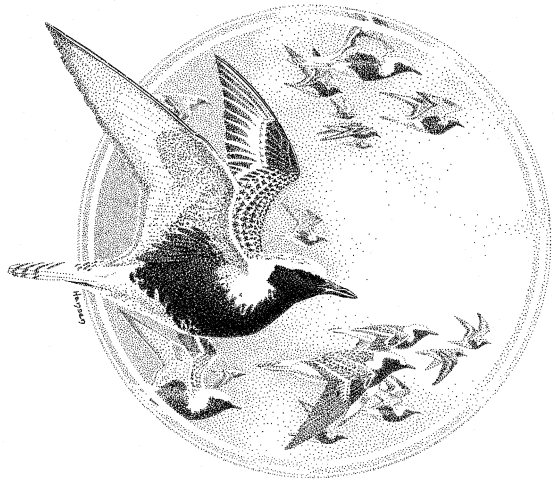
U.S. SHOREBIRD CONSERVATION PLAN

LOWER MISSISSIPPI VALLEY/WESTERN GULF COASTAL PLAIN



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EXECUTIVE SUMMARY

Of the 43 species recorded in the MAVGCP, 32 occur regularly. Species of concern span a variety of habitats and foraging guilds – from terrestrial gleaners (American Golden-Plover) to aquatic probers (Least Sandpiper).

Whereas several species winter and breed in MAVGCP, most of the shorebirds found in this region utilize the area as stopover habitat. Clearing of much of the Mississippi Alluvial Valley, with resulting open agricultural fields, has resulted in tremendous potential for providing shorebird habitat. Supplying the necessary mix of water depth and vegetative structure at the appropriate times is the most important management issue in this region.

Habitats in the region that possess the greatest potential for shorebirds include agricultural fields, moist soil impoundments, semi-permanent impoundments, and aquaculture ponds. Recommended management practices for each of these habitat types are described in this plan. Because of the abundance of agricultural and aquacultural land with water control capabilities, and the prevalence of water management for waterfowl in the region, opportunities for shorebird habitat management are substantial. Perhaps the factor most important to maintaining and increasing habitat for shorebirds in the MAVGCP is outreach and education. Providing land managers and supervisors with specific management information (migration chronology, water depth and vegetation density tolerances, etc.) should facilitate an increase in the quality and quantity of shorebird habitat in the region.

Regional habitat objectives previously were set for the Lower Mississippi Valley by the Lower Mississippi Valley Migratory Bird Initiative based on fall population estimates. Two general aspects of these objectives are in particular need of attention: (1) testing assumptions of the model upon which habitat objectives are based, (2) inclusion of the West Gulf Coastal Plain BCR in the model. Because the habitat objectives model is based on untested assumptions regarding population size, obtaining better estimates of population abundance and chronology are the highest research priorities. Of the two assumptions of the model that have been tested, one (food density) appears to be valid and one (habitat carrying capacity; *i.e.* birds per ha) is suspect.

Coordination of continued planning, implementation, and evaluation of this plan will be provided by the Lower Mississippi Valley Joint Venture Office. Interested members of the Regional Working Group will serve as a technical advisory team, providing input to the LMV Joint Venture with regards to the biological foundation and evaluation of shorebird habitat management objectives.

DESCRIPTION OF THE REGION

The Mississippi Alluvial Valley/West Gulf Coastal Plain (MAVGCP) planning region (Figure 1) includes portions of Texas, Oklahoma, Arkansas, Louisiana, Missouri, Kentucky, Tennessee, and Mississippi, and consists of two Bird Conservation Regions: the West Gulf Coastal Plain/Ouachitas (WGCP; BCR 25) and the Mississippi Alluvial Valley (MAV; BCR 26). The dominant vegetative component of the WGCP is forest, principally shortleaf pine in the north, longleaf pine in the south, and hardwood dominated systems in the river bottoms and floodplains. This is a relatively heavily populated region, with present rural land use dominated by pine silviculture and hayed/grazed pasture. The MAV is an alluvial floodplain, which was mostly hardwood forest prior to European settlement. Today, roughly 75% of the forest has been cleared and replaced by other land uses, predominantly row crop agriculture. Dominant crops include soybeans, corn, grain sorghum, and rice.

Historically, there likely was substantial shorebird habitat within the extensive mudbars, sandbars, and drying oxbows and sloughs of the major rivers (Arkansas River, Red River, Sabine River, Mississippi River, etc.). However, construction of levees, wingdams, reservoirs, and other changes to the hydrology of these systems has seriously altered their natural functions. Whereas the forest-dominated systems of this region probably offered limited habitat value for most shorebirds (Twedt et al. 1998), clearing of much of the Mississippi Alluvial Valley, with resulting open agricultural fields, has increased this region's potential for providing shorebird habitat. Water management capability on agricultural fields (particularly rice fields) and aquaculture facilities, along with frequent inundation of fields by spring floodwater further enhance this region's value to shorebirds. Providing the necessary mix of water depth and vegetative structure at the appropriate times is, perhaps, the most important management issue in this region.

SHOREBIRD SPECIES OCCURRENCE AND PRIORITIES

Forty-three shorebird species have been recorded in the region, with 32 species occurring regularly (Tables 1 and 2). Few shorebird species breed in the planning region (Killdeer, Black-necked Stilt, Spotted Sandpiper, American Woodcock), whereas many more pass through in migration (Table 1). Migrant shorebird populations typically peak in the MAVGCP from August through October, and from April to mid-May.

According to the USSCP prioritization matrix, Piping Plover and Eskimo Curlew are the only species in the region considered Highly Imperiled. Because Piping Plover are listed as Threatened by the U.S. Fish and Wildlife Service, this plan will not address their conservation in detail (see Haig 1992). It is important to note, however, that Piping Plover migration routes and ecology in this region remain poorly known (S. Haig, pers. comm.). Furthermore, the Piping Plover Recovery Team no longer exists. Hence, any additional information regarding this species in the planning region is of great value. Eskimo Curlew are Federally Endangered and thought to be extinct.

Among species of High Concern, only American Golden-Plover and American Woodcock have area importance scores ≥4, whereas Wilson's Phalarope, Buff-breasted Sandpiper, Ruddy Turnstone, Red Knot, Sanderling, Hudsonian Godwit, and Marbled Godwit have area importance scores of 3 (Appendix A).

Highly Imperilied and High Concern species span a variety of habitats and foraging guilds, including terrestrial gleaner (Piping Plover, American Golden-Plover), terrestrial/aquatic gleaner/prober (Ruddy Turnstone, American Woodcock), aquatic/terrestrial gleaner (Red Knot, Buff-breasted Sandpiper), aquatic prober/gleaner (Sanderling), and aquatic gleaner (Wilson's Phalarope: Appendix A). Hence, there is no clear pattern with respect to species priorities and habitat type.

