example, North Horn Lake at grid reference YJ57), and numerous borrow pits, formed during construction of manmade levees, are highly productive and are the sites for most commercial and sport fisheries. These habitats are particularly productive during spring flooding. However, the commercial fishery of the Mississippi River in Shelby County, Tennessee (grid reference YJ47 to YK61), currently is closed due to chlordane pollution. A similar action is being considered for the adjacent Arkansas waters.

The blue sucker, which is threatened in Tennessee, has been collected in the Mississippi River around Memphis (grid reference YJ69 to YK62), although it probably occurs over a larger stretch of the river.

The Saint Francis River (grid reference YJ17 to YK38), although greatly channelized, supports a major commercial fishery, mainly downstream of the Saint Francis Sunken Lands Wildlife Management Area (grid reference YK34). In particular, this river is one of only two rivers in Arkansas that supports a large mussel harvest. The other river with a major commercial mussel harvest is the White River, described below.

Probably the only remaining viable population of the endangered fat pocketbook pearly mussel is found on a portion of the Saint Francis River (grid reference YJ17 to YJ18, continued from the adjacent Helena quadrangle).

Big Lake (grid reference YK57 to YK67), in the Big Lake National Wildlife Refuge, is at the terminus of one of the largest drainage systems in the southern United States, the Saint Francis River Basin Project. Fishing in Big Lake was outstanding at one time, but deteriorated as the five canals which drained into it brought pesticides and silts; new diversions bypass the lake except during flooding and, as a result, sportfishing is improving.

Bordering Big Lake National Wildlife Refuge, Mallard Lake (grid reference YK67) is managed by the Arkansas Game and Fish Commission. This lake is known for its largemouth bass, since it contains fish in the 4.5-kilogram (10-pound) and up class.

Several other Arkansas Game and Fish Commission-managed lakes are located in the east-central portion of this quadrangle, including Lake Poinsett (grid reference YK13), Lake Hogue (grid reference XK83), and Lake Frierson (grid reference YK08). The latter lake ranks as one of the best sunfish, largemouth bass, catfish, and crappie lakes in the northeast section of Arkansas. These lakes provide sportfishing opportunities in an area where the quality of natural fishing sites has declined due to agricultural operations.

The White River system (grid reference XJ37 to WK97), including the Cache River (grid reference XJ57 to XK74), lower Little Red River (grid reference XJ49 to XK20), and Black River (grid reference XK54 to XK68), produces the second most valuable fishery in Arkansas. The White River, along with the Saint Francis River, are the only two rivers in Arkansas that support major commercial mussel harvests. The endangered fat pocketbook pearly mussel historically was found in the White River, last being sampled 20 years ago; however, sampling during 1981 and 1982 along the White River from the mouth to Newport (grid reference XK54) did not yield any individuals. As a result, it is presumed that the species has been extirpated from this reach of the White River.

The White River upstream from Batesville, Arkansas (grid reference XK25) contains the tailwaters of Bull Shoals Lake (located on the Harrison quadrangle to the northwest). The cool, clear river water supports several cool water sport fish species including rainbow trout, smallmouth bass, and walleye. The White River was the first in Arkansas to be stocked with trout (in the early 1950's); it now is considered one of the best trout streams in the southern United States and supports a large sport fishery. Larger and more plentiful rainbow trout and some brown trout are found in the cooler waters closer to the Bull Shoals Dam, 193 kilometers (120 miles) upstream from Batesville. The White River upstream from U.S. Highway 167 at Batesville is closed to commercial fishing.

The Little Red River upstream of grid reference XK12 contains the tailwaters of Greers Ferry Lake (grid reference WK93). This reach rivals the White River for its rainbow trout fishing and also is considered one of the best trout streams in the southern United States. Walleye also is sought in this portion of the river. The Little Red River is closed to commercial fishing upstream from U.S. Highway 167 near Searcy, Arkansas (grid reference XK10).

