

U.S. Fish & Wildlife Service

UPPER MISSISSIPPI VALLEY/GREAT LAKES REGIONAL SHOREBIRD CONSERVATION PLAN

Version 2.0



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EXECUTIVE SUMMARY

The Upper Mississippi Valley / Great Lakes (UMVGL) region is a diverse area that includes five Bird Conservation Regions (BCRs) and provides important habitat for shorebirds, especially migrants. In 2000, Version 1.0 of the UMVGL Regional Shorebird Conservation Plan (de Szalay et al. 2000) was developed. This plan - Version 2.0 - updates that document. Thirty-five shorebird species occur regularly in the UMVGL region, and information is provided on their seasonal occurrence and abundance in each of the BCRs comprising the UMVGL region. Habitat preferences, migration chronology, population status, and management recommendations are also noted. Updated information on continental populations has been stepped down to the UMVGL region.

All 35 shorebird species that occur regularly in the UMVGL region migrate through the region. Ten of them also breed there. The following 20 shorebird species are priorities in the UMVGL region because of their conservation concern category, stewardship status, and/or our ability to take conservation and management actions in the region that will significantly benefit them: Black-bellied Plover, American Golden-Plover, Piping Plover (Great Lakes population), Killdeer, Lesser Yellowlegs, Upland Sandpiper, Whimbrel, Hudsonian Godwit, Marbled Godwit (Great Plains population), Ruddy Turnstone, Red Knot, Sanderling, Dunlin, White-rumped Sandpiper, Buff-breasted Sandpiper, Pectoral Sandpiper, Semipalmated Sandpiper, Short-billed Dowitcher, American Woodcock, and Wilson's Phalarope (see Table 1 for scientific names).

Interior areas like the UMVGL region experience dynamic climatic conditions, from floods to droughts, making habitat conditions for shorebirds less predictable when compared to conditions in coastal regions. Loss of wetlands from urban development, river dredging and diking; loss of grasslands to agriculture; and habitat degradation from urban and agricultural runoff, agricultural tiling (including draining of ephemeral wetlands), and reduction of wetland plant diversity from invasive plants such as hybrid cattail, have seriously reduced the quantity and quality of shorebird habitat in the region.

Major shorebird habitats in the UMVGL region, such as Great Lakes beaches, lake shorelines, ephemeral and managed wetlands, river floodplains, forested wetlands, reservoirs, and flooded agricultural fields, are noted, as well as minor habitats such as dredged disposal islands, gravel quarries, sand bars, and rock jetties used by only a handful of species. Current threats to shorebirds in this region often focus on agricultural practices, including tiling, drainage of ephemeral wetlands, grassland ploughing, and pesticides. Future threats, such as climate change and stochastic events like 100-year floods and late spring cold snaps, add increased uncertainty to managing and/or predicting changes in shorebird populations.

A primary goal of this plan is to guide action that will ensure the availability of shorebird foraging and nesting sites over a range of climatic conditions by protecting, restoring, and managing a variety of habitat types throughout the UMVGL region. At many intensively managed sites, water level manipulation and other management activities (e.g., burning or disking) can be used to provide shorebird habitat, usually without compromising other wildlife objectives. Ultimately, an integrated management approach should be adopted that combines

region-specific information on wetland and grassland dynamics and life history strategies of a variety of wildlife species.

The Upper Mississippi River and Great Lakes Region Joint Venture (JV) established waterfowl habitat conservation objectives that focus on providing complexes of ephemeral and permanent wetlands and associated upland habitats. These objectives were adopted for Version 1.0 of the UMVGL Shorebird Conservation Plan. This plan (Version 2.0) builds on the JV's 2007 Shorebird Habitat Conservation Strategy (Potter et al. 2007) and expands upon management information for all regularly-occurring shorebirds, specifically by foraging guilds. Monitoring programs are discussed, with emphasis on standardized protocols such as the International Shorebird Survey and the Breeding Bird Survey.

New with this Version 2.0 plan is reference to a series of species-specific management plans produced largely by Manomet Center for Conservation Sciences. Using these plans in conjunction with the habitat management information provided under the guild/species section of this document, managers now have a full array of localized and continental planning recommendations to guide site-specific and regional management efforts. Research and information needs developed by the JV Science Team and others are identified and prioritized, along with education, outreach, and funding needs.

INTRODUCTION

The U.S. Shorebird Conservation Plan (USSCP; Brown et al. 2001) was developed to summarize needs and focus direction for stabilizing populations of declining shorebird species and ensuring that common species remain common. This has been accomplished, in part, through the development, refinement, and continued implementation of 11 regional conservation plans that outline strategies to provide sufficient high-quality shorebird habitat and to overcome other shorebird limiting factors. In 2000, Version 1.0 of the Upper Mississippi Valley/Great Lakes (UMVGL) Regional Shorebird Conservation Plan (de Szalay et al. 2000) was developed. We now present an updated plan - Version 2.0 – that incorporates relevant information from Version 1.0 and further addresses shorebird conservation in the UMVGL planning region. The region is a large, diverse area that provides important habitat for a variety of shorebirds, especially during migration. The purpose of this plan is to provide recommendations for a course of action to support healthy shorebird populations in the UMVGL region through a combination of securing and effectively restoring/enhancing high-quality habitat and facilitating habitat modeling, population monitoring, research, and education and outreach. These collective actions will hopefully reverse wetland losses, preserve and enhance existing shorebird habitats, provide needed data on populations and limiting factors, and disseminate information on shorebird needs and values. While the ultimate goal will be the maintenance or increase of shorebird populations, many other wetland bird species with similar habitat needs will benefit, including some waterfowl, rails, bitterns, other waterbirds, and wetland-inhabiting landbirds. As a component of the North American Bird Conservation Initiative, the USSCP is aimed at promoting partnerships at a landscape level that emphasize integrated management for multiple bird species.

The Upper Mississippi River and Great Lakes Region Joint Venture (JV) published the *Shorebird Habitat Conservation Strategy* in 2007 (Potter et al. 2007). The key strategic goal of the strategy is to “establish efficient habitat conservation to maintain or increase carrying capacity for populations of priority shorebird species consistent with continental and JV regional goals.” The JV strategy adopted the population assessments and conservation priorities in the original (Version 1.0) UMVGL Shorebird Conservation Plan. Thus, the strategy worked symbiotically with the first plan, and this new plan is intended to facilitate the development of additional strategies and a potential reassessment of species and habitat priorities for a future update of the JV Shorebird Habitat Conservation Strategy. Both documents need to be used together by managers and planners to realize the fullest conservation capacity required for maintaining and increasing UMVGL shorebird populations.

DESCRIPTION OF THE UPPER MISSISSIPPI VALLEY/ GREAT LAKES (UMVGL) REGION

Physical Description

The UMVGL shorebird planning region encompasses 1.4 million square kilometers (km) (535,000 square miles [mi]) in the north-central United States, including all or most of Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin, plus portions of

Alabama, Arkansas, Kansas, Nebraska, New York, Oklahoma, Pennsylvania, South Dakota, Tennessee, and Vermont (Figure 1). Large portions of the UMVGL region are heavily forested or have rugged terrain with few wetlands, and these support little shorebird use except for the American Woodcock (see Table 1 for scientific names).

Bird Conservation Regions (BCRs)

The UMVGL planning region includes five BCRs that were established by the North American Bird Conservation Initiative to delineate areas with similar bird communities, habitats, and resource management issues (Commission on Environmental Cooperation 1998). These BCRs are, from north to south, the Boreal-Hardwood Transition (BCR 12), Lower Great Lakes/St. Lawrence Plain (BCR 13), Prairie-Hardwood Transition (BCR 23), Eastern Tallgrass Prairie (BCR 22), and Central Hardwoods (BCR 24) (Figure 1). Only the U.S. portions of BCRs 12 and 13 are considered in this plan since it is a step-down to the U.S. Shorebird Conservation Plan.

BCR 12, the Boreal-Hardwood Transition (comprising 16% of the UMVGL region), is characterized by coniferous and northern hardwood forests, nutrient poor soils, shallow lakes, Great Lakes coastal estuaries, and riparian habitat. BCR 13, the Lower Great Lakes / St. Lawrence Plain (7% of the UMVGL region), is a low-lying area with important lakeshore habitats and associated wetlands. Although it was once covered by oak-hickory, northern hardwood, and mixed-coniferous forests, many forests have been cleared, and cropland and early successional habitats now predominate. BCR 23, the Prairie-Hardwood Transition (16% of the UMVGL region), contains important lakeshore marshes both inland and on the Great Lakes. BCR 22, the Eastern Tallgrass Prairie (39% of the UMVGL region), was once a vast expanse of prairie and savannah, dotted with numerous shallow, glacial wetlands and broad river floodplains that provided much shorebird habitat, but now it is dominated by row-crop agriculture. BCR 24, the Central Hardwoods (22% of the UMVGL region), includes oak-hickory forests in the hilly region of the Ozark Plateau in Missouri and Arkansas, which are separated from the Interior Low Plateaus of Kentucky and Tennessee by the floodplains of the Mississippi River and its larger tributaries. This latter region, dominated by well-drained limestone plateaus, has little shorebird habitat save along river and stream valleys, man-made reservoirs, and sewage treatment plants.