HABITAT REPORT

HABITAT FOR SHOREBIRDS

Shorebird habitats in the region include riverine mudbars, riverine sandbars, oxbows, margins of borrow pits, margins of stock ponds, margins of large reservoirs, aquaculture (baitfish, crayfish, catfish) ponds, sewage treatment lagoons, flooded agricultural fields, and managed impoundments. Most of the existing and potential shorebird habitat in the region is found in flooded agricultural fields, aquaculture ponds, and managed impoundments.

Agricultural Fields

There are over 5.5 million ha of agricultural land in the Mississippi Alluvial Valley, with the majority occurring in Arkansas, Louisiana, and Mississippi. Aquatic probers and gleaners (i.e. dowitchers, Pectoral Sandpiper) typically utilize shallowly flooded and/or moist ag fields, whereas terrestrial gleaners (i.e. Buff-breasted Sandpiper, Black-bellied Plover) also can be found in drier habitats such as turf farms. The majority of agricultural acreage in the region has no water control capability. However, a significant portion has the capacity for water management. In Arkansas, Louisiana, and Mississippi over 800,000 ha are in rice production, and these areas potentially could be managed for shorebirds. Natural flooding on the remaining agricultural land during spring likely provides a significant amount of shorebird habitat during most years. However, the extent and frequency of this habitat is unknown. Ducks Unlimited and partners in the Lower Mississippi Valley Joint Venture are developing a GIS model that will attempt to quantify the area of the 2-10 year natural flood in the MAV. This information should better elucidate the availability and predictability of naturally flooded habitat.

Specific Management Practices: Winter

Between November and February, when the majority of wintering waterfowl occurs in southern regions, agricultural fields managed for dabbling ducks are typically flooded 20 cm (Ringelman 1990), which is too deep for most shorebirds. Wintering shorebirds in the extreme southern

portion of the region, such as Long-billed Dowitchers (*Limondromus scolopaceus*), require areas with water depth of ≤10 cm, whereas Dunlin (*Calidris alpina*) and Western Sandpipers (*C. mauri*) require mudflats and water depths <5 cm. Staggered water depths within and between fields during this period will provide foraging opportunities for a variety of species. Fields not flooded by irrigation can have levees pulled up or gates put in, for gradual flooding by winter rains. This maneuver will benefit several waterbird groups.

As is generally the case, fields with sparse or no vegetation are more attractive to the most common shorebird species in this region. In agricultural fields in Arkansas and Mississippi, winter shorebird densities were higher in flooded soybean fields than in rice fields or moist soil habitats (Twedt et al. 1998), presumably because soybean fields had less vegetative cover. Augustin (1998), however, found substantially lower benthic invertebrate biomass in a flooded soybean field (0.02 g/m^2) than in a flooded moist soil impoundment (1.9 g/m^2) during fall in west Tennessee. Furthermore, soybean fields typically are not associated with water control structures, and therefore may offer limited opportunity for managed flooding. Reasons for high densities of shorebirds in soybean fields in Twedt et al.'s (1998) study, given the low biomass of invertebrates found in the west Tennessee soybean field (Augustin 1998) require further investigation.

Specific Management Practices: Spring Migration

In most years there are many areas that are naturally flooded, typically into May. Some agricultural fields flooded for dabbling ducks over winter are drawn down quickly in early spring to prepare fields for planting. These fields, planted in long-season crops, such as corn or rice, can be drawn down slowly beginning in late February through March so that early migrant shorebirds are provided with invertebrates. Fields planned for crops with a shorter growing season, such as soybeans and milo, can be drawn down slowly in late March or early April to provide habitats for later migrating shorebirds. During the spring, fields flooded for winter waterfowl that are to be left fallow (unplanted), should not be drawn down completely until late May to ensure that habitat remains for late migrating shorebirds. Water also should be held as long as possible before preparing fields for later crops such as cover crops or millet.

Specific Management Practices: Summer/Fall Migration

Agricultural fields are harvested from July to November, depending on the number of crops, the planting date, and the type of crop. Between late July and September, shallowly flooded fields (1-15 cm) will provide foraging opportunities for southbound shorebirds such as the Semipalmated (*Calidris pusilla*) and Pectoral (*C. melanotos*) Sandpipers, as well as early migrating Blue-winged Teal (*Anas discors*).

Many fields, such as rice fields, have contour levees used to regulate water depths during the growing season. After harvest, rice fields can be rolled with a water-filled drum or shallowly disked to remove stubble. This creates open areas preferred by shorebirds. Flooding contoured fields to different water depths creates feeding opportunities for different shorebirds. Several

level fields without contours should be flooded to different depths to provide foraging opportunities for different waterbird guilds (e.g. 5 cm, 10 cm, 15 cm).

In the southern portion of the planning region, shallow flooding of fallow or harvested fields for shorebirds in late summer typically results in abundant vegetation growth. For these areas to be of maximum use to shorebirds, vegetation must be mechanically reduced by rolling or shallow disking – sometimes as many as 2-3 times during southward migration (June-October).

Aquaculture Ponds

Commercial aquaculture ponds are distributed throughout the region. Crawfish farms are prevalent in Louisiana, catfish farms in Mississippi, and baitfish ponds in Arkansas. These areas likely provide a significant amount of shorebird habitat because they contain numerous small basins that are periodically drawn down. Data collected by U.S. Fish and Wildlife Service biologists in 1995 and 1996 suggests that as many as 531,000 shorebirds may use these habitats in the MAV during southward migration. Whereas all three types of aquacultural practices hold potential for providing shorebird habitat, crawfish production has been studied relatively more extensively in this regard, and is covered in more detail below. Further assessment of shorebird use of aquaculture ponds and realistic opportunities for management (especially on baitfish and catfish production facilities) will be essential to refining habitat goals and objectives.

Crawfish Impoundments

Impoundments managed for commercial crawfish production represent a substantial potential for providing shallow water and mudflat habitat for shorebirds. Land area in crawfish production in 1998 within the West Gulf Coastal Plains Planning Region of Louisiana exceeded 17,000 ha. Crawfish production follows one of two general cycles of (a) crawfish--dryland crop (e.g. soybeans) or fallow--rice, or (b) crawfish--rice. Timing of de-watering in the regular production cycle often coincides with periods of high shorebird abundance. For example, if the crawfish harvest (typically no later than May) is to be followed by a fallow period, then water may be left on the field to draw down naturally through late summer/early fall when shorebirds are migrating south.

Daily shorebird densities on crawfish basins experimentally allowed to remain flooded until July/August can be very high (42 birds/ha; J. Huner unpubl. Data). Rettig (1994) reported a single-day shorebird density of 133 birds/ha on an 18.8-ha crawfish complex in southwest Louisiana in August 1992. Although this habitat occupies a relatively small portion of the landscape, crawfish ponds often represent a large proportion of the available shallow water habitat in the region during early southward migration (July/August; Rosenberg and Sillett 1991, Rettig 1994).