Greers Ferry Lake (grid reference WK93) is a popular sportfishing reservoir, containing such cool water species as rainbow trout, smallmouth bass, and walleye. One of the best known walleye areas in Arkansas, fishing is especially intense in the spring when the fish ascend feeder rivers to spawn. The sunshine bass, a hybrid of striped and white bass, is stocked in Greers Ferry Lake.

Lake des Arc (grid reference XJ37) is managed by the Arkansas Game and Fish Commission for sportfishing. This lake is a prime example of the need for

a public fishing lake in an area with an abundance of natural waters, but where fishing has declined due to farming operations.

4.7.2 Terrestrial Resources

Widespread Species

Species common to the Lower Mississippi Valley as a whole are widespread throughout the area depicted on the Memphis quadrangle. Black bear, bobcat, and red fox are uncommon species that generally may be found in suitable habitat in the area depicted on this quadrangle. Abundant species with widespread distributions include common snipe, rails, American woodcock, woodpeckers, wild turkey, white-tailed deer, beaver, mink, gray fox, nutria, muskrat, coyote, swamp rabbit, squirrels, skunks, and eastern cottontail. Bald eagles and peregrine falcons, both species with special status, occasionally are found near water.

Geographic Inventory

Most of the 4,450 hectares (11,000 acres) around Hurricane Lake Wildlife Management Area (grid reference XK40) are flooded in fall to provide excellent duck hunting. Squirrel and swamp rabbit populations are also high.

Bald eagles, as well as white-tailed deer and wintering ducks, utilize the White River at grid reference XJ48.

Migrating and wintering bald eagles also can be found along the Cache River (grid reference XJ57 to XK75). This 17,800-hectare (44,000-acre) area of bottomland hardwoods provides habitat for many rare wild flowers. Some of the best duck hunting in the United States can be found here, as many waterfowl overwinter in the basin. Unusual animals include ruddy duck, purple gallinule, grasshopper sparrow, sedge wren, pied-billed grebe, and least bittern. Other species present are river otter, bobcat, white-tailed deer, wild turkey, and aquatic furbearers.

Bayou DeView (grid reference XJ67 to XK83) occupies 6,368 hectares (15,736 acres) and is among the top areas of importance to waterfowl in the Arkansas portion of the Lower Mississippi Valley. It is valuable for both wintering and breeding ducks. Unusual waterfowl here include ruddy duck, purple gallinule, and pied-billed grebe. The bottomland hardwoods are also important for the rare grasshopper sparrow, wild turkey, white-tailed deer, and bobcat. The area serves as a concentration site for river otter, squirrels, and aquatic furbearers.

Village Creek State Park (grid reference YJ09) has sizeable populations of wildlife, including a diversity of perching birds. Several species of dusky and mole salamanders occur here, but are rare elsewhere in the area. Unusual plant distributions within the park, include yellow lady's slipper, ginseng, tulip tree, white walnut, and schizandra vine.

Yellow-crowned night-herons have nested at grid reference YJ68, along with woodpeckers and a wide variety of perching birds, especially warblers.

Meeman-Shelby Forest State Park (grid reference YK61) contains bottomland hardwoods of high importance to wild turkey. Wild turkey populations here are the highest in Tennessee. Ospreys are raised and released, and Mississippi kites are summer residents; bald eagles sometimes winter in the area. The scarlet woodbine, a plant listed as threatened by Tennessee, also has been recorded here. Over 150 white-tailed deer per year are harvested from the forest.

Mississippi kites, peregrine falcons, and nesting Bachman's sparrows have been reported in an area adjacent to Meeman-Shelby Forest State Park (grid reference YK71).

On Wapanocca National Wildlife Refuge (grid reference YK51) up to 100,000 ducks spend the winter, along with 20,000 geese. Woodpeckers of many species are abundant, as are numerous songbird species. Bald eagles are winter residents. Species in high concentrations include mallards, ruddy ducks, and Canada geese. Owls are common; Mississippi kites and wood ducks breed in the refuge.