Shorebird Habitats in the UMVGL Region

Many shorebirds using the UMVGL region are long-distance migrants that require suitable wetlands where they can periodically stop over to replenish their fat reserves or wait for favorable winds before continuing migration. For most species, these staging areas must have shallow water (<20 cm or 8 in deep) and/or mudflat habitats with sparse vegetation (<25% cover), undisturbed resting areas, and abundant invertebrate food resources to meet the high energetic demands of migration (Burger et al. 1977, Colwell and Oring 1988, Hands 1988, Helmers 1991 and 1992). The region has a wide variety of habitats that provide, or have the potential to provide, these requirements, including natural and managed wetlands, lake shorelines, river floodplains (especially along the Mississippi, Illinois, Missouri, Ohio, and Wabash Rivers), reservoirs, and flooded agricultural fields. Killdeer, Upland Sandpiper, Marbled Godwit, and a few other species forage and nest in upland habitats (e.g., grasslands, wet

meadows, pastures, hayfields, croplands, sparsely-vegetated beaches, and sand and gravel bars), many of which are associated with wetland complexes.

In the late 1990s, the importance of interior U.S. habitats to shorebirds became more widely understood (Dinsmore et al. 1999, Skagen et al. 1999). Unlike coastal areas where habitat and food resources are fairly predictable and abundant, resource availability in inland areas is highly dependent on precipitation and hydrology patterns and varies in time and space (Fredrickson and Reid 1990, Skagen and Knopf 1993 and 1994, Skagen 1997). While many natural wetlands in inland regions can potentially provide excellent shorebird habitat, precipitation directly influences wetland conditions and corresponding use by shorebirds. For example, during extremely dry years, naturally-receding semi-permanent or permanent wetlands may provide the only non-intensively managed habitat available for shorebirds. In extremely wet years, these same areas are likely to be flooded, sometimes with water levels well into the wet meadow zone, and thus are unusable by most shorebird species. Seasonal or temporary habitats, such as flooded fields, may be the only wetlands available in these conditions.

Managers have, to date, failed to address shorebird needs across the full range of natural variation, including *average* seasons when normal precipitation amounts result in bank-full but non-flooding rivers, lakes, and marshes and mesic but non-flooded fields. During average times, shorebirds may actually be at higher risk for lack of natural habitat availability, resulting in the greatest need for managed habitats. Wet and dry cycles make it difficult to predict the location, available food resources, and duration of suitable wetland conditions of prime shorebird habitats. Despite the breadth of the UMVGL region and the vagaries of weather across this vast area, shorebirds apparently can detect available habitat and adjust their flight paths accordingly. Whether there is sufficient habitat available to allow replenishment of fat reserves for arctic-bound species in spring so that breeders can bring off full clutches is unknown and is a priority for research. The dynamics of climatic cycles and the changing availability of habitat within basins cause shorebirds migrating through interior regions like the UMVGL to be scattered over larger areas and in small numbers at numerous sites, rather than concentrated at a few major staging sites, as is common along the Atlantic and Pacific coasts (Skagen and Knopf 1993 and 1994, Dinsmore et al. 1999, Skagen et al. 1999).

Important shorebird habitats in the Great Lakes include coastal marshes, deposited sandy beaches, and both mainland and island rocky shorelines important for roosting sites for a few species of migrant shorebirds such as Whimbrel, and Ruddy Turnstone, as well as breeding Piping Plovers. Great Lakes coastal wetlands are usually dominated by herbaceous vegetation and have a fringe of woody vegetation in shallower areas. Many have a bare zone at the water's edge from scouring by waves and winter ice. The large size of the Great Lakes creates some physical characteristics that are more similar to marine coastal environments than inland habitats. For example, waves from storms erode vegetation and sediments along shorelines, and most coastal marshes occur in sheltered areas (e. g., embayments and behind barrier beaches or sandbars) (Maynard and Wilcox 1997).

A key characteristic of Great Lakes beach habitats and undiked coastal marshes is that they are affected by changes in Great Lakes water levels (Bedford 1992). Lake water levels typically vary 25-75 cm (10-30 in) during the year, with levels being the lowest in mid-winter and highest

in mid-summer. Furthermore, long-term changes in precipitation patterns and freezing cycles affect lake water levels, and differences of 1-2 m (3-6 ft.) between all-time high and low water levels have been recorded in the Great Lakes. Later seasonal freezing of the Great Lakes could be causing increased evaporation and tilting future water levels towards the lower elevations of the long-term cycles historically characteristic of the region. While lowered water levels would likely provide larger areas of available beach and mudflat habitat, the drying out of some coastal wetlands might also occur, potentially offsetting any habitat gains. Coastal storms can cause wracks of algae beds to be washed up on the shores of all of the Great Lakes, particularly the southern four lakes, providing a temporary plethora of foraging opportunities for migrant shorebirds in summer and early autumn. The recent spate of exotic mollusks, such as zebra and quagga mussels, has filtered out many of the organisms responsible for these beds, limiting their appearance in recent years.

Man-made reservoirs and stock ponds, sewage lagoons, flooded agricultural fields, sand, gravel, and expressway borrow pits that have shallow water margins are all used by shorebirds to a varying extent. In coastal areas along the southern Great Lakes, dredged material is deposited in Confined Disposal Facilities (CDFs), such as in Saginaw Bay, Michigan, and along Lake Erie, and these are sometimes used heavily by foraging shorebirds. However, the sediments in CDFs often have high contaminant levels and may negatively impact shorebirds. Dikes and water control structures have provided shorebird habitat in some Great Lakes coastal marshes that otherwise would have been inundated by high lake levels. Wetland restoration programs have provided additional shorebird habitat, and at least one species, the Upland Sandpiper, has benefitted from grassland restoration programs such as the Conservation Reserve Program (Dechant et al. 2000).

SHOREBIRD SPECIES OCCURRENCE, ABUNDANCE, AND REGIONAL PRIORITIES

Species Occurrence and Abundance

Thirty-five species of shorebirds occur regularly in at least one BCR in the UMVGL region, and all of the species are migrants (Table 1). Ten of the 35 species - Piping Plover, Killdeer, Spotted Sandpiper, Upland Sandpiper, Wilson's Snipe, American Woodcock, Black-necked Stilt, Solitary Sandpiper, Marbled Godwit, and Wilson's Phalarope - also breed in the region, with the first six being major breeders. Two species - Piping Plover and Marbled Godwit - each have two populations occurring in the UMVGL region.

Rare shorebird species recorded in the UMVGL region - some only recorded once and some occurring only 1-5 times annually - include: Lesser Sand Plover (*Charadrius mongolus*), Wilson's Plover (*Charadrius wilsonia*), Snowy Plover (*Charadrius alexandrinus*), Mountain Plover (*Charadrius montanus*), Northern Lapwing (*Vanellus vanellus*), American Oystercatcher (*Haematopus palliatus*), Spotted Redshank (*Tringa erythropus*), Long-billed Curlew (*Numenius arquata*), Slender-billed Curlew (*Numenius tenuirostris*) (now near extinction), Black-tailed Godwit (*Limosa limosa*), Black Turnstone (*Arenaria melanocephala*), Surf-bird (*Aphriza virgata*), Red-necked Stint (*Calidris ruficollis*), Little Stint (*Calidris minuta*), Curlew Sandpiper

(*Calidris himantopus*), Sharp-tailed Sandpiper (*Calidris acuminata*), Ruff (*Philomachus pugnax*), European Woodcock (*Scolopax rusticola*), and Red Phalarope (*Phalaropus fulicarius*). The Eskimo Curlew (*Numenius borealis*), once a regular, common migrant, has not been verified in this region for 100+ years and may be near extinction. The species is still occasionally reported from elsewhere in the Americas.

Appendix 1 provides information on the population status (abundance and trends) of UMVGL shorebirds continentally and in the region.

Regional Species Priorities

To determine which UMVGL shorebird species are priorities for conservation and management actions, we considered several sources of information. First, we noted the National Conservation Concern Category of each species, as follows (see also Table 1), based on the Watch List 2014 assessment (U.S. Shorebird Conservation Plan Partnership 2015):

Listed Under the Endangered Species Act (ESA): Two species occurring in the UMVGL region are Federally-listed under the ESA. The Red Knot and the Great Plains population of Piping Plover are listed as Threatened, while the Great Lakes population of Piping Plover is listed as Endangered.

Require Immediate Management Actions: Whimbrel and Ruddy Turnstone fall into this category.

In Need of Management Attention: The 12 species in this category will benefit from actions taken in the UMVGL region.

Warrant Long-term Planning and Responsibility, including Monitoring: Dunlin and Purple Sandpiper fall into this category, but only the Dunlin can benefit from undertaking these actions in the UMVGL region.

Vulnerable to Climate Change: While American Avocet, Black-bellied Plover, and Western Sandpiper are considered especially vulnerable to climate change, the impact of this threat is greater in other parts of their range than in the UMVGL region. Within the UMVGL region, however, other management actions can be undertaken to benefit these species.

Common Shorebirds in Decline: Killdeer and Red-necked Phalarope fall into this category, but only the former can benefit from undertaking actions in the UMVGL region.

Least Concern: Thirteen species (see Table 1) are classified as least concern at the national level. Two of these - Upland Sandpiper and Wilson's Phalarope - are of greater concern in the UMVGL region and can benefit from regional management actions.

Second, we determined which species are **Stewardship Species**, having at least 20% of their populations occurring at some time of the year in the UMVGL region. While the 20% criterion is somewhat arbitrary, we feel it is a reasonable indicator of species for which we have special responsibility for maintaining robust populations. Ten UMVGL species meet the stewardship criterion (Table 1).