Even though crawfish ponds can provide substantial shorebird habitat in late summer/fall, availability of habitat within these basins is unpredictable. Availability of shorebird habitat depends on the timing of water level management and vegetative density. The precise sequence

of events within crawfish operations varies among farms and years, depending on rainfall, commodity prices, geographic location, etc. Hence, there may be a variety of opportunities for accommodating shorebirds in particular crawfish farm management schemes. Researchers at the University of Louisiana at Lafayette Crawfish Research Center presently are investigating management options that optimize shorebird habitat and crawfish production.

Specific Management Practices

Availability of shorebird habitat within aquaculture ponds depends entirely on timing of drawdown. Timing of drawdowns to coincide with shorebird migration should be similar to that recommended above for agricultural fields. Hence, further attention should be placed on understanding and working with the management of these operations, particularly rotations of crayfish/rice/fallow in crayfish ponds. Emphasis should be placed on supporting research efforts aimed at elucidating management schemes that are compatible with crawfish production while simultaneously providing habitat for shorebirds, particularly in late summer/early fall. Opportunities for education and extension relative to the value of crawfish farms to shorebirds and other wildlife (i.e. wading birds) should be explored. Clearly, slight modification of water and vegetation management on a small proportion of the aquaculture ponds in this region could result in a large increase in shorebird habitat.

Managed Shallow Impoundments

Managed impoundments in the region have been managed predominantly for migrating and wintering dabbling ducks. Management for migrating and wintering dabbling ducks and shorebirds are not mutually exclusive (see Gray et al. 1999, Short 1999). However, shorebird tolerances for vegetative density and water level generally are narrower than those of most dabbling ducks. Furthermore, timing of southward migration in shorebirds is somewhat earlier than for most dabbling ducks species. Hence, to optimize shorebird habitat on managed impoundments, it is necessary to give special consideration to the timing and extent of drawdown, and to vegetation manipulation (Short 1999).

Because shorebirds generally use only the shallowest portions of a wetland (0-18 cm), substantial control over water level in impoundments is desirable. Fine-tuned control of water levels can be facilitated by at least two factors: small basin size and shallow boards in the water control structure. Because less water must be moved in or out, management units of 5-10 ha allow timely maintenance of appropriate depths. Also, 5-cm and 7.5-cm vs. standard 10-cm flashboards allow for more precise maintenance of water depth.

The Lower Mississippi Valley Joint Venture office conducted an intensive survey of all public managed wetlands in the MAV (Table 3). The survey specifically tallied acreage of units managed primarily for shorebirds. Managed units were defined as those where hydrology is actively controlled through the use of dikes, levees, or water-control structures to benefit migrating/wintering shorebirds. Shorebird habitat was quantified as the maximum area intentionally flooded in late summer-autumn for migrating shorebirds, and totaled 599 ha.

Specific Management Practices: Spring Migration

Spring shorebird migration in the MAVGCP occurs between mid-February and late May (Helmers 1992). Moist-soil units suitable for spring shorebird management require fall flooding approximately one month before the first heavy freeze, and maintenance of flooded conditions over winter to enable chironomids (*Chironomus spp*.) and other invertebrates to re-populate, as well as to assure survival of larvae over winter. During the spring migratory period, units should be drawn down slowly, 2-3 cm/week to allow for continuous availability of invertebrates (Rundle and Fredrickson 1981 and Hands et al. 1991). Units planned for spring shorebird management should have extensive areas of open water with generally less than 50% dense emergent vegetation. This will allow shorebirds to forage in open shallow water and mudflats as drawdown occurs (Rundle and Fredrickson 1981, Hands et al. 1991, Helmers 1991). If more than one unit is being drawn down for shorebirds, staggering the initial drawdown dates will extend the availability of habitat and provide resources throughout the migratory period. This slow and staggered drawdown of moist-soil units will not only provide resources for shorebirds and other species, but will also promote a diversity of vegetation communities (Fredrickson 1991).

Specific ManagementPractices: Summer/Fall Migration

The summer/fall shorebird migration period is much more extended than the spring migration, generally occurring between mid-July and late October. Management for summer/fall shorebird habitats includes two different strategies. Moist soil-units that remained flooded through spring and early summer can be drawn down or units that are dry can be reflooded. If units were flooded through spring and early summer to provide habitats for breeding herons and rails, then natural evaporation or slow drawdowns make invertebrates available to shorebirds and concentrate prey for other waterbirds (Reid 1989).

If dry units are to be flooded for shorebirds, units should be shallowly flooded 10-15 cm 2-3 weeks before summer/fall migration begins. This will allow invertebrates to re-populate the newly created habitats (Rundle and Fredrickson 1981, Hands et al. 1991, Helmers 1991). Usually the vegetation must be manipulated by disking before re-flooding to assure shorebird response. The type of disking is critical since the rationale behind this manipulation is to convert plant biomass to a detrital base attractive to invertebrates. Deep disking that completely buries plant material is less desirable than shallow disking that only partially buries plant biomass. Thus, shallow disking acts as man-induced senescence and provides excellent substrates for invertebrates, whereas deep disking buries the plant biomass and reduces the availability of plant material for invertebrate processing (Fredrickson and Reid 1986).

Moist-soil units may need reconditioning every several years to remove undesirable vegetation. Reconditioning units through shallow disking and reflooding can provide excellent opportunities for shorebird management during the summer. As with spring management, staggering the manipulations within several units extends the availability of habitats.

Drawdown management of units through retention of water retained from spring is, perhaps, the most desirable approach to providing shorebird habitat in managed units for several reasons (Twedt et al. 1998). First, floodwater typically is scarce in late summer/fall, and pumping can be expensive. Second, weedy vegetation can rapidly invade areas that have been disked and flooded. Finally, bird densities on areas that have been drawn down tend to be higher than densities in areas that are "flooded up" (Twedt et al. 1998), probably due to greater invertebrate densities in areas that have been inundated for a longer duration.

Semi-permanent Wetlands

Semi-permanent or permanent wetlands without water control capabilities also provide foraging sites for shorebirds if appropriate habitats are available. Short, sparse vegetation, shallowly flooded during early spring, can provide foraging habitats within wet meadow zones (Colwell and Oring 1988, Eldridge 1990). Summer/fall drawdowns from natural evaporation also provide habitats for south-bound migrants (Hands et.al. 1991). During periods of natural drawdown, dense emergent vegetation can be reduced by burning or mowing the edges. When basins are reflooded from precipitation or winter snow melt, shallowly flooded habitats will be available at wetland edges the following spring. Removing dense vegetation from wetlands by burning or mowing after basins have dried in late summer or fall will provide additional foraging areas for migrant shorebirds the following spring.

Semi-permanent and permanent wetlands with water control can be drawn down in a fashion similar to those described for moist-soil units. However, complete drawdowns are not always necessary if wetlands are sufficiently large (>20 ha) and have low relief (< 1 m).