The Indiana myotis inhabits caves at grid reference XK07 and the gray myotis breeds at grid references XK07, XK06, and XK26. The latter cave (grid reference XK26) contains the largest known breeding colony of gray myotis in Arkansas. Other bat species also are present, including the big brown and evening bats.

Habitat for wintering bald eagles occurs at grid reference XK85 and YK04. These areas also support migrating and wintering waterfowl, resident white-tailed deer, and northern harrier.

While unusual, the grasshopper sparrow has been recorded in summer from grid reference YK16. A variety of other perching birds can be observed here, together with short-eared owls.

A nearby forest at grid reference YK16 contains many large specimens of most tree species common to the region. The area is a fine example of an upland hardwood forest.

Saint Francis Sunken Lands Wildlife Management Area is scattered for 48 kilometers (30 miles) along the Saint Francis River flood plain (grid reference YK34 to YK38). These sites provide some excellent duck hunting. Besides waterfowl, the area offers good squirrel and white-tailed deer hunting in the bottomland hardwoods.

One of the nation's oldest refuges is Big Lake National Wildlife Refuge (grid reference YK67 to YK58). Its 2,833 hectares (7,000 acres) has nearly every species of duck common to the Mississippi Flyway during migration. Some ducks winter, at times peaking at 25,000, plus 3,000 Canada geese. Many songbirds arrive in spring and, although unconfirmed, the Bachman's warbler is believed by some to be here at times. This refuge contains 2,023 hectares (5,000 acres) of virgin cypress swamp and flooded timberland. It is one of the most important natural areas in the Lower Mississippi Valley and has been recommended for inclusion in the National Natural Landmark program. A portion

of the refuge has been designated as Big Lake Wilderness, the only national wilderness area within the Lower Mississippi Valley study region.

Big Lake Wildlife Management Area (grid reference YK68) is one of the last remaining large tracts of bottomland hardwoods in northeast Arkansas. There are few roads through its 4,921 hectares (12,160 acres). The area is traversed by numerous canals and drainage ditches, and portions are flooded each fall and winter for waterfowl hunting.

4.8 THE BLYTHEVILLE QUADRANGLE

4.8.1 Aquatic Resources

Widespread Species

The aquatic resources depicted on the Blytheville quadrangle are part of two major river systems, the Mississippi on the west and Tennessee on the east. Within these basins are a number of aquatic habitats in both the alluvial plain and adjacent uplands: rivers, streams and associated impoundments, and flood plain lakes, borrow pits, chutes, swamps, and backwaters. These habitats support commercially and recreationally important fish species including catfish; buffalo; gar; freshwater drum; carp; bowfin; paddlefish; white and black crappie; largemouth, spotted, yellow, and white bass; sauger; and several sunfishes. Turtles and bullfrogs also are sought.

Many of the aquatic habitats depicted on the Blytheville quadrangle have been degraded due to agricultural pollution, sedimentation, and channelization. In general, those aquatic systems delineated on the map are of relatively good quality as fish habitat; those which are labelled with species are particularly notable either for their commercial or recreational importance.

Geographic Inventory

The Tennessee River (grid reference CP97 to DQ08) is the fifth largest river in the United States in terms of flow. It has been highly altered by virtue of the nine locks and dams on the main stem. The second in the series, the Pickwick Lock and Dam (grid reference CP88) is within the study region. Upstream of the dam are the lentic waters of Pickwick Lake (grid reference CP88 to CP97). Downstream of the dam are the lotic waters of Kentucky Lake (grid reference CP88 to DQ08), the largest and longest of the main stem reservoirs. The Tennessee River provides abundant sport and commercial fishing opportunities for smallmouth, bigmouth, and black buffalo; blue and channel catfish; freshwater drum; crappie; carp; sauger; paddlefish; white and yellow bass; largemouth, smallmouth, and spotted bass; bluegill and other sunfishes; and walleye in the tailwaters. Unlike the other states in the Lower Mississippi Valley study region, crappie and temperate basses are harvested commercially in Tennessee.