Third, we assessed which species can most benefit from conservation and management actions that are undertaken in the UMVGL region. Taking these three factors into consideration, we conclude that the following 20 shorebird species should be priorities in the UMVGL region: Black-bellied Plover, American Golden-Plover, Piping Plover (Great Lakes breeding population), Killdeer, Lesser Yellowlegs, Upland Sandpiper, Whimbrel, Hudsonian Godwit, Marbled Godwit (Plains breeding population), Ruddy Turnstone, Red Knot, Sanderling, Dunlin, White-rumped Sandpiper, Buff-breasted Sandpiper, Pectoral Sandpiper, Semipalmated Sandpiper, Short-billed Dowitcher, American Woodcock, and Wilson's Phalarope (Table 1).

CURRENT AND FUTURE THREATS TO SHOREBIRDS IN THE UMVGL REGION

Shorebirds are subject to numerous threats and challenges in the UMVGL region. While it is difficult to precisely determine which threats have the greatest impact, we list the threats in order of what we perceive to be the greatest to least potential impacts to shorebirds in the region.

Wetland Loss and Upland Habitat Degradation

Perhaps the most severe and long-ranging threat to both migrant and breeding shorebirds is the continuing loss of wetlands and other important habitats. The loss of seasonal ponds due to tiling and various drainage schemes, usually done for agricultural purposes, is of particular concern. Other causes of wetland loss include increased sedimentation, development that causes water levels to rise in nearby wetlands, loss of marsh and fringing meadow habitat due to development, and loss of ephemeral forest pools and roadside ditches often used by spring migrants such as Pectoral Sandpiper, Greater and Lesser Yellowlegs, and Wilson's Snipe. Thousands of acres of pasture land, grasslands, and Conservation Reserve Program lands in the Midwest have also been lost due to declines in dairy and beef cattle grazing and an increase in production of ethanol from corn; this impacts shorebirds that use upland habitats.

Threats on the Non-breeding Grounds

Many of the threats facing shorebirds on their breeding grounds also affect them on their non-breeding grounds. Conservationists concerned with full life cycle stewardship of these "wind birds" that span the globe are urged to involve themselves in national and world bird conservation groups that address many of these problem areas. American Bird Conservancy, National Wildlife Refuge and National Park "friends groups", and various Audubon groups address many of the conservation issues affecting shorebird populations, while The Nature Conservancy, numerous land trusts, Ducks Unlimited, various chapters of the Prairie Enthusiasts, and other local conservation groups concentrate on preservation and restoration of habitat in

either Mexico, the United States, or Canada. Those interested in working on conservation issues where the majority of shorebirds winter will find a variety of conservation groups in Mexico, almost every South and Central American country, and in many of the Caribbean island nations. Some groups specialize in one country, such as ProAves in Colombia, Pronatura in Mexico, and Aves Argentinas, whereas the Wildlife Conservation Society works in multiple countries.

Climate Change

A growing body of evidence shows that Arctic-breeding shorebirds, which include many that migrate through the UMVGL region, are becoming out of synchrony with their forage base during the nesting season. Evidence of this occurring in the UMVGL region is still lacking, but should be investigated. Stochastic events such as wind storms and large precipitation events have locally washed out many shorebird breeding sites and appear to be increasing in both intensity and frequency. A warmer and wetter regime has characterized recent decades in the Upper Midwest. Flooded fields remaining into late spring have allowed many Killdeer broods to prosper in agricultural areas free from the impacts of early plowing and planting. On the other hand, long stretches of cold weather in late spring have adversely affected breeding Piping Plovers, forcing many pairs to re-nest and lowering productivity.

Rising water levels on the Great Lakes could flood coastal marshes and fringing beaches, eliminating large expanses of currently available habitat. Inland, increased rainfall could provide more sheet flow in spring and offset some of the losses caused by agricultural tiling. Arctic and sub-arctic vegetation changes may greatly limit future shorebird breeding sites. Canadian researchers have noticed increased brush growth on the tundra, which may negatively affect grassland breeding Upland Sandpiper, American Golden-Plover, and Buff-breasted Sandpiper.

Shoreline Loss

Many breeding and stopover sites are eliminated when lake levels are held artificially high (e.g., Upper Mississippi River for recreational use or the Great Lakes for commercial shipping). The bulk-heading and rocking of urban shorelines eliminates useful beach habitat on the southern Great Lakes. The policy of rocking sewage treatment lagoon shorelines has eliminated or reduced usage at hundreds of former stopover sites for shorebirds. Loss of sediment sources caused by dams eliminates many riverine islands; however, some temporary habitat may eventually form in older reservoirs where sediments accumulate.

Urbanization

This can have both direct and indirect adverse impacts upon shorebirds. Killing or disturbance of both breeding and migrant shorebirds by feral and pet cats and dogs frequently occurs in populated beach areas. Residential development on thousands of inland lakes has usurped many breeding sites of Killdeer and Spotted Sandpiper. Infrastructure development and habitat maintenance for urban expansion and flood protection, such as stream and river dredging and damming, has eliminated many shorebird breeding and stopover sites. Late season draw-downs on reservoirs and dredged disposal islands may replace some of this lost habitat for migrants, but

much of this human-created habitat is very ephemeral and may not match the quality of natural sites.

Invasive Species and Native Species with Expanding Populations/Ranges

The presence of zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis*) in the lower Great Lakes has increased water clarity and allowed native submerged aquatic vegetation to prosper. However, the mussels' presence may be connected to a decreased density of algae and fewer wracks of algae occurring along lake shores. This was once a major source of high-quality food for many beach-guild shorebird species.

The major Piping Plover colony at Long Point, Ontario, declined to zero following colonization of the area by expanding Ring-billed Gull populations and mammalian predators like the raccoon. Pelican Island in Leech Lake, Minnesota, lost the largest colony of Spotted Sandpipers known in the Midwest to a combination of brush invasion and expanding breeding populations of Ring-billed Gulls (*Larus delawarensis*) and Double-crested Cormorants (*Phalacrocorax auritus*) (Steve Mortensen, pers. comm., 2009).

Throughout the Midwest a host of invasive plant species are taking over habitat and destroying the mosaic of wet meadow/wet prairie and open shallow water habitats essential for many migrant shorebirds. These include reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites communis*), hybrid cattail (*Typha* sp.) and purple loosestrife (*Lythrum salicaria*), which can become dense monocultures that choke out open wetlands; water hyacinth (*Eichhornia crassipes*) (only in southern portion of the UMVGL region); glossy buckthorn (*Frangula alnus*) and garlic mustard (*Alliaria petiolata*), both threats to wooded ephemeral ponds; and non-native, super-aggressive switch grass (*Panicum virgatum*) genotypes that threaten Upland Sandpiper breeding sites. Invasive common reed (*Phragmites communis*) has decreased open water and destroyed a rich hemi-marsh and the coastal wet meadows at Nayanquing and Tobico Marsh State Game Areas along the shores of Michigan's Saginaw Bay. This has greatly restricted available shorebird foraging areas.

Energy Development and Communication Towers

Little is known about the relative impacts of wind turbines and communication towers on migrants at shorebird staging areas. The number of wind turbines in the UMVGL region is rapidly increasing, especially in Indiana, Illinois, and Iowa. To date, there has been no offshore placement of turbines in the Great Lakes, but multiple plans are on the drawing boards, and a few operations seem inevitable within the next decade. Turbines have known impacts on migratory and resident birds, including direct mortality from strikes; cumulative impacts from the proliferation of turbine projects across the landscape; fragmentation of habitat; avoidance, disturbance, and barrier effects; disruption of foraging areas; and creation of marginal/suboptimum habitats. A pre-construction study by West, Inc. of Cheyenne, Wyoming, for a British Petroleum-owned wind turbine megaproject in Benton County, Indiana, found that greater than 30% of the staging American Golden-Plovers in the area (the largest known concentration of this species) flew within the rotor sweep zone (RSZ) when moving from field to field (pers. comm. to USFWS, 2005) before construction began. Anecdotal reports following

construction allege that the plovers avoid many of these fields altogether, which may ultimately have an adverse impact upon body condition of the plovers if they are forced into marginal or less productive habitats.

Very few shorebird mortalities, other than American Woodcock, have been documented at communication towers, tall buildings, and wind turbines. Shire et al. (2000) investigated the results of 47 different communication tower collision studies and, of 184,797 birds killed, only 77 (.04%) were shorebirds. Wilson's Snipe was the most vulnerable shorebird species, with 49 individuals killed. Ten other species were tallied, with only a single Killdeer noted. However, the potential presence of offshore turbines poses a threat to night-flying shorebirds, especially during low ceiling or windy conditions when birds are forced to migrate at low altitudes. Additionally, several shorebird species, such as Marbled Godwit and Upland Sandpiper, perform aerial courtship displays which could carry them into the RSZ with likely adverse results. Houston et al. (2011) note that Upland Sandpiper pairs rise "from feeding in unison, and sometimes crisscross paths in an aerial circle 200–300 m in diameter, generally at a height of about 30 m (but may be up to 400 m); when they close within 1 m together, they make a rapid, nearly vertical, descent to ground."