Existing Areas of Importance to Shorebirds

Arkansas
Bald Knob NWR
Cache River NWR*
Ed Gordon/Point Remove WMA
Oakwood Unit
Overflow NWR*
Wapanocca NWR*
White River NWR*

Louisiana
Bayou Cocodrie NWR*
Catahoula Lake
Grand Cote NWR*
Lake Ophelia NWR*
Mollicy Unit (Upper Quachita NWR)
Ouachita WMA
Sherburne WMA
Tensas River NWR*

Mississippi
Dahomey NWR*
Morgan Brake NWR*
St. Catherine Creek NWR*
Coldwater River NWR
Yazoo NWR*

Missouri
Duck Creek Conservation Area
Otter Slough

Tennessee
Eagle Lake State Refuge
Ensley Bottoms (Earth Complex)
Island 13
Phillipy Pits
Black Bayou State Refuge
White Lake State Refuge

*National Wildlife Refuges considered "High Priority Refuges for Shorebird Management" by Rettig and Aycock (1994).

Other sites with potential for high shorebird use

- Bayou Pierre WMA (Louisiana)
- Boeuf WMA (Louisiana)
- Borrow Pits inside Miss. River levees
- Lower Hatchie NWR (Tennessee)
- Mississippi River sandbars and pools
- Old oxbows used by farmers for irrigation
- Pomme de Terre WMA (Louisiana)
- Red River Valley (Arkansas)
- Reelfoot Lake WMA (Tennessee)
- Soda Lake WMA (Louisiana)

THREATS AND SOLUTIONS

Agricultural Fields

Agriculture in the MAVGCP is among the most productive on the continent, and appears to be under little threat of reduction. However, habitat value of these lands to most shorebirds depends upon the timing and extent of the presence of surface water and the density of standing vegetation. The dominant management issues in this habitat are ensuring that fields are flooded and/or drawn down during periods when shorebirds can use them, and that residual vegetative structure is reduced by mowing, burning, or disking.

Aquaculture Ponds

Maintaining or increasing shorebird habitat on aquacultural facilities will depend on effective information transfer to and from farm operators, while concurrently working to increase knowledge regarding how standard farming practices affect shorebird habitat and how these reasonably can be adjusted to better accommodate shorebirds.

Managed Shallow Impoundments

Because managed shallow impoundments have been traditionally managed primarily for migrating and wintering waterfowl, management of these habitats requires only slight modification to better accommodate shorebirds. One of the "threats" to these basins as habitat for shorebirds is the notion that managing for waterfowl and shorebirds is mutually exclusive. Well-planned and carefully documented demonstration projects whereby the needs of dabbling ducks and shorebirds are included and optimized in the management scheme might help alleviate such concerns (*see* Short 1999).

All Habitat Types

Actions of public and private organizations, through ongoing non-regulatory programs, have substantial effects on land use practices in the region. Establishing linkages with these organizations which facilitate promotion of shorebird habitat conservation likely will contribute to achieving this plan's goal.

REGIONAL GOALS & OBJECTIVES

Setting conservation objectives for shorebirds is complicated by this region's uncertain historical and present role in shorebird life history. Channelization, draining, and construction of dams and levees have altered the natural hydrology of most major rivers and tributaries. This likely has reduced the quantity and quality of natural shallow water and mudflat habitats associated with these streams. For example, a free-flowing Mississippi River may have provided abundant

shorebird habitat in the form of extensive sandbars, mudflats, and oxbows, especially in fall when stream flow typically is low. Hence, this region may have been relatively important continentally to shorebirds during migration prior to large-scale alteration of rivers and streams.

Substantial numbers of shorebirds presently are found in the MAVGCP during winter and migration. Because of the shift in land use from forest to agriculture, an abundance of actual and potential shorebird habitat now exists. Land cleared for agriculture is the relatively flat, and flood-prone river valleys offer exceptional potential for shorebird habitat. Areas with water control capability, such as rice fields, aquaculture ponds, and moist soil management units offer even greater potential. Hence, there exists an opportunity to capitalize on changes to the landscape in the MAVGCP which may compensate for loss of historic shorebird habitat in the region, as well as habitat loss to the west in the Central Plains and to the east in the Southeastern Coastal Plains. Finally, the relatively high overlap between shorebird and dabbling ducks habitat makes incorporating shorebird management with ongoing management for wintering and migrating waterfowl an attractive and viable option. However, setting population and habitat goals for shorebirds in the planning region is hampered by a general lack of knowledge concerning populations sized, and the relative role and function of the region in the life histories of these populations.

Mississippi Alluvial Valley Migratory Bird Initiative Habitat Objectives

In 1995, the Mississippi Alluvial Valley Migratory Bird Initiative (MBI) developed management objectives for shorebirds within the Mississippi Alluvial Valley. To arrive at habitat objectives, a model with the following assumptions was used:

(1) Shorebird habitat is most limiting during fall, when surface water is relatively scarce
(2) Food is the limiting factor
(3) 500,000 shorebirds move through the LMV in fall
(4) Average length of stay is 10 days
(5) Shorebirds feed mainly on Chironomid larvae in fall, and density of this food is $2g/m^2$
(6) Average bird mass is 45g

This information, coupled with estimated energetic requirements, yields an estimated 2,000 ha of shorebird habitat needed in fall to meet the needs of shorebirds. The approach of the Lower Mississippi Valley Joint Venture has been to ensure that this habitat is provided on managed public lands, with the understanding that in "good" years adequate habitat is provided on private and un-managed lands. This objective, then, represents a "safety net" during years when habitat conditions outside of public lands are poor (i.e. drought).

The goal for shorebirds according to the MBI is to provide habitat on public managed land sufficient to accommodate all shorebirds that occur in the region during southward migration. This goal was stepped down to specific habitat objectives among the states as follows:

State	Hectares
Arkansas	520
Illinois	70
Kentucky	35
Louisiana	520
Mississippi	600
Missouri	70
Tennessee	185
Total	2000

One of the major problems with this approach from the Shorebird Plan perspective is that these figures apply only to the Mississippi Alluvial Valley, not the rest of the planning sub-region (West Gulf Coastal Plain). However, more fundamental questions relating to the assumptions of the model also require attention. These are detailed below.

Spring vs. Fall Habitat Limitation

The issue of spring vs. fall habitat limitation directly affects setting habitat objectives. Additionally, it is an especially important consideration on public areas where limited funds for providing water may preclude drawing units down (hence, providing mudflats) during spring because of the need to store water to provide fall habitat.

Whereas surface water certainly is more abundant in spring than in fall in most years, conservation planning regarding habitat for migrating shorebirds in spring should not be overlooked. Spring habitat conditions may have important implications for reproduction, and the window of opportunity for providing migration habitat is much narrower in spring than in fall. Also, migration patterns of some species would suggest that they are adapted to avoiding the typically dry interior habitats in fall migration, while using these interior habitats when they are wet in spring (e.g. Semipalmated Sandpipers: Gratto-Trevor and Dickson 1994). Finally, presence of shallow water does not necessarily equate to quality shorebird habitat. Hence, data are needed to determine the extent of natural flooding and the density of food present in available flooded habitats in spring.