The waters of Kentucky Lake (grid reference CP88 to DQ08) support an extensive commercial mussel fishery consisting mainly of the block, washboard, and maple leaf mussels. Because the lotic habitat of upper Kentucky Lake is similar to the conditions that existed before the Tennessee River was extensively impounded, the Pickwick Dam tailwaters support what are now rare

species. In particular, the reach from just below the dam (grid reference CP88) to grid reference DQ02 is believed to harbor four mussels on the Federal list of endangered species: the pink mucket pearly mussel, white wartyback pearly mussel, orange-footed pearly mussel, and rough pigtoe pearly mussel. Currently, it is not apparent whether the pink mucket and white wartyback pearly mussel populations in the Pickwick Dam tailwaters are reproducing; there is evidence that the orange-footed pearly mussel is reproducing marginally, while the rough pigtoe apparently is existing in non-reproducing relict beds. This reach also supports four river snails that are being proposed for Federal protection: the potentially endangered verrucose, rugged, and mainstream river snails and the potentially threatened geniculate river snail. It is possible that all these populations are relict.

Two mussel sanctuaries have been established in Kentucky Lake to protect mussel beds from gravel dredging operations. They are located from Pickwick Dam downstream 3.2 kilometers (2 miles) (grid reference CP88) and grid reference DQ13 downstream to grid reference DQ16 (both grid references refer to the adjacent Columbia quadrangle).

The tributaries to the Tennessee River in Hardin, Decatur, Perry, and Benton Counties, Tennessee (generally, east of grid reference CP77 to CQ78) are cool water streams that support good sport fisheries, especially for largemouth and spotted bass, sauger, warmouth, and other sunfishes. The mouths of these rivers provide a large commercial fishery.

The multipurpose reservoirs of the Beech River Development Authority (grid reference CQ73, CQ74, and CQ85) are managed for public sportfishing. Maple Creek Lake (grid reference CQ86) is owned and managed by the State of Tennessee for sportfishing.

The Wolf River (grid reference BP97 to BP29) and Loosahatchie River (grid reference CQ00 to BQ20), both tributaries to the Mississippi River, at one time supported major fish populations. However, channelization and agricultural operations have reduced the productivity of these systems.

Herb Parsons Lake (grid reference BP69) and Whiteville Lake (grid reference CQ00) are owned and managed by the State of Tennessee for sportfishing.

The Hatchie River (grid reference CP47 to BQ33) has been designated by Tennessee as a Class I scenic river. It is the only remaining unchannelized river in western Tennessee. The river and its backwaters provide good sportfishing for catfish, spotted and largemouth bass, sunfish, and crappie, and commercial fishing for catfish, buffalos, carp, and suckers. Because of its relatively pristine condition, the Hatchie River supports several rare species that at one time were common. The blue sucker, threatened in Tennessee, is seasonally common in the Hatchie River and makes upstream spawning migrations in the late winter and early spring. The Hatchie River is one of the last refuges in Tennessee for the scaly and naked sand darters, both deemed by the state to be in need of management, and supports probably the healthiest remaining North American population of the northern madtom, deemed by the Tennessee Natural Heritage Program as a species of special concern.

The Hatchie River also supports rich and diverse mussel populations; the lower Hatchie River in particular, is one of the few remaining areas containing many shellfish native to the Mississippi River basin. A survey during 1980 to 1981 yielded 29 species including both shells and live specimens. Several of these species are unique, including five which have never been reported from the direct drainage of the Mississippi River in west Tennessee (Fusconaia ebenus, Plethobasus cyphus, Pleurobema cordatum, Unio merus tetralasmus, and Leptodea laevis); two which have never been reported from west Tennessee (Unio merus declivus, often considered synonymous with U. tetralasmus, and Corbicula fluminae); and two which have never been reported from Tennessee (Obovaria jacksoniana and Villosa vibex).

The Forked Deer-Obion River system (grid reference CQ50, CQ65, CQ37, and BQ68 to BQ67) at one time supported major fish populations. However, channelization and agricultural operations have degraded the habitat and fish productivity. Commercial fishing is most active on the lower Forked Deer River (grid reference BQ67 to BQ56) which lies within the Mississippi River flood plain.