Hunting

Shooting shorebirds is largely a thing of the past in North America. Both the American Woodcock and Wilson's Snipe are classified as hunted species with regulated seasons. The American Woodcock is carefully managed using annual data from the Singing Ground Survey. The Wilson's Snipe is the only hunted American bird without an adequate population survey (efforts to survey this species along with secretive marshbirds are being piloted in several UMVGL states). Sport harvest of American Woodcock remains locally popular, whereas hunting of Wilson's Snipe has declined in recent years.

Subsistence hunting in the Arctic targets some of the larger shorebird species. The extent and impact of this hunting is currently being studied (R. Lanctot, pers. comm., 2011). Hunting of many shorebirds which migrate through eastern North America still occurs during migration and on the wintering grounds in Barbados, Guadalupe, Surinam, French Guiana, and Martinique. An ongoing international conservation effort is slowly making headway in reducing this human-caused mortality through increased hunting regulations and protection of stopover sites.

Predation

Predation is an ever-present threat to shorebirds during migration, on their breeding grounds, and on their wintering sites. As ground nesters, Midwestern breeding shorebirds are subject to the usual mammalian predators, such as skunks, raccoons, opossums, fox, mink, and feral and pet cats and dogs. An expanding native population of Merlins has been noted preying on endangered Piping Plover on Michigan's Leelenau Peninsula. An introduced population of Peregrine Falcons nesting at artificial nest sites such as water towers and power plants also poses a threat. This top predator was historically only a rare, local breeder in most of the Midwest and was absent from large swaths of the region.

Toxic Substances and Disease

Dozens of shorebirds, including the endangered Piping Plover, have been killed by periodic Type E botulism episodes in northern Lake Michigan and on Lakes Erie and Huron. Research is ongoing to understand the factors that contribute to these episodes. Blue-green algae outbreaks are toxic to some wildlife and have recently occurred on western Lake Erie marshes. Migrant shorebirds may accumulate toxic chemicals from foraging at sewage treatment plants or on treated agricultural lands. The few inland studies completed to date have shown no serious impacts, but coastal studies have shown that bioaccumulation may be a threat to some species.

REGIONAL SHOREBIRD HABITAT CONSERVATION STRATEGIES

Habitat Goals and Objectives

Habitat goals and objectives for the UMVGL region are addressed in the *Shorebird Habitat Conservation Strategy* (Potter et al. 2007) developed by the Upper Mississippi River and Great Lakes Region Joint Venture (available online at http://www.uppermissgreatlakesjv.org/docs/UMRGLR_JV_ShorebirdHCS.pdf). In that document, continental shorebird population and habitat objectives are “stepped down” to the JV level to assist wildlife managers in designing landscapes with greater value to shorebirds. Shorebird “focal species” were selected by the JV for planning purposes based on habitat used during the breeding season and/or foraging guilds that correspond to different cover types. Priority areas for different habitat actions (i.e., protection and restoration) are mapped by species and/or foraging guild throughout the JV region. Migration habitat objectives were generated from the most current estimates of spring population size. The JV Shorebird Habitat Conservation Strategy recognizes that these numbers are continually being refined, and priority areas and actions may change as new information becomes available.

Restoring Habitat for Breeding Shorebirds

Twelve species of shorebirds likely bred regularly within the UMVGL region in the past but, currently, only 10 species are known to breed in the region regularly. The Long-billed Curlew was extirpated as a breeding species in the 19th century from the Upper Midwest as far east as the Chicago area. The Willet may have bred in northwest Iowa and southwestern Minnesota, but the historical record is not definitive. Unless large tracks (10,000 acres+) of prairie and wetland complexes are restored within the historic range of these species, potential reintroduction should probably not be attempted as success would likely be limited. Preliminary feasibility planning is underway to determine potential reintroduction sites for the curlew in northwestern Minnesota in the Prairie Pothole Joint Venture.

Maintaining and increasing the small breeding populations of Wilson’s Phalarope and Marbled Godwit in the UMVGL region appears to be a more attainable goal. Wilson’s Phalaropes are fairly adept at colonizing newly created or restored habitats outside their existing range or recolonizing portions of their historic range. Preservation of grazing activities in northwest Minnesota and central Wisconsin would contribute favorable habitat for the Marbled Godwit.

Restoration of larger grassland and wetland complexes would help assure that the small population of this species now existing in central Minnesota would continue to persist. Although Marbled Godwits are seemingly poor colonizers, population restoration might be possible in northwest Iowa and possibly even Wisconsin, where some evidence points to the species being a former breeder. It may be necessary to begin with an actual reintroduction program to first reestablish this species in its former range.

Breeding populations of Wilson's Snipe have declined along the southern portion of its breeding range in northern Ohio and northeastern Illinois, southern Michigan, and northern Indiana. Although some of this has apparently been due to losses of wetland habitat, such as at Pymatuning Reservoir, a former bog in Pennsylvania, there are indications that wetland degradation and loss of vegetative diversity in marshes may also be a contributing factor. Declines in cattle grazing and dairying have also caused the loss of wet pasture habitat that formerly remained in early stages of succession and was attractive to both breeding and migrating snipe.

While both the Killdeer and Spotted Sandpiper have remained common throughout most of the UMVGL region, both species have suffered some declines, according to the Breeding Bird Survey. Tiling of agricultural fields, coupled with more intensive agriculture and fewer grazing activities, has reduced early season wetland breeding habitat for Killdeer. The Spotted Sandpiper has declined in some lakeshore areas where home density has precluded the availability of any undeveloped shoreline that could be used for breeding. Other contributing factors include loss of undisturbed island and sandbar habitat to vegetation succession or recreational use. Preservation of wetlands in quarries, maintenance of sandbars in early successional stages, and creation of small lake and riverine/sandbar shores and inviolate preserves could help stem this regional decline.

Large-scale Habitat Restoration

Conservation and restoration of large-scale habitat complexes has been a shorebird management strategy in the UMVGL region during the past decade in several states. Such large-scale preserves provide sufficient habitat for viable populations of breeding shorebirds and habitat for several aspects of migrant shorebirds' life cycles, including roosting and foraging sites. In BCR 12, ongoing efforts to maintain or restore open country for Sharp-tailed Grouse (*Tympanuchus phasianellus*) have led to increased local breeding populations of Upland Sandpipers. One of the largest prairie focal regions in this BCR is the Crex Meadows-Fish Lake complex in northwestern Wisconsin. Upland Sandpipers have also benefited from large jack pine savanna restorations for grouse and the endangered Kirtland's Warbler (*Setophaga kirtlandii*) in northern Michigan and northwest Wisconsin.

Several large restorations in BCR 22 have greatly benefited shorebirds. The newly restored Beehunter Marsh-Goose Pond State Wildlife complex in Indiana has a growing population of breeding Black-necked Stilts and 30+ species of migrant shorebirds recorded in just six years. Emiquon NWR in the Illinois River Valley, in its first five years of restoring water to the site, has attracted many thousands of migrant shorebirds. The large Midewin National Tallgrass Prairie near Joliet, Illinois, has a growing population of breeding Upland Sandpipers, with the

potential for several hundred pairs when restoration is complete. The 4,431-acre Eagle Bluffs Conservation Area in BCR 24 and nearby units of Big Muddy NWR in BCR 22 serve as a valuable complex that partially mitigates for thousands of forested bottomlands and adjacent wetlands drained by the leveeing of the Missouri River.

BCR 23 encompasses two of Wisconsin's large prairie focal areas: the vicinity of Military Ridge Prairie Heritage Area in the southwest, which has a growing Upland Sandpiper population and the Buena Vista Marsh/ Leola Grasslands in the north-central region, which provides increasing acreage of important stopover habitat for many migrant shorebird species. As bird-friendly grassland management techniques are implemented on these lands, it is hoped that these megapreserves will act as source populations for large meta-populations.

Western Hemisphere Shorebird Reserve Network Sites in the UMVGL Region

The Western Hemisphere Reserve Network (WHSRN) was formed to protect and manage critical sites where large numbers of shorebirds concentrate during migration. As mentioned previously, the UMVGL region has relatively few sites that attract large numbers of shorebirds on a regular basis. However, congregations of birds have been found at several National Wildlife Refuges in the region, and these have been designated as WHSRN sites. Four such sites now have been designated in the region: Chautauqua NWR, Illinois; Swan Lake NWR, Missouri; Squaw Creek NWR, Missouri; and the Western Lake Erie Marshlands, which encompass Ottawa NWR, Magee Marsh and Pickerel Creek State Wildlife Areas in Ohio, Pt. Mouille (the mouth of the Detroit River) in Michigan, and several private hunting clubs.

Other potential WHSRN candidate sites exist in the region, and ongoing habitat restoration, management and monitoring efforts may lead to designation of these sites. They include Emiquon NWR and the adjacent Nature Conservancy Preserve in Illinois and Goose Pond State Wildlife Area in Indiana. Manomet Center for Conservation Sciences has developed a site assessment tool for WHSRN sites (<http://www.whsrn.org/tools>). WHSRN sites should conduct site assessments every three years.

Recommendations for Shorebird Habitat Management in the UMVGL Region

Sandy Shorelines, Great Lakes

Extensive sandy beaches exist along the shorelines of Lakes Erie, Michigan, and Huron and on the southern shore of Lake Superior. Some of these beaches in northern Michigan and the Apostle Islands region of Wisconsin provide breeding and foraging habitat for the endangered Great Lakes Piping Plover population and for small numbers of Spotted Sandpiper and occasional Killdeer. During migration, these beaches provide important foraging and resting habitat for a variety of shorebird species, although stopover times may be quite short, ranging from a few hours to several days.