Population Estimates

Meaningful habitat objectives must be based on population objectives. The MBI took the approach of estimating the number of shorebirds in the region during fall migration, and setting habitat objectives to be met on public managed land. This is a conservative approach, in that its purpose is to accommodate only the number of birds assumed to be in the region, and makes no attempt at increasing that number. This approach recognizes that habitat outside public managed areas exists, and that agencies with management responsibility should be prepared to provide for the habitat needs of shorebirds solely on public lands when habitat conditions elsewhere are poor (i.e. during a dry year). Taking this approach, two aspects of population estimation need to be

addressed: (1) estimates of bird numbers in the West Gulf Coastal Plain and (2) refined estimates of birds in the MAV.

As proposed by several members of the working group, a preliminary "snapshot" count of shorebirds at known concentration areas across the planning region was conducted in late August 1999. The purpose of was twofold: (1) initiate the collection of data on shorebird populations that pass through the region, and (2) poll the interest of skilled birders in participating in such an endeavor. A total of 22,981 individuals of 29 shorebird species was counted from 20-22 August 1999. Forty-five people participated in the survey, counting shorebirds at 62 sites in 6 states. Data from this count should be evaluated with the knowledge that the region was exceptionally dry prior to and during the count. Hence, shorebird habitat was very limited. In addition, several observers noted that shorebird numbers at the sites they counted had been declining for several weeks prior to the count. Drought conditions coupled with 2-3 weeks of emigration without noticeable replacement likely resulted in relatively low numbers of birds.

Despite the low bird numbers, several patterns emerge from the data. As might be expected, Pectoral Sandpiper, Least Sandpiper, and Killdeer were the most abundant species across the region. Although density estimates are not available due to lack of habitat area data reported for many sites, number of birds per site varied according to "management type". The sewage treatment site west of Memphis (Ensley Bottoms) hosted over 1600 shorebirds. This area has been known to hold 2-3 times this number of shorebirds during fall migration. Throughout the region, unmanaged sites had the lowest mean number of birds per site of all management types. Public managed sites (45%) and aquaculture ponds (29%) hosted the majority of birds. Results of this initial effort support the assertion that under dry conditions, public managed sites and aquaculture facilities provide a disproportionate amount of shorebird habitat during late summer/fall in the planning region.

Volunteer response to this opportunity was exceptional. It is intended that in the future the frequency and scope of these counts will be increased throughout fall and spring migrations. Tapping volunteer efforts may provide an efficient means of gaining much-needed population information.

Invertebrate Density

Data now are available relative to macroinvertebrate density in western Tennessee (Augustin et al. *in review*). Mean macroinvertebrate biomass in mudflats within managed impoundments (Eagle Lake State Refuge, Black Bayou State Refuge) was 2.17 g/m^2. This is very similar to the 2.0 g/m^2 assumed by the MBI habitat objectives model. However, benthic invertebrate density can vary by an order of magnitude among moist soil, soybean, and sewage treatment habitats (Augustin 1998, Augustin et al. 1998) during fall. Hence, the model should account for such variation when calculating habitat objectives. Also notable is the fact that Chironomid larvae composed a relatively small portion of the invertebrate biomass measured at these sites. Dominant potential prey items included Oligochaetes, Ceratopogonidae (biting midge larvae), Ostracoda (seed shrimp), Corixidae (water boatman), and baetid mayflies.

Habitat Carrying Capacity

Although the food density assumption of the model appears to be reasonable, data collected in 3 state management areas in west Tennessee (Eagle Lake State Refuge, White Lake State Refuge, and Black Bayou State Refuge/Reelfoot Lake WMA) suggest that shorebird densities on managed impoundments are below those predicted by the model. The MBI model assumes 2500 shorebird use days/ha, whereas in the best case on the management areas in Tennessee shorebird use days/ha were significantly lower (Short 1999). While it may be imprudent to adjust the model based in results of a single study, the relatively lower bird-use-days (compared to predicted carrying capacity) suggests that further validation of the model is needed. It is possible that habitat objectives produced by the MBI model need to be increased to account for this discrepancy, or management techniques need refinement and adjustment to accommodate a greater density of birds.

Based on the few adjusted population numbers provided by the working group (*see* Table 1), the current estimated fall shorebird population of 504,000 birds would require 2016 ha (an additional 16 ha compared to the MBI estimate) of habitat. However, until more data critical to testing the assumptions of the habitat model are available, few biologically-sound revisions to these objectives are possible. At a minimum, population estimates from the West Gulf Coastal Plains portion of the planning region should be incorporated into the model.

U.S. Shorebird Conservation Plan Goals & Objectives

Clearly, much of the information necessary to form a solid biological foundation for shorebird population and habitat objectives in this region is lacking. However, as we work to fill these information gaps, efforts to ensure that habitat for shorebirds in the MAVGCP is not limiting should be encouraged. This notion is especially realistic in light of the fact that the infrastructure (levees, water control structures, water sources, active hydrology management on public and private land, etc.) necessary to provide quality shorebird habitat presently exists. The following Goal and Objectives can be accomplished through education, outreach, and by slight modification of or increase in current practices and programs.

PRIMARY ASSUMPTION: Populations of shorebirds during the non-breeding season in the MAVGCP potentially are limited by foraging habitat, especially during southward migration

GOAL: Ensure that shorebirds using habitats in the planning region are not limited by availability of quality foraging habitat

OBJECTIVE 1: Provide late summer/fall (late July-October) habitat on public managed areas sufficient to accommodate the estimated fall flight of shorebirds through the region. The following specific actions are recommended to achieve this objective:

a) Encourage management for early (September) teal season habitat that results in some shorebird habitat in July and August.

- Including but not restricted to reducing standing vegetation by mowing or light disking prior to flooding

b) Find sources of funding for water.

- Local Audubon chapters
- State ornithological societies

c) Provide technical assistance and encouragement to management area and refuge managers

- Technical handbooks (I.D., habitat management, species chronology, etc.)
- Workshops with follow-up visits to evaluate management

d) Leadership by the LMV Joint Venture Office in planning for and monitoring of shorebird habitat on managed public lands has been valuable. Continued participation by the Joint Venture Office in this effort is essential.

OBJECTIVE 2: Increase late summer/fall habitat on private lands 25% by 2002

a) Aquaculture may provide some potential avenues for habitat in fall. This could be accomplished by:
- leaving water control structures closed after "normal" draining to hold rainwater in idle basins
- providing monetary and other incentives to farm operators for late summer drawdown

OBJECTIVE 3: Increase winter-flooded rice field acreage 25% by 2002 to provide winter and early spring migration habitat

a) Work with Rice Federation, extension services, private conservation organizations, and agricultural groups to increase awareness of the benefits of winter-flooded rice field management

b) Encourage farm operators to allow some water to remain on fields through March to accommodate early spring migrants

OBJECTIVE 4: Establish mechanisms and/or linkages that advance shorebird conservation in all relevant non-regulatory agencies and programs by 2001

Objectives 1-3 could be greatly enhanced by incrasing awareness within and working through existing public and private organizations and non-regulatory programs, such as:

- Arkansas RICE program
- Natural Resources Conservation Service
- Corps of Engineers
- Private lands programs
- Timber companies with managed water
- others

Much of this may be accomplished through partnerships already established within the LMV Joint Venture.