Humbolt Lake (grid reference CQ26) is owned and managed by the State of Tennessee for recreational fishing.

The Mississippi River and its associated flood plain (grid reference BQ22 to BQ58) provide several habitat types for aquatic species. The main stem river generally has low productivity due to high turbidity, high current velocities, and shifting substrate. In addition, the fast and variable currents make sport and commercial fishing dangerous. However, the main stem littoral areas, chutes, and especially backwaters, flood plain lakes, and numerous borrow pits, formed during construction of manmade levees, are highly productive and are the sites for most commercial and sport fisheries. Examples of these flood plain areas include Crutcher and Healthright Pocket Lake (grid reference BQ44 to BQ45), Open Lake (grid reference BQ56), and Chisholm Lake (grid reference BQ66 to BQ67). These habitats are particularly productive during spring flooding.

4.8.2 Terrestrial Resources

Widespread Species

Terrestrial species with special status that may be found in suitable habitat throughout the area depicted on the Blytheville quadrangle include river otter, black-crowned night-heron, sharp-shinned and Cooper's hawks, and Bewick's wren. Osprey occur in the northwest portion, while grasshopper sparrows inhabit the northern and western regions. Mississippi kites breed in summer in the western portion, along the Mississippi River. The western pygmy rattlesnake and northern pine snake are confined to the eastern region.

Prevalent wildlife that generally may be found throughout the Blytheville quadrangle include common snipe, rails, woodpeckers, mourning dove, wild turkey, bobcat, white-tailed deer, beaver, mink, gray fox, nutria, muskrat, coyote, swamp rabbit, squirrels, skunks, and eastern cottontail.

Geographic Inventory

Golden seals, listed as threatened plants by the State of Tennessee, Mississippi kites, northern harriers, bald eagles, peregrine falcons, ospreys, grasshopper sparrows, and Bachman's sparrows all have been recorded in the vicinity of Memphis, Tennessee (grid reference BP29 to BP49). Mississippi kites, peregrine falcons, grasshopper sparrows, and Bachman's sparrows also have been recorded from grid reference BQ21 to BQ41, and Mississippi kites and ospreys have been sighted near grid reference BQ43.

Bald eagles, Bachman's sparrows, and river otters have been recorded along and just north of the Wolf River between grid reference BP78 and BP98.

The woods on the plantation at grid reference BP98 consist of about 20 hectares (50 acres) of mixed oaks and gum hardwood forest which have not been cut in this century. Many of these trees are nearly 76 centimeters (30 inches) in diameter.

Records exist for transient Mississippi kites, bald eagles, ospreys, and Bachman's sparrows at grid reference CP29.

The woods at grid reference CQ10 compose a small but impressive mixed oak forest containing many trees greater than 91 centimeters (36 inches) in diameter; two trees are over 127 centimeters (50 inches) in diameter. This stand is probably the finest remaining example of an oak slope forest in west Tennessee. One windthrown tree was calculated to be 450 years old. This site has been designated a National Natural Landmark.

The 4,539 hectares (11,215 acres) of Chickasaw State Rustic Park and Forest (grid reference CQ31) is valuable for forest game and non-game wildlife. White-tailed deer are numerous, and beaver, coyote, and squirrels can be found here. Northern harriers and two Tennessee-listed threatened plants, the purple fringeless orchid and scarlet woodbine, have been recorded nearby between grid references CQ41 and CQ44.

Spring and summer records of Bachman's sparrow have occurred at grid reference CP58.

Northern harriers, bald eagles, peregrine falcons, ospreys, grasshopper sparrows, and Bachman's sparrows have been recorded east of the Tennessee River in the vicinity of grid reference CP99. Downstream, sightings of two Tennessee-listed threatened plants, the water-purslane and little glade-cress, were mapped near grid references CQ81 and CQ91 to DQ02, respectively.