Human disturbance and food availability appear to be the limiting factors in determining length of stay for many migrant species in this habitat. Occasional forage "jubilees" occur when strong onshore winds pile up thick wracks of algae. For several days these beds may offer breeding

habitat for numerous worms (*Platyhelminthes*, *Nematoda*, etc.), fingernail clams (*Sphaerium* or *Musculium* sp.), and insect larvae, especially true flies (*Diptera* sp.), mayflies (*Ephemeroptera* sp.), and dragonflies (*Odonata* sp.). These beds can attract a high diversity of migrant shorebirds, including Sanderling, Dunlin, Least Sandpiper, Semipalmated Sandpiper, Baird's Sandpiper, Ruddy Turnstone, and occasionally lesser numbers of other species such as Red Knot (rare), Black-bellied Plover, White-rumped Sandpiper, and Semipalmated Plover. The recent invasion of the Great Lakes by zebra mussels and quagga mussels has lessened the density of algae beds and shoreline wrack lines, which has reduced concentrations of some shorebirds locally and eliminated them in other locales.

Management: Closing of beaches for breeding Piping Plover or migrant shorebirds is an effective method of providing undisturbed shorebird habitat, although it is often unpopular with public beach goers. A beach closure in southern Illinois Beach State Park is perhaps the most successful example. The Dead River, which marks the northern boundary of this park, is deep enough to prevent most access, and its mouth contains quicksand. Beach closures in northern Michigan west of Whitefish Point are regularly implemented to protect breeding Piping Plovers. A small set-aside at Chicago's Montrose Harbor is successful in attracting small numbers of migrant shorebirds at times; however, unleashed dogs often enter the area and flush the birds, thus limiting stopover time. A strong and continuous outreach program is necessary before closing segments of popular bathing beaches for shorebirds will be accepted.

A study by Prestby (2015) showed the value of high energy sandy beaches and protected (from humans) areas in lower Green Bay both for a high diversity of shorebirds and high shorebird abundance. Shorebirds were strongly attracted to well-designed wave barriers that promoted sand accretion on undeveloped beaches.

Rocky Shorelines, Great Lakes

Largely restricted to the northern reaches of Lakes Superior, Huron, and Michigan (and their bays), rocky shorelines provide foraging habitat for a few species of shorebirds, especially in small pools that form on the rocky surface. This habitat also includes man-made rock and concrete jetties and breakwaters common around harbor entrances. Ruddy Turnstones favor this habitat, but Sanderlings, Least Sandpipers, Dunlins, Black-bellied Plovers, and Whimbrels occasionally occur, often using these largely undisturbed sites for roosting and stopover. Rare species that regularly occur in the Great Lakes using these habitats include Red Phalarope and Purple Sandpiper.

Management: Since rocky habitats are not preferred by most humans (except for occasional anglers) and often occur in remote areas such as islands, the long-term viability of this habitat seems secure in the UMVGL region. Fencing at the base of a jetty can prevent both unwanted human and predatory animal incursions onto such sites.

Sewage Treatment Ponds

Nearly every Midwestern municipality has a sewage treatment plant, and many of these have open air settling/sewage ponds that can attract shorebirds preferring muddy sediments. All

species of UMVGL shorebirds can occur at these ponds, but the dominant species include Lesser, Semipalmated, Pectoral, Baird's, and White-rumped Sandpipers, Greater and Lesser Yellowlegs, Wilson's Snipe, Killdeer, Semipalmated Plover, and Red-necked and Wilson's Phalaropes. The recent trend towards rocking the shores of these ponds has limited, but not eliminated, shorebird usage.

Management: Most managers of these ponds stage a short drawdown period in the spring, when shorebirds of several species may appear. The current management practice is to rock the shorelines of sewage treatment ponds. Once treatment ponds are rocked, their value to most shorebirds is greatly lessened. Fencing prevents human disturbance at most of these sites and often allows for a buildup of numbers in migration of both Red-necked and Wilson's Phalaropes. Shorebirds that frequently use interior berms for roosting or foraging during migration or post-breeding periods include godwits, plovers, Buff-breasted Sandpipers, and Upland Sandpipers. Managers should be encouraged to keep these berms well-mowed to provide good visibility for predator avoidance and to secure resting places for shorebirds.

Riverine Sandbars, Shorelines, Islands

These habitats are mostly limited to major Midwestern rivers such as the Mississippi, Ohio, and Wabash Rivers, but can occur on smaller streams and rivers, depending on sediments and human activities such as dredging. Sandbars, both natural and artificial, provide important breeding and foraging habitat for Spotted Sandpipers and small numbers of Killdeer. The largest dredged disposal islands may cover many acres, with forested areas that may attract predators such as raptors and raccoons and may result in sinks for breeding sandpipers. Small islands often do not have the predator issue, but nesting birds are vulnerable to seasonal flooding that destroys their nests. During migration, most species of shorebirds will use these islands and sandbars on occasion, particularly for resting and roosting. Experimental drawdowns such as those that occurred on the Mississippi River below La Crosse, Wisconsin, in the early 2000s did not attract the large numbers of shorebirds expected during autumn migration. It is possible that these sands are relatively sterile, lacking large amounts of organic material that would attract an abundance of chironomids and other invertebrates needed by foraging shorebirds.

Management: Creating and maintaining vegetation-free sandbars is a desired goal for this habitat group, but the reality of site remoteness and high labor costs involved would seem to limit active management. Many sandbars are temporary and occur largely in unmanaged, free-flowing rivers. Maintaining natural river systems would appear to be best to assure that sandbars appear and periodically renew themselves. Dredged disposal islands can be shaped by earth-moving machinery to allow for shallow water ponds or inlets with gentle slopes attractive to shorebirds. Some of these sites may remain attractive for shorebirds for several years before revegetation occurs and predators become established.

Agricultural Fields (Wet, Dry)

Agricultural fields cover the majority of the unforested landscape in the UMVGL region. Untiled fields can provide some shorebird habitat when ponded areas exist on the landscape or when sheet flow from snow melt and precipitation events covers larger acreages. Areas which

annually flood generally offer more food availability for migrants. Killdeer readily use early seasonal wet fields for breeding. A recent phenomenon is the presence of breeding Upland Sandpipers in agricultural fields, primarily untilled soybean fields. Densities are low, but such usage appears to be increasing and has now been documented in Illinois, Iowa, and Minnesota. Dry agricultural fields are used by a few species of migrant shorebirds in autumn, namely Buff-breasted Sandpiper, Upland Sandpiper, Killdeer and, occasionally, other species such as American Golden-Plover. Normally these species occur in recently harvested hay fields, alfalfa fields, and occasionally corn stubble, sugar beet, and bean fields.

Management: Agricultural fields are seldom managed for shorebirds but, if tiling continues at its current rate, field management throughout the Midwest may be necessary to maintain migrant numbers. The shallow flooding of fields from snowmelt until late May, followed by the rapid draining of the fields for agricultural use, could provide thousands of acres of potential shorebird habitat and benefit farmers by maintaining soil moisture for planting and negatively affecting weed growth. Hay fields should not be cut until at least 1 July to protect nesting Marbled Godwits, Upland Sandpipers, and Killdeer. Fall flooding of harvested fields could provide an excellent forage base for invertebrates, especially if the area remains flooded the following spring.

At least 20 shorebird species historically utilized agricultural habitats in the Midwest, particularly in spring when traditionally wet fields abounded before large scale drainage efforts and recent tiling adversely impacted their stopover sites. One species in particular, the American Golden-Plover, is almost completely dependent on agricultural fields in spring. An ongoing, multi-agency project in Illinois entitled the Shorebird Conservation Acreage via drainage water Runoff Control program (SCARC) will hopefully demonstrate how drainage water management can be used to reduce nutrient runoff, increase crop production, and provide habitat specifically for migrating shorebirds and waterfowl by strategically placing managed sites in the central part of the state. (Drew Becker, personal communication 2016).

Sod Farms (Wet, Dry)

Sod farms, which produce grass sod for residential and industrial use, are found scattered around the Midwest, usually within 80 km (50 mi) of a major city. During migration they can be attractive to a variety of shorebirds, particularly from mid-July to mid-September. Species most commonly found at these sites include Killdeer, Pectoral Sandpiper, Baird's Sandpiper, Dunlin, Black-bellied Plover, American Golden-Plover, Buff-breasted Sandpiper, and Upland Sandpiper. Following heavy rains, other species may occasionally appear, including Greater and Lesser Yellowlegs and Lesser, Semipalmated, Pectoral, Baird's, and White-rumped Sandpipers. Shorebird usage is often low during dry conditions but, following heavy rains, stopover times appear to increase, with birds staying over several days if water persists. Killdeer occasionally use these farms as major, pre-migration staging areas beginning in mid-July, with numbers often in the dozens or low hundreds. Upland Sandpipers have been reported to stage at such sites in the East or in similar habitat at airport grasslands where protection against human disturbance may be one of the attractants. Few Upland Sandpiper staging areas have been identified to date in the Midwest.

Management: Allowing ponded areas to remain for a few days at a time or purposely flooding such areas for short periods of time (1-3 days) would be highly beneficial to shorebirds.

Airports

The large, short-grass landscapes of airports often attract Killdeer, migrant plover species, Upland Sandpiper, and occasionally Baird's Sandpiper and Buff-breasted Sandpiper. Airports are **not** recommended for managing shorebirds due to the potential for collisions with aircraft. The U.S. Fish and Wildlife Service (USFWS) actively issues permits to managers to harass shorebirds and other species away from airports or to remove birds at airports by lethal means.