Research and Monitoring Needs

Current shorebird habitat objectives for this region are based on untested assumptions regarding shorebird population number and chronology during fall migration. Obtaining an improved population estimate based on sampling is the highest priority research need in the MAVGCP. Specifically, a more biologically sound habitat objective will require:

(a) minimum absolute abundance estimate for fall migration, and a
(b) measure of turnover rate.

Other assumptions of the MBI model (e.g. food density, carrying capacity) also require validation. Further, inherent in habitat-based objectives is the ability to monitor existing and future shorebird habitat. The framework and resources to accomplish this do not presently exist. Specific recommendations relative to detailed study descriptions and prioritization of research topics are being formulated by the Shorebird Working Group of the Lower Mississippi Valley Joint Venture Migratory Bird Science Team.

Funding Needs to Meet Regional Goals

Management Costs

- Pumping costs in late summer/fall
- Two-inch boards (to replace or augment standard 4-inch boards) for water control structures
- Addition of low semi-permanent levees within large basins to allow greater precision in water-level management

Technical Assistance

- Regional "Shorebird Technical Advisor" as central point of contact to:
    1. Facilitate and oversee timely updates of the conservation plan
    2. Conduct education and outreach to land owners, farmers, and general public
    3. Develop technical information manuals, pamphlets, etc.
    4. Generate interest and funding for shorebird conservation projects
    5. Provide technical input to the Joint Venture
- Management techniques manual
- Workshops and seminars for public and private land managers

Management Coordination

The Lower Mississippi Valley Joint Venture office will continue to provide management coordination within the planning region. The Shorebird Working Group of the Lower Mississippi Valley Joint Venture Migratory Bird Science Team will assist the Joint Venture office in planning, implementing, and evaluating conservation action on behalf of shorebirds.

Recognition of Contributors

This report is the result of exceptional efforts by numerous individuals and organizations. Doug Helmers' draft shorebird conservation plan for the Mississippi Alluvial Valley was used extensively in this report, especially with respect to specific management actions. Ducks Unlimited, Inc. contributed substantial amounts of staff time and funding to this effort. The following individuals and working group members contributed to this report:

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Table 1. Population estimates and season of occurrence of shorebirds in the Mississippi Alluvial Valley/West Gulf Coastal Plain planning region.

Species	MAVGCP[a]	Modified MAVGCP[b]	Seasonal abundance[c]
Black-bellied Plover	769		s, f
American Golden-Plover	449	3000	**S**, f
Snowy Plover	?	10	s (tr), f (tr)
Wilson's Plover	?		f (tr)
Semipalmated Plover	4,765		s, f
Piping Plover	121		s, f
Killdeer	91,838		S, F, W, B
Mountain Plover	?		w (tr)
Black-necked Stilt	778		s, f, b
American Avocet	232		s, f
Greater Yellowlegs	3,235		S, F, w
Lesser Yellowlegs	21,120		**S, F,** w
Solitary Sandpiper	?	1000	s, f, w
Willet	92		s, f
Spotted Sandpiper	4,112		s, f, w, b
Upland Sandpiper	237		s, f
Eskimo Curlew	?		**S, F**
Whimbrel	?		s (tr), f (tr)
Long-billed Curlew	?		s (tr), f (tr)
Hudsonian Godwit	?		s [d]
Marbled Godwit	39		S, f
Ruddy Turnstone	405		s (tr), f
Red Knot	162		s (tr), f
Sanderling	5,052		s, f
Semipalmated Sandpiper	37,713		S, F
Western Sandpiper	3,382		S, f, w
Least Sandpiper	151,119		S, F, w
White-rumped Sandpiper	221	500	s, f
Baird's Sandpiper	690		s, f
Pectoral Sandpiper	121,077		**S, F**
Dunlin	7,866		s, f, w
Stilt Sandpiper	3,310		s, f
Buff-breasted Sandpiper	964		s, f
Short-billed Dowitcher	1,121		s, f
Long-billed Dowitcher	1,121		S, F, w
Common Snipe	2,374		S, F, W
American Woodcock	?		W, B
Wilson's Phalarope	171		S
Red-necked Phalarope	?		s(tr), f(tr)
Red Phalarope	?		f (tr)

[a] from Hunter et al. (1996)

[b] Based on single-day maximum counts and other information from the working group.

[c] b=breeding, f=fall migration, s=spring migration, w=winter, (tr)=species occurs sporadically in very small numbers. **BOLD UPPER CASE** = region as/more important than other regions; UPPER CASE = region important; lower case = region not important relative to other regions. Eskimo Curlew likely extinct.

[d] at the western edge of the region only

Table 2. Conservation Priority Scores for shorebird species occurring within MAVGCP Region. PT=Population Trend; RA=(Global) Relative Abundance; TB=Threats Breeding; ; TN=Threats Non-breeding; BD=Breeding Distribution; ND=Non-breeding Distribution; AI=Area Importance. See pages 25-26 for explanation of scores.

	Priority score categories							Overall
Species	**PT**	**RA**	**TB**	**TN**	**BD**	**ND**	**AI**	**Regional priority**
Black-bellied Plover	5	3	2	2	2	1	3	3
American Golden-Plover	4	3	2	4	2	3	4	4
Snowy Plover	5	5	4	4	3	4	2	1*
Wilson's Plover	3	5	4	4	4	3	2	2
Semipalmated Plover	3	3	2	2	1	1	3	2
Piping Plover	5	5	5	4	4	4	3	5
Killdeer	5	1	3	3	1	2	4	3
Mountain Plover	5	5	4	4	5	4	2	1*
Black-necked Stilt	3	3	3	2	1	2	3	2
American Avocet	3	2	3	4	2	3	3	2
Greater Yellowlegs	3	4	2	2	2	1	4	3
Lesser Yellowlegs	3	2	2	3	2	1	5	2
Solitary Sandpiper	3	4	2	2	3	2	3	3
Willet	3	3	3	3	3	3	3	2
Spotted Sandpiper	3	3	2	2	1	1	3	2
Upland Sandpiper	2	2	2	4	2	3	3	2
Eskimo Curlew	5	5	3	4	5	5	5	5
Whimbrel	5	4	2	2	3	2	2	1*
Long-billed Curlew	5	5	3	3	3	3	2	1*
Hudsonian Godwit	3	4	3	4	4	4	3	4
Marbled Godwit	4	3	4	4	3	3	3	4
Ruddy Turnstone	4	3	2	4	2	2	3	4
Red Knot	5	2	2	4	3	3	3	4
Sanderling	5	2	2	4	2	1	3	4
Semipalmated Sandpiper	5	1	2	3	3	3	4	3
Western Sandpiper	3	1	2	4	4	2	3	3
Least Sandpiper	5	2	2	2	2	2	4	3
White-rumped Sandpiper	3	2	2	2	3	3	3	2
Baird's Sandpiper	3	2	2	2	3	3	3	2
Pectoral Sandpiper	3	2	2	2	2	3	5	2
Dunlin	5	2	2	3	2	3	3	3
Stilt Sandpiper	3	3	3	4	3	3	3	3
Buff-breasted Sandpiper	4	5	3	4	3	4	3	4
Short-billed Dowitcher	5	2	2	3	3	2	3	3
Long-billed Dowitcher	5	2	2	3	4	3	4	2
Common Snipe	5	1	2	2	1	2	4	3
American Woodcock	5	1	4	3	2	3	4	4
Wilson's Phalarope	4	1	3	4	2	5	3	4
Red-necked Phalarope	4	1	2	3	1	3	2	1*
Red Phalarope	4	1	2	3	2	1	2	1*

* Low regional priority due to its relatively low occurrence in the region (AI=2)

Curlew Sandpiper, Purple Sandpiper, Ruff, and Sharp-tailed Sandpiper also have been recorded in the planning region.