Hatchie National Wildlife Refuge (grid reference BQ93) comprises 4,677 hectares (11,556 acres) of beautiful bottomland hardwoods with meandering streams, oxbow lakes, and uplands. It supports an abundance of wildlife including white-tailed deer, wild turkey, beaver, waterfowl, and a variety of small land birds in greater numbers than anywhere else in the region. Wintering waterfowl number up to 60,000 with 75 percent mallards. Other ducks are gadwall, northern pintail, teals, American wigeon, canvasback, and redhead. Canada and snow geese number up to 5,000. Northern harriers, golden eagles, and Bachman's sparrows have been recorded just north of the refuge near grid reference BQ95.

The Lower Hatchie National Wildlife Refuge is found to the west at grid reference BQ44. The 2,590 hectares (6,400 acres) are mostly high and low flood plain, with prime bottomland hardwood habitat along the only remaining unchanneled stream of significance in west Tennessee. The area supports peak wintering waterfowl populations of 20,000. The diverse wildlife include over 200 species of mammals and birds. Perching birds concentrate here and many breed, including the rare Swainson's warbler. Many threatened and endangered species with special status can be found, such as Mississippi kite, overwintering bald and golden eagles, osprey, Cooper's hawk, and nesting Bewick's wren. The largest known concentration of river otter in Tennessee occurs here.

The area at grid reference BQ55 is an outstanding example of a bottomland hardwood cypress swamp. It has high quality habitat for river otter, long-legged wading birds, and raptors, including bald eagles. Dabbling ducks concentrate here in winter and some breed in summer.

Nesting locations for herons and egrets have been recorded at grid references BQ46, BQ37, and BQ67.

The bottoms adjacent to the Mississippi River at grid reference BQ67 are the largest remaining tracts of quality bottomland hardwoods habitat in Tennessee. Waterfowl populations peak at 125,000 and over 200 species of birds can be found here at one season or another. The same species with special status occurring on the Lower Hatchie National Wildlife Refuge also can be found, along with summering Indiana myotis. Wild boar inhabit the area and the highest wild turkey hunting kills in Tennessee have occurred here. Mississippi kites, bald eagles, peregrine falcons, and grasshopper sparrows have been recorded in adjacent lands to the east (grid reference BQ77).

Moss Island Wildlife Management Area (grid reference BQ68) has 1,295 hectares (3,200 acres) for waterfowl migration stopover, breeding, and hunting. Wild turkeys, white-tailed deer, squirrels, and raccoons also are common.

The lands at grid reference BQ67 to BQ77 are a concentration area for breeding and wintering waterfowl. Bald eagles also winter here, and river otter, wild turkey, and white-tailed deer are permanent residents.

Breeding locations for the least tern and bank swallow are unusual in the region depicted on this map, but occur at grid reference BQ58.

At grid reference BQ98, the 1,578-hectare (3,900-acre) Tigrett Wildlife Management Area has had peak duck populations of 3,600 and average populations of 1,200. Waterfowl are attracted to the area for resting, feeding, and breeding, but other wildlife also use the area, such as small wading birds, aquatic furbearers, and many non-game species.

Areas along the middle and south fork Forked Deer Rivers (grid reference CQ07 and CQ05) provide valuable wetlands as winter habitat for up to 19,000 ducks. They are significant for wood duck breeding, and have good habitat for furbearers and small wading birds.

The Big Sandy River and flood plain (grid reference CQ75 to CQ88) are very valuable for indigenous wildlife including white-tailed deer, waterfowl, aquatic furbearers, perching birds, and other non-game species.

Spring and summer sightings of Bachman's sparrow have occurred in the vicinity of grid reference CQ84.

The highest white-tailed deer concentration in west Tennessee or on any wildlife management area in the state has been recorded on Natchez Trace State Resort Park and Forest (grid reference CQ86). Between 400 and 500 white-tailed deer per year are killed during hunting season. Wild turkey populations are also high on this 18,212-hectare (45,000-acre) refuge. Ginseng has been recorded in the park at grid reference CQ87.