Management: Implementing rapid drainage at airports and allowing grass to grow tall in some areas or cutting it extremely short would lessen the attractiveness to shorebirds and reduce potential conflicts.

Wet and Dry Prairies, Burned Prairies

There is little evidence that Midwestern shorebirds currently use burned prairies during migration despite many historical accounts to the contrary. Bridgette Olson, former biologist at Big Stone NWR in western Minnesota, noted that she had never seen any shorebirds using prairies following numerous spring controlled burns at the refuge. However, prescribed burns are an important management tool in Midwestern prairies. They rejuvenate the prairie, rid it of accumulated dead vegetation and duff, and stimulate new plant growth.

Many Midwestern restored prairies are dominated by tall grasses like Big Bluestem (*Andropogon gerardii*) and Indian Grass (*Sorghastrum nutans*). Without grazing or fire, there is seldom any open habitat for shorebirds to forage in, even in spring. A heavy snowpack in more northerly prairies can allow for packing down of prairie grasses and a low grass cover when spring arrives. Wilson's Snipe, Marbled Godwit, Greater and Lesser Yellowlegs, and even Upland Sandpiper can utilize small pools and cool season grass openings within this short grass matrix.

Management: Grazing should be introduced onto grassland sites to replicate native herbivores and allow for a matrix of grass heights attractive to breeding shorebirds such as Upland Sandpiper and Killdeer. Late summer and fall burns should be experimented with to discover the best burning regime for prairie-inhabiting shorebirds such as American Golden-Plover. Burning later in the year more closely replicates natural systems and may prove more beneficial to migrant shorebirds.

Pastures

Killdeer, Marbled Godwit, and Upland Sandpiper all use lightly- to moderately-grazed pastures for breeding sites. Migrant plovers and Buff-breasted Sandpiper, as well as staging Killdeer, also use this habitat, especially in fall. Acreage in pasture has steadily declined across the UMVGL region due to declining dairy herds and more corn-fed cattle on feedlot operations.

Management: Recent implementation of managed grazing on some UMVGL region National Wildlife Refuges and Waterfowl Production Areas by the USFWS may alleviate some of these losses and provide high quality pasture lands. Light to moderate grazing can provide a mosaic of grassland structure. Moderate to even heavy grazing can be beneficial to wetland edges by knocking back permanent vegetation, creating muddy shorelines, and allowing greater predator visibility for shorebirds. Such sites have proven beneficial for breeding Wilson's Phalarope, Killdeer, and Wilson's Snipe if cattle can be moved out of the area before the initiation of shorebird nesting.

Marshes, Lakeshores, Shallow Wetlands, Drying Ponds

These areas provide important late summer/autumn habitat for migrant shorebirds. Where shorelines are grazed or otherwise impacted, shorebirds may use the sites in spring as well. Precipitation events and spring runoff may preclude heavy shorebird use earlier in the year but, in most typical fall migrations, these habitats can be very important from mid-July through October.

Management: Ponds with water control structures are usually lowered beginning in late June or early July and are allowed to remain low well into the fall. Whereas some managers raise the water levels in early Sept. to accommodate returning waterfowl, it is recommended that at least a couple of units on a refuge be held at low levels (2-6 cm; 5-15 in) through Oct. (Nov. in south) for late migrant shorebirds including Dunlin, White-rumped Sandpiper, Wilson's Snipe, Long-billed Dowitcher, and Greater Yellowlegs. Such management can also be beneficial for specialized foraging of waterfowl species such as Green-winged Teal (*Anus crecca*) and Northern Shoveler (*Anus clypeata*). Protection of the watershed feeding these wetlands can be critical. Runoff can increase in urban areas and make formerly shallow wetlands deep water, with no available shoreline and no value to shorebirds.

Moist Soil Units and Managed Units/Drawdowns

Managed wildlife areas provide important shorebird habitat when drawdowns or natural drying conditions occur. Recessional waters often expose mudflats rich with invertebrate prey and create a mosaic of shallow water and exposed mudflat habitats that attract several guilds of shorebirds, including dry mudflat gleaners, wet mudflat gleaners and probers, shallow water probers (<5 cm; <2 in), and deep water (5-15 cm; 2-6 in) probers (these guilds are highlighted in Appendix 2).

Management: Annual vegetation should be allowed to grow for a season and then disked in fall before flooding for waterfowl, to provide maximum invertebrate production the following spring after a drawdown. Late spring disking and early-summer flooding followed by a slow drawdown can benefit July and August migrants. Such areas must be closely watched for potential blue-green algae blooms and botulism outbreaks. Larger refuges should provide at least one unit with late season shallow flooding, which would benefit late migrants such as Dunlin, Greater and Lesser Yellowlegs, Long-billed Dowitcher, Killdeer, and Wilson's Snipe. Other growth and flooding regimes should be experimented with to provide the right mix of flooded and drawdown units attractive to an area's shorebirds.

Forested Ephemeral Ponds (Vernal Ponds)

A specialized but formerly more widespread habitat consists of shallow meltwater ponds that persist on forest floors for a week to a couple of months following snow melt. These ephemeral pools are valued as breeding pools for various frogs, toads, and salamanders and often contain high invertebrate populations attractive to spring migrant Solitary Sandpipers. In open forests, some of these pools are edged with low grasses and sedges and may also attract a few Wilson's Snipe, American Woodcock, Spotted Sandpipers, and occasionally Killdeer or Lesser Yellowlegs. Deeper pools may persist into mid-summer and again attract southbound Solitary Sandpipers, which peak in this region in mid-to-late July.

Management: Passive management is normally recommended for this habitat. During drought cycles, the majority of these pools may be dry during the spring. Restoration of hydrology and slope may be required for sites subject to past alteration, such as from logging skidders and drainage. Some sites may require removal of logging debris, although a few well-placed logs and branches in a shallow pool may be attractive for Solitary Sandpiper, Lesser Yellowlegs, and Wilson's Snipe roosting and perching. Biebighauser (2010) is a useful reference on design, construction, and planting when creating ephemeral ponds.

SHOREBIRD SPECIES MANAGEMENT GUIDELINES

Appendix 2 provides information on habitat preferences, chronology, and management guidelines for shorebird species occurring in the UMVGL region, organized by foraging guilds.

SHOREBIRD POPULATION MONITORING ACTIVITIES

Appendix 3 provides information on monitoring programs for UMVGL region shorebird species. Data collected through shorebird monitoring efforts vary in complexity, depending on the contributor and user needs, and can be generally categorized as:

1. Casual data collection – no set protocol or design.
2. Protocol-based monitoring programs – field survey methods developed, but no statistically-based spatial sampling framework.
3. Statistically-designed surveys – field survey methods, including detection considerations, developed within a probability-based sampling frame.
4. Electronic and visual marking programs.
5. Data management.

Casual Data Collection

eBird

The purpose of eBird (<http://ebird.org/content/ebird/>) is to maximize the utility and accessibility of the vast number of bird observations made each year by recreational and professional bird watchers. Developers suggest that the sheer magnitude of the captured information will uncover ecological patterns useful to bird conservation (i.e., eBird data have served as the foundation for recent U.S. State of the Birds reports). Observers set up their sites as a “hotspots” and submit data by filling out checklists that note presence or counts of individuals at the specified sites at specified times (accounting for effort). Both birding volunteers and professional biologists can contribute to this rapidly-growing database.

Protocol-based Monitoring Programs

International Shorebird Survey (ISS)

The ISS (<https://www.manomet.org/program/shorebird-recovery/international-shorebird-survey-iss>) is a volunteer-based survey conducted at shorebird stopover and wintering sites throughout North America. Administered by Manomet Center for Conservation Sciences, the program has accumulated 40+ years of data. Observers follow a specific protocol and visit sites of their choosing during migration periods. Monitoring requires a long-term commitment, running surveys every ten days from 15 March to 15 June in spring and 15 July to 15 October in fall. Longer seasons are recommended for less severe climates and shorter seasons in the Upper Midwest, with spring counts recommended to begin on 1 April. Each site is a discrete sampling unit; thus one refuge may contain one to several sampling sites that are each visited by one or more observers. Observers can now enter their data through an eBird portal (<http://ebird.org/content/iss/>). Research is underway to develop programs to better ascertain trend patterns and population estimates using ISS data.

Christmas Bird Count

The Christmas Bird Count (www.audubon.org/conservation/science/christmas-bird-count) is sponsored by the National Audubon Society. It is conducted from mid-December to early January, mainly across North America. In 2013, 2,369 24 km (14 mi) diameter circles were surveyed.

Avian Influenza Monitoring

A highly specialized form of shorebird monitoring is avian influenza monitoring conducted by the USFWS, U. S. Geological Survey (National Wildlife Health Center), U. S. Department of Agriculture’s Animal and Plant Health Inspection Service, State natural resource agencies, and other groups. Surveys from 2006-2011 throughout North America were conducted to ascertain the potential transmission of H5N1 avian influenza from Asia into North America by wild birds. Species with breeding populations in Asia that winter in North or South America are particularly targeted. They include Pectoral, Baird’s, and Western Sandpipers, and Long-billed Dowitcher.

Despite collecting blood samples from thousands of shorebirds, the subject pathogen was not detected. New strains of the disease will likely require future shorebird monitoring. Such monitoring efforts offer opportunities for gathering additional data on migration, hormonal levels, and stopover times.