Priority Score Explanation (from Table 2)

1) Population Trend, PT

5 Significant population decline ($p<0.10$)
4 Apparent population decline
3 Apparently stable population or status unknown*
2 Apparent population increase
1 Significant population increase

*Note: If the population trend cannot be classified at all due to the lack of appropriate data, the PT score is represented as "U" for Unknown.

2) Relative Abundance,RA

5 ≤25,000
4 25,000 - <150,000
3 150,000 - <300,000
2 300,000 - <1,000,000
1 >1,000,000

3) Threats During Breeding Season, TB

5 Known threats are actually occurring (i.e. significant loss of critical habitat), and can be documented.
4 Significant potential threats exist (i.e. oil spills) but have not actually occurred
3 No known threats, or information not available
2 Threats assumed to be low
1 Demonstrably secure

4) Threats During Non-breeding Season, TN

5 Known threats are actually occurring (i.e. significant loss of critical habitat), and can be documented. Concentration results in actual risk.
4 Significant potential threats exist (i.e. oil spills) but have not actually occurred. Concentration results in high potential risk.
3 No known threats, or concentration not a risk, or information not available
2 Threats assumed to be low from all factors including concentration
1 Demonstrably secure

5) Breeding Distribution, BD

5 <2.5% of North America (212,880 sq. mi., or 551,493 km^2)
4 2.5-4.9% of North America
3 5-9.9% of North America
2 10-20% of North America
1 >20% of North America (1,703,008 sq. mi., or 4,411,940 km^2)

6) Non-breeding Distribution, ND

5 Highly restricted ≤ 50,000 sq. mi., or very restricted coastal areas, or interior uplands,
4 Local = 50,000 - 200,000 sq. mi., or ≤ 1,000 mi. of coast
3 Intermediate = 200,000 - 2,000,000 sq. mi., or along 1,000 - 3,000 mi. of coast
2 Widespread = 2,000,000 - 4,000,000 sq. mi., or along 3,000 - 5,000 mi. of coast
1 Very widespread = 4,000,000 - 7,000,000 sq. mi., or along 5,000 - 9,000 mi. of coast

Criteria for Priorities

5) Highly Imperiled

All species listed as threatened or endangered nationally, plus all species with significant population declines and either low populations or some other high risk factor.

a. PT = 5 and RA, BD, TB, or TN = 5

4) Species of High concern

Populations of these species are known or thought to be declining, and have some other known or potential threat as well:

a. PT = 4 or 5 and either RA, BD, TB, or TN = 4 or 5
b. RA = 4 or 5 and either TB or TN = 4 or 5

For regional lists only:

c. AI = 5 and RA >3

3) Species of Moderate concern

Populations of these species are either a) declining with moderate threats or distributions; b) stable with known or potential threats and moderate to restricted distributions; c) and d) relatively small and restricted; or e) declining but with no other known threats.

a. PT = 4 or 5 and RA, BD, ND, TN, or TB = 3
b. PT = 3 and RA, BD, ND, TN, or TB = 4 or 5
c. RA = 3 and BD or ND = 4, or 5
d. RA = 4 and BD and ND <4
e. PT = 5 and RA, BD, ND, TN, or TB > 1

For regional lists only

f. AI=4 and RA>3

2) Species of Low Concern

Populations of these species are either a) stable with moderate threats and distributions; b) increasing but with known or potential threats and moderate to restricted distributions; or c) of moderate size.

a. PT = 3 and RA, BD, ND, TN, or TB = 3
b. PT = 2 and RA, BD, ND, TN, or TB = 4 or 5
c. RA = 3
For regional lists only:
d. AI = 3

1) Species Not at Risk

All other species

Variables for Regional Priorities

Considering area importance at the regional scale ensures that conservation effort will not be misdirected toward species that are rare in a particular region only because it is close to the edge of their range.

Area importance scores (AI) are based on knowledge of distributions, expert opinion, and data on distributions for species where it is available. Because management decisions based on species priorities must often be conducted at appropriate seasons, the scores for these variables are reported using a system that reflects both the relative area importance and the season or seasons during which the area is important, including breeding, wintering, and migration (spring and fall).

Score	Symbol	Description of occurrence within BCR or Planning Region, including relative abundance, importance relative to other regions, and importance of management and protection activities.
5	**B, W, M**	High concentrations known to occur. Area of high importance to the species relative to the majority of other regions. Management or protection activity within the area is critical for supporting hemispheric populations of the species.
4	B, W, M	Common or locally abundant, with large numbers occurring or suspected to occur. Area of known or suspected importance relative to other regions, especially within the same flyway. Management or protection activity within the area important to supporting hemispheric or regional populations.
3	b, w, m	Uncommon to fairly common. Area is within the primary range of the species, and it occurs regularly, but the species is present in low relative abundance. Occurrence is substantial enough to warrant consideration of management and protection activity.