Arctic peregrine falcons and gray myotis bats have been recorded from areas just west of Kentucky Lake near grid reference CQ94 to DQ04.

Tennessee National Wildlife Refuge at grid reference DQ05, DQ06, and DQ08 has over 20,640 hectares (51,000 acres) of land and water. Waterfowl are abundant, with wintering concentrations sometimes reaching 60,000 Canada geese, the largest flock in the South. Up to 300,000 ducks, mostly mallards, are here in winter. More than 30 bald eagles and 30 golden eagles have been counted; this is the largest concentration of wintering golden eagles anywhere this far east in the United States. Many other raptors utilize the area, including northern harriers, Cooper's and sharp-shinned hawks, and many mammals. Great blue herons have had 30 nests here, which represents the largest colony in Tennessee.

4.9 LIST OF SOURCES FOR THE LOWER MISSISSIPPI VALLEY STUDY REGION

The List of Sources has been expanded into a matrix (Table 6), linking individual reference sources to the topics for which each reference was used in the preparation of the inventory maps and report.

Table 6. List of sources for the Lower Mississippi Valley study region.

	AQUATIC										TERRESTRIAL										QUADRANGLES					
	Land Use/Land Cover	Species with Special Status	Plants	Invertebrates	Fishes	Reptiles and Amphibians	Mammals	Plants	Invertebrates	Small Wading Birds	Long-Legged Wading Birds	Waterfowl	Raptors	Seabirds	Perching Birds	Non-Perching Land Birds	Fowl-Like Birds	Reptiles and Amphibians	Mammals		Natchez	Jackson	Greenwood	Helena	Memphis	Blytheville
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Table 6 (continued).

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Table 6 (continued).

	AQUATIC										TERRESTRIAL							QUADRANGLES					
	Plants	Invertebrates	Fishes	Reptiles and Amphibians	Mammals	Plants	Invertebrates	Small Wading Birds	Long-Legged Wading Birds	Waterfowl	Raptors	Seabirds	Perching Birds	Non-Perching Land Birds	Fowl-Like Birds	Reptiles and Amphibians	Mammals	Natchez	Jackson	Greenwood	Holena	Memphis	Blytheville
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Table 6 (continued).