Statistically-designed Surveys

North America Breeding Bird Survey (BBS)

The BBS (<http://www.pwrc.usgs.gov/BBS/>) is a long-term, large-scale, international avian monitoring program initiated in 1966 to track the status and trends of North American bird populations and is administered by the U.S. Geological Survey's Patuxent Wildlife Research Center. Annually during the breeding season, observers conduct a series of 50 point counts (3 minutes each) along a 40 km (24.5 mi) roadside survey route. Data from the randomly-selected routes provide a statistical index of population abundance that can be used to estimate population trends and relative abundance at various geographic scales. Most of the primary mid-latitude breeding shorebirds are sufficiently well-covered by BBS routes to ascertain trends and abundance from the existing data. The two species that likely are not well-covered by the BBS are the riverine and lakeshore-inhabiting Spotted Sandpiper and the crepuscular Wilson's Snipe. Only the very first 1-5 BBS stops along a survey route capture the winnowing flight sounds of the latter species due to the timing and seasonality of this survey.

Program for Regional and International Shorebird Monitoring (PRISM)

PRISM (<http://www.shorebirdplan.org/science/program-for-regional-and-international-shorebird-monitoring>) is being implemented by a Canada-U. S. Shorebird Monitoring and Assessment Committee, formed in 2001 by the Canadian Shorebird Working Group and the U.S. Shorebird Council. PRISM provides a single blueprint for implementing the shorebird conservation plans recently completed in Canada and the United States. The original goals of PRISM were to: (1) estimate the size of breeding populations of 74 shorebird taxa in North America; (2) describe the distribution, abundance, and habitat relationships for each of these taxa; (3) monitor trends in shorebird population size; (4) monitor shorebird numbers at stopover locations, and (5) assist local managers in meeting their shorebird conservation goals.

PRISM has four main components: arctic and boreal breeding surveys, temperate breeding surveys, temperate nonbreeding surveys, and Neotropical surveys. The most important tasks for immediate action are carrying out the arctic surveys, conducting regional analyses to design migration counts, and evaluating aerial photographic surveys for migration and winter counts. Boreal breeding surveys have proven logistically difficult and have been shelved for now.

Integrated Waterbird Management and Monitoring (IWMM)

The IWMM program (<http://iwmmprogram.org>) is a collaboration among conservation partners (Federal, state, and non-governmental agencies) located along the Atlantic and Mississippi Flyways to monitor non-breeding wetland birds, including waterfowl, waterbirds, and shorebirds, in a structured, transparent, and defensible fashion. The IWMM developed monitoring protocols

to simultaneously track habitat conditions, shorebird use, and management actions at local sites. It also developed a flyway-scale migration simulation model to provide decision support for land acquisition and habitat restoration, and is finalizing a local scale, multi-unit decision support model. IWMM's centralized database is part of the Avian Knowledge Network (AKN; <http://www.avianknowledge.net>).

American Woodcock Singing-Ground Survey

This survey, conducted by the USFWS, is made possible by the conspicuous courtship display of the male woodcock. The survey consists of numerous routes in the eastern half of the U.S. and Canada, which are surveyed in the spring. Counts of singing male woodcock along the routes provide an index to woodcock abundance and are used to estimate woodcock population trends for states, provinces, management regions, and the continent. The survey is the major source of information considered in the annual setting of woodcock hunting seasons. These data can also be used to examine the effects of weather, landscape change, and other factors on woodcock population abundance. For more information, see: <https://migbirdapps.fws.gov/mbdc/databases/awsgs/aboutwscgs.htm>.

Electronic and Visual Marking Programs

Recent advances in electronic miniaturization and color banding techniques have led to a greatly expanded knowledge base of shorebird stopover times, migration routes, and connectivity of breeding, migration, and wintering sites. The following techniques are now widely employed by shorebird researchers:

Color Banding

Shorebirds are fitted with a traditional metal band, one or more of a series of color bands, and a colored flag indicating the country in which the species was banded. Colors utilized include: yellow (Canada), light green (U. S.), blue (Brazil), orange (Argentina), and red (Chile). It is important to note on which leg color bands are placed and in which position the bands are stacked. To report a color-banded shorebird, data may be entered at <http://www.bandedbirds.org/>. For certain species such as the Piping Plover or the eastern Red Knot, a significant percentage of the population may be color-marked, and the public is relied upon to help track these individuals.

Geolocators

Geolocators collect and store activity or location information via geographic positioning systems or light levels. The units must be retrieved, so targeted birds are primarily those with high site fidelity.

Radio Telemetry Tracking

Radio telemetry tracking generally gives the least information for large-scale movements, as a signal must be detected by a nearby receiver. This technique has been used to study stopover

times and habitat use and to document migration windows for shorebirds with narrow coastal or inland migration routes passing a known point with a receiving station.

Satellite Tracking

Satellite tracking allows the location of a bird to be determined anywhere in the world, but it is very expensive and, due to size, can currently only be used on large shorebirds such as curlews and godwits. Satellite transmitters can be either implanted into the bird or worn as a “backpack” unit. Despite the expense, a great deal can be learned from this technique. Notable Great Lakes findings include Marbled Godwits breeding on Akimiski Island, Nunavut, Canada tracked migrating southwestward over Lake Superior to Baja California, Mexico wintering grounds, and Whimbrels collared during staging in coastal Virginia flying over Lakes Ontario and Huron on their way to breeding grounds in Alaska and the Northwest Territories, Canada.

Data Management

Midwest Avian Data Center (MWADC)

In 2011, the Midwest Coordinated Bird Monitoring Partnership, in cooperation with Point Blue Conservation Science, launched the Midwest Avian Data Center (<http://data.pointblue.org/partners/mwadc/index.php?page=home>), a cutting edge data management and decision support system that provides readily accessible avian monitoring data to the Midwestern bird conservation community. The goal for MWADC is to improve conservation of birds and their habitats through the use of sound monitoring data, the best available science, and open, collaborative partnerships. MWADC provides access to many tools, including those to upload, integrate, and download bird monitoring data; visualize and query data using maps, histograms, and other decision support tools; and summarize bird data within specified locations and time periods. These powerful online tools enable users to work with collective data resources of many participating partners. MWADC is hosted by Point Blue Conservation Science and based on technology developed by members of the AKN.

Integrated Waterbird Management and Monitoring Program’s Avian Data Center

IWMM is working to provide decision support tools that will enable multi-scaled waterbird habitat management decisions to be made in a structured, transparent, and defensible fashion. A key element of this process is the creation of a relational database that stores, manages, and reports non-breeding waterbird population, habitat, and management action data for management units located across multiple flyways. To this end, IWMM is working with Point Blue Conservation Science to provide participants a centralized database with online entry and reporting. In addition to supporting IWMM participants, the database will also help create and allow for iteratively updating decision support tools. Planned as a node of the AKN, the IWMM database enables cross-programmatic data and tool sharing that lead to cost efficiencies and a greater range of data analysis opportunities.

SHOREBIRD RESEARCH AND INFORMATION NEEDS

Case and Hughes (2011) identified rangewide research and information needs for Wilson's Snipe, including implementation of a national monitoring program, continued improvement of the Harvest Information Program sampling frame, improvement of the Rails and Snipe Parts Collection Survey, and an estimation of vital rates to support population modeling.

Case and Sanders (2010) identified rangewide research and information needs for American Woodcock, including development of a demographic-based model for assessing population response to harvest and habitat management, improving understanding of migration, breeding, and wintering habitat quality of the woodcock, and improvement of the Singing-ground Survey.

Additional shorebird research and information needs for the UMVGL region, vetted through Federal and state agencies and non-governmental organizations, include the following:

High Priority

- Identify important breeding, wintering, and stopover sites for Midwest shorebirds and implement conservation and management efforts at those sites.
- Document both seasonal stopover periods for most regularly-occurring species and the number of migrational waves (implied turnover rates) each species makes. For instance, Whimbrels make a single rapid movement northward in spring, but there may be several waves of both adult and juvenile Least Sandpipers moving southward in fall.
- Explore various grazing and burning regimes on managed Federal, state, and privately protected prairies, pastures, and grasslands and their effects upon breeding Upland Sandpiper, Marbled Godwit, and Wilson's Phalarope.
- Assess the effects of wind energy development and the associated infrastructure on staging American Golden-Plover and other shorebird species. Evaluate different operating regimes that decrease impacts and allow for continued avian use of historic concentration areas. Ongoing research is being undertaken by Illinois Natural History Survey.
- Investigate which moist soil management regimes can best support both waterfowl/waterbirds and migrant shorebirds, especially late-season shorebirds like Greater Yellowlegs, Dunlin, Wilson's Snipe, and Long-billed Dowitcher. Investigate ways to accommodate species with specialist foraging requirements (e.g., American Avocet and Wilson's Phalarope) within systems managed for the greatest wildlife diversity. Currently, the IWMM Program is investigating aspects of some of these needs.
- Using energetic models in the Upper Mississippi River and Great Lakes Region Joint Venture Shorebird Habitat Conservation Strategy, calculate the acreages needed to support target numbers of shorebirds in the region. Plan where and how many such acreage assemblages need to be located across the landscape to accommodate the needs of migrating

shorebirds given the vagaries of climatic shifts and stochastic events in precipitation/soil moisture/prevaling winds, etc.