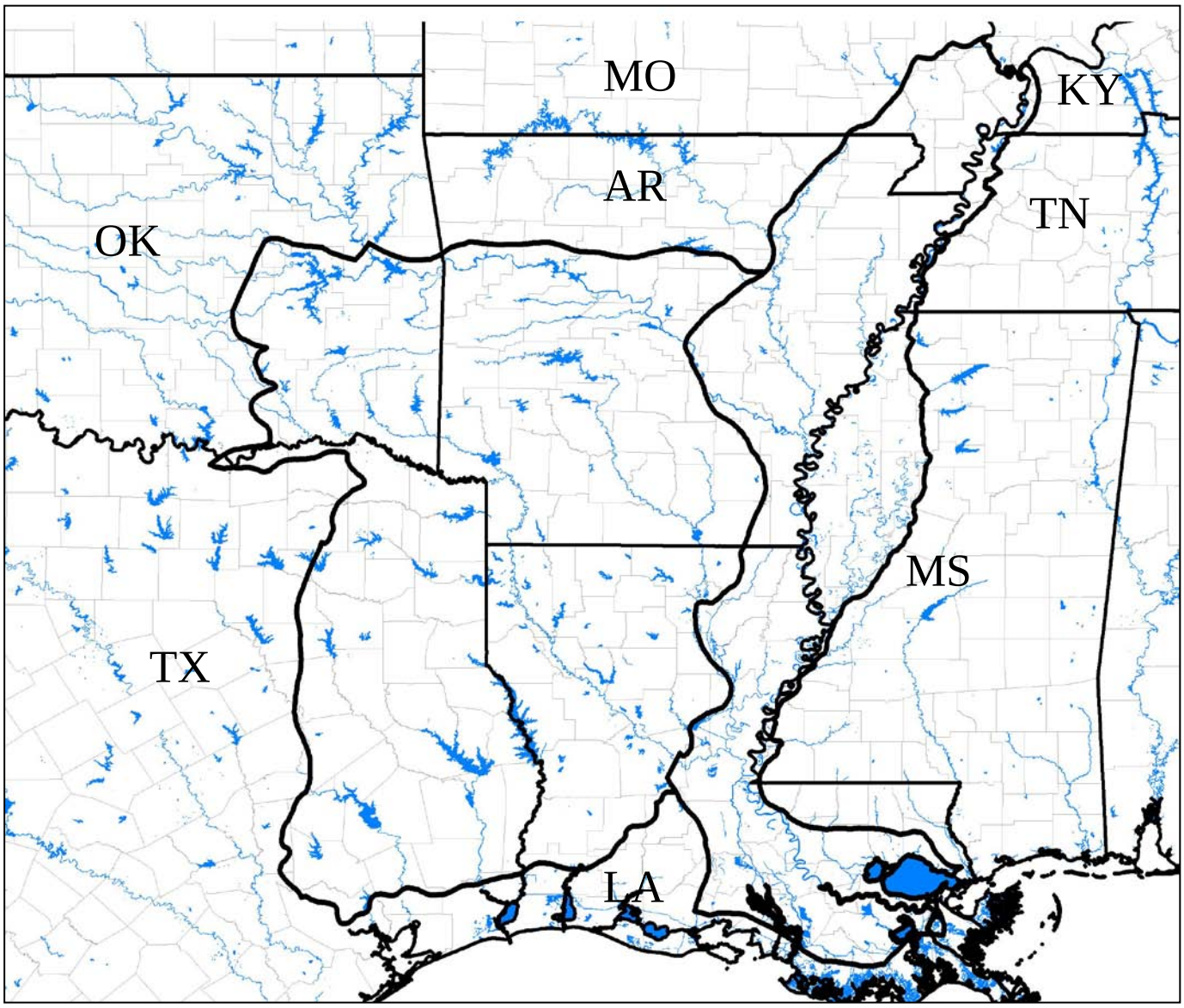
2 (tr) Rare but regular occurrences. Area is within the expected range of the species. Occurrence is at a low enough frequency that active management is not warranted.

1 not in table Does not occur in the area, or only unpredictable, irregular occurrence as a vagrant. Area is outside of expected range.

Table 3. Area of habitat (ha) managed primarily for shorebirds during fall migration (late July – late September) in the Mississippi Alluvial Valley region of the MAVGCP planning region as of July 1999. Data collected by Lower Mississippi Valley Joint Venture Office, Vicksburg, MS.

State	Area	Area actively managed (ha)	MBI Objectives	% of Objective
Arkansas	Bald Knob NWR	58.8		
	Oakwood NWR	86.0		
	Wapannocca NWR	3.8		
	Subtotal	**148.6**	**520**	**29**
Kentucky		**0**	**35**	**0**
Louisiana	Grand Cote NWR	15.6		
	Lake Ophelia NWR	22.9		
	Tensas NWR	4.5		
	Subtotal	**43.0**	**520**	**8**
Mississippi	Morgan Brake NWR	45.5		
	Panther Swamp NWR	6.8		
	St. Catherine Creek NWR	69.5		
	Tallahatchie NWR	108.1		
	Yazoo NWR	82.6		
	Subtotal	**312.5**	**600**	**52**
Missouri	Otter Slough CA	39.9		
	Ten Mile Pond CA	15.1		
	Subtotal	**55.0**	**70**	**79**
Tennessee	Eagle Lake State Refuge	22.3		
	Black Bayou State Refuge	6.1		
	Whites Lake WMA	10.8		
	Subtotal	**39.2**	**185**	**21**
	Total	**598.4**	**2000**	**30**

Figure 1. Map of MAVGCP Planning Region, composed of the West Gulf Coastal Plain/Ouachitas and Mississippi Alluvial Valley BCRs.



Appendix A. Conservation priority of shorebirds in the Lower Mississippi Valley/Western Gulf Coastal Plain organized by foraging guild.

Priority Level	Guild							
	Terrestrial/Aquatic		Aquatic/ Terrestrial	Aquatic				
	Gleaner	Gleaner/ Prober	Gleaner	Prober/ Gleaner	Prober	Gleaner	Sweeper	Prober/Prier
Highly Imperiled	PIPL	**ESCU** *						
High Concern	**AMGP**	RUTU **AMWO**	REKN BBSA	SAND	MAGO HUGO	WIPH		
Moderate Concern	**KILL** BBPL			**LESA** SBDO **SESA** DUNL STSA WESA **COSN**		**GRYE** SOSA		
Low Concern	SEPL	SPSA	UPSA	**PESA** * **LBDO** BASA WRSA		**LEYE** * WILL	AMAV BNST	

Species codes:

AGPL	American Golden-Plover	ESCU	Eskimo Curlew	PIPL	Piping Plover	SOSA	Solitary Sandpiper
AMAV	American Avocet	GRYE	Greater Yellowlegs	REKN	Red Knot	SPSA	Spotted Sandpiper
AMOY	American Oystercatcher	KILL	Killdeer	REPH	Red Phalarope	STSA	Stilt Sandpiper
AMWO	American Woodcock	LBCU	Long-billed Curlew	RNPH	Red-necked Phalarope	UPSA	Upland Sandpiper
BASA	Baird's Sandpiper	LBDO	Long-billed Dowitcher	RUTU	Ruddy Turnstone	WESA	Western Sandpiper
BBPL	Black-bellied Plover	LESA	Least Sandpiper	SAND	Sanderling	WHIM	Whimbrel
BBSA	Buff-breasted Sandpiper	LEYE	Lesser Yellowlegs	SBDO	Short-billed Dowitcher	WILL	Willet
BNST	Black-necked Stilt	MAGO	Marbled Godwit	SEPL	Semipalmated Plover	WIPH	Wilson's Phalarope
COSN	Common Snipe	MOPL	Mountain Plover	SESA	Semipalmated Sandpiper	WIPL	Wilson's Plover
DUNL	Dunlin	PESA	Pectoral Sandpiper	SNPL	Snowy Plover	WRSA	White-rumped Sandpiper

BOLD with asterisk denotes Area Importance score = 5
BOLD denotes Area Importance score = 4
ALL CAPS denotes Area Importance score = 3