	AQUATIC					TERRESTRIAL										QUADRANGLES									
	Land Use/Land Cover	Species with Special Status	Plants	Invertebrates	Fishes	Reptiles and Amphibians	Mammals	Plants	Invertebrates	Small Wading Birds	Long-Legged Wading Birds	Waterfowl	Raptors	Seabirds	Perching Birds	Non-Perching Land Birds	Fowl-Like Birds	Reptiles and Amphibians	Mammals	Natchez	Jackson	Greenwood	Helena	Memphis	Blytheville
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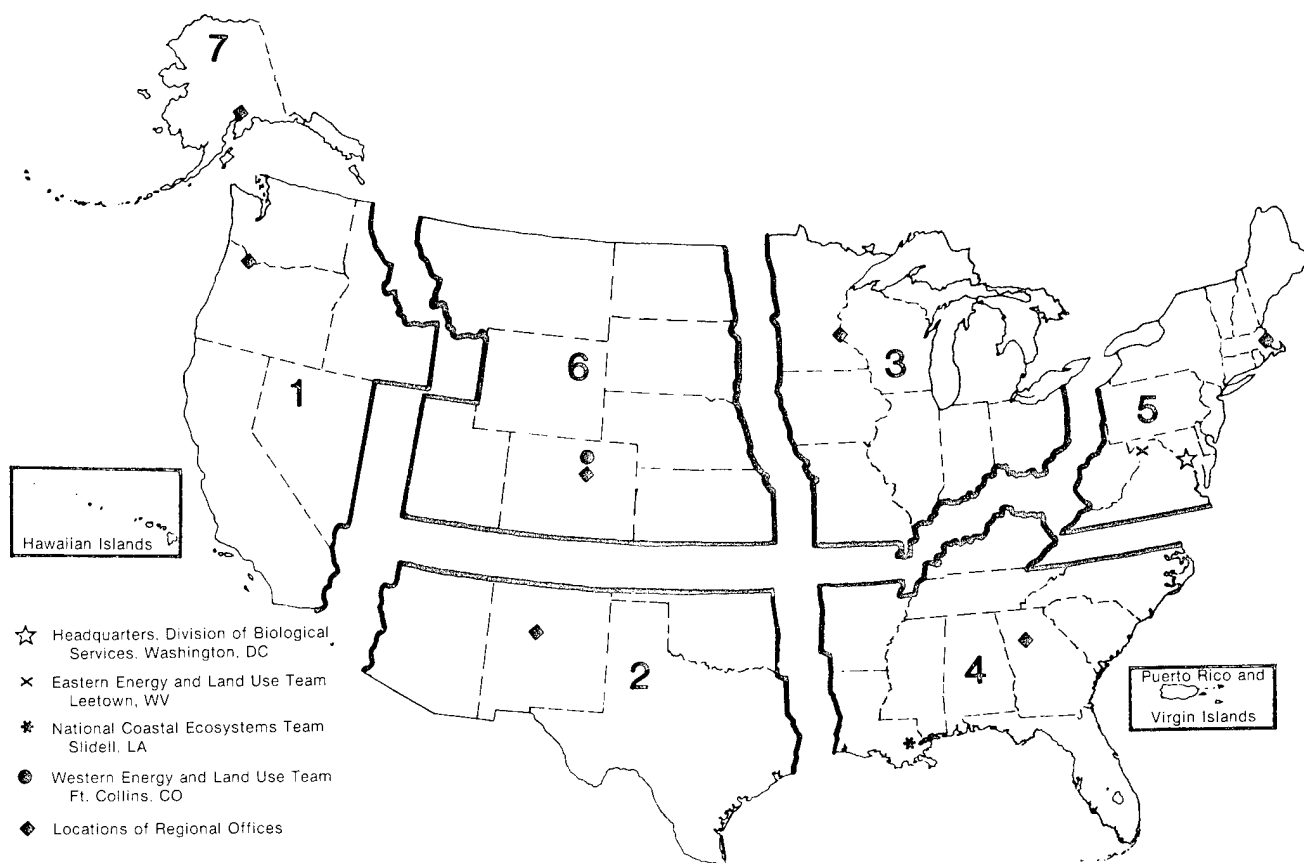
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Table 6 (continued).

	Land Use/Land Cover		AQUATIC				TERRESTRIAL												QUADRANGLES					
	Species with Special Status	Plants	Invertebrates	Fishes	Reptiles and Amphibians	Mammals	Plants	Invertebrates	Small Wading Birds	Long-Legged Wading Birds	Waterfowl	Raptors	Seabirds	Perching Birds	Non-Perching Land Birds	Powl-Like Birds	Reptiles and Amphibians	Mammals	Natchez	Jackson	Greenwood	Helena	Memphis	Bienville
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16. Abstract (Limit: 200 words) This study provides an inventory of important ecological resources along the lower Mississippi River, an area of some 126,200 square kilometers (48,700 square miles). This inventory is intended to provide government and industry decisionmakers with valuable ecological information which will assist in the regional siting of oil and gas processing and manufacturing facilities and their respective transportation systems. The preparation of this ecological inventory involved four major tasks: the collection, review, and analysis of available data on fish and wildlife species and their habitats and special land use areas; the synthesis and compilation of these data into a format which is compatible with the requirements of 1:250,000-scale mapping; the preparation of a series of six resource inventory graphics for the Lower Mississippi Valley; and the preparation of a report narrative keyed to the inventory graphics. Ecological resources are summarized by their appropriate 1:250,000-scale USGS quadrangle, and descriptions and locations of species with special status and aquatic and terrestrial species of high commercial, recreational, and aesthetic value are included. The designation of more than 82 special land use areas along the lower Mississippi River also is provided.		13. Type of Report & Period Covered Final Report	
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