Medium Priority

- Assess shorebird habitat and energetic requirements under differing climatic regimes, including whether average years require more intensive management for shorebirds than the extremes of flooding and drought. Climate change effects that result in either migrants or breeders being out of synchrony with available food sources are cause for alarm and require more study.
- Assess the impacts of human disturbance on the distribution, abundance, and foraging of shorebirds on refuges, riverine systems, and along the Great Lakes shores. Evaluate different conservation actions which can both accommodate human activity in these areas as well as diminish disturbance to shorebirds, other wildlife species, and their habitats.
- Evaluate different agricultural cropping and irrigation/flooding regimes to determine the most beneficial pattern resulting in both the greatest good for shorebirds as well as meeting agricultural plowing, planting, and harvesting schedules. Assess whether seasonal shallow water sheet flow on level grazing lands is a workable alternative to crop field habitat for shorebirds, especially the American Golden-Plover. Evaluate patterned tile systems to provide both seasonal shorebird habitat and agricultural productivity.
- Continue studies of American Woodcock migration and stopover requirements through future satellite telemetry and monitoring. Studies examining nest and brood survival are currently ongoing in Maine, Minnesota, and New York. Expand research on detection probability for this species using both the American Woodcock Singing-ground survey and the Breeding Bird Survey.
- Determine the necessary minimum breeding density, distribution, and genetics of Upland Sandpiper populations to assure that viable metapopulations of this species persist, interact, and prosper, connecting the St. Lawrence River Valley population and southern Ontario populations with Midwest populations through northern Wisconsin and Michigan's Upper Peninsula and through central Illinois, northern Indiana, northern Ohio, and western and upstate New York.
- Assess the value of working croplands, especially low-till soybean fields, to breeding Upland Sandpipers in the Upper Midwest where this species has been noted as occurring with increasing frequency.

Low Priority

- Identify habitat requirements and management needs for staging areas, if they exist, for Upland Sandpiper, Killdeer, Spotted Sandpiper, and other breeding shorebirds.

- Assess the effects of contaminants from agricultural sources, sewage treatment plants, golf courses, and sod farms on migrant shorebirds.
- Investigate the ability of long-distance migrants to transport disease vectors such as avian influenza and West Nile virus. Assess the frequency and effects on shorebirds of Great Lakes botulism outbreak episodes. Continue investigating transmission methods with the hope of finding better management capabilities.
- Assess impacts of the expanding Great Lakes breeding populations of Merlin and Peregrine Falcon on breeding Piping Plover and migrant shorebirds.
- Assess the value and potential management schemes of gravel quarries, sand pits, dredged disposal islands, sewage treatment plants, sod farms, interstate highway borrow pits, and other often overlooked habitats to Spotted Sandpiper, Killdeer, and other breeding and migrant shorebirds. Evaluate whether, cumulatively, such sites could provide significant acreage of managed shorebird habitat on a permanent basis in the UMVGL region.
- Evaluate monitoring methods, including during the wintering (ongoing in Louisiana) and breeding season, to best survey Wilson's Snipe. Use data from the first few 1-5 stops of BBS routes to determine applicability as a snipe monitoring protocol.

Many of these shorebird research and monitoring priorities are also highlighted in the Upper Mississippi River and Great Lakes Region Joint Venture's Shorebird Habitat Conservation Strategy (<http://www.uppermissgreatlakesjv.org/Priorities.htm>).

SHOREBIRD EDUCATION AND OUTREACH TOOLS AND NEEDS

Key Shorebird Publications

In 2000, the first UMVGL Shorebird Conservation Plan (de Szalay et al. 2000) identified the need for literature and training on shorebird identification, life histories, habitat requirements, and management techniques. Since then, several high-quality shorebird identification books have been published. The following are highly recommended for managers and educators: *The Shorebird Guide* (O'Brien et al. 2006) has superb photographs, range maps, and information on plumage characteristics and migration for all regularly-occurring and casual shorebirds on the North American continent. *The Shorebirds of North America* (Paulsen 2005) is somewhat more compact than the previous work, less comprehensive, lacks maps, but still covers all North American species. A more detailed regional work by the same author is his 1993 work *Shorebirds of the Pacific Northwest*, which entails a detailed look at the plumage variations, migration timing, and status of all of the shorebird species found in that region and coincidentally includes all of the UMVGL region birds as well. It is profusely illustrated with photos. The book lacks maps but has an excellent bibliography.

A world shorebird guide keyed towards identification is *Shorebirds: An Identification Guide* (Hayman et al. 1986). This older guide covers all world species and is profusely illustrated to

show both sedentary and flying birds and contains brief notes on plumage and voice characteristics and information on migrations, habits, and measurements. A handy field guide to Midwestern shorebirds is *A Pocket Guide to Great Plains Shorebirds* (Fellows and Gress 2006), which includes all of the shorebird species occurring in the UMVGL region. All regularly occurring species found in the Great Plains are included. A similarly-sized guide is an identified need for the Great Lakes region.

The *Birds of North America* series (Academy of Natural Science, various authors and years) provides in-depth individual species accounts of all North American shorebirds including detailed habitat, conservation, and behavior information. A subscription to this series is available online from Cornell University at <http://bna.birds.cornell.edu/bna/>.

The most valuable publication to address shorebird needs in recent years is *Shorebird Ecology, Conservation, and Management* (Colwell 2010), which is a state-of-the-art text covering the basics of shorebird systematics, morphology, anatomy, and mating systems as well as breeding and migration biology, foraging ecology, habitat conservation, and management.

Several federal agencies have developed brochures and management guidelines for shorebirds at a national scale that often contain useful information pertinent to the UMVGL region. The Department of Defense (DOD) has developed *Conserving Shorebirds on Department of Defense Lands* (Harrington 2007), which contains information on shorebird guilds, habitat utilization, and case studies of shorebird management on DOD lands. Ducks Unlimited, Manomet Center for Conservation Sciences, and the U.S. Forest Service developed *Shorebird Migrations: Fundamentals for Land Managers in the United States* (Payne 1999), which contains some useful charts on shorebird migration. *A Guide to Creating Vernal Pools* (Biebighauser 2002) contains useful information to build and maintain an ephemeral wetland that would greatly benefit Solitary Sandpiper and other forest-inhabiting shorebirds such as snipe and woodcock.

Shorebird management workshops are periodically held in the Midwest under the auspices of the USFWS, the Manomet Center for Conservation Sciences, state Departments of Natural Resources, and local bird and conservation groups. Ohio, Minnesota, Missouri, and Wisconsin have all held such workshops with audiences ranging from birders and land managers to private land owners and State and Federal biologists. Such workshops usually combine field identification and field trips to observe habitat management with classroom study on migration, habitat analysis, ecology, and management options.

Technical Assistance

A large portion of shorebird habitat is on private lands in the UMVGL region. There is a continuing need to develop outreach information on the values and needs of shorebirds and make this available to private landowners. Technical assistance is also needed for those landowners with specific interests in managing their lands for shorebirds. This can be provided by biologists with the USFWS (through the Joint Ventures, Migratory Birds, and Private Lands Programs), the Natural Resources Conservation Service, Farm Service Agency, and the various state and county wildlife agencies.

SHOREBIRD CONSERVATION FUNDING NEEDS AND FUNDING SOURCES

Version 1.0 of this plan (de Szalay et al. 2000) identified eight general activities where financial support was needed to conserve shorebirds in the UMVGL region. These include:

1. Habitat protection through fee-title acquisition, easements, and agreements.
2. Restoration of wetlands and grasslands.
3. Habitat management activities and infrastructure, including water control structures, pumping systems, dikes, impoundments, and farming equipment.
4. Population monitoring and development of Geographic Information Systems and other databases to house region-specific information on shorebird numbers, distribution, chronology, population trends, and habitats.
5. Research to address information needs related to shorebird conservation, as outlined above in the section on research and information needs.
6. Education and outreach activities and materials, including training workshops, publications, and educational programs.
7. Technical assistance to private landowners.
8. Additional biologists, resource managers, and support personnel to accomplish the above tasks.

Many of these items have been well addressed in the ensuing 15 years, but all are a continuing need. The following Federal programs support funding for shorebird conservation activities in the UMVGL region, dependent upon annual budgets and competition with other species-groups: (1) USFWS Region 3 Migratory Bird Conservation small grants program, which largely focuses on birds of highest conservation concern; (2) Upper Mississippi River and Great Lakes Joint Venture small grants program, which focuses mainly on research and monitoring priorities identified in Joint Venture plans; (3) North American Wetlands Conservation Act grant program, which is largely related to habitat protection, restoration, and management; (4) grants from Landscape Conservation Cooperatives; (5) U.S. Geological Survey Science Support and Quick Response programs, which use USGS funds to address USFWS research needs; and (6) the USFWS Great Lakes Fish and Wildlife Restoration Act program, which provides assistance to states, tribes, and others to encourage cooperative conservation, restoration and management of the fish and wildlife resources in the Great Lakes Basin.

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APPENDIX 1 – SHOREBIRD POPULATION STATUS IN THE UPPER MISSISSIPPI VALLEY/GREAT LAKES REGION

Following is information on population numbers and trends of UMVGL shorebirds, largely derived from Morrison et al. (2001) and Andres et al. (2012). Regional populations are estimated from a combination of eBird, state Breeding Bird Atlases, state bird books and bird journals, and expert opinion. The first number listed is the estimated continental population or an appropriate regional population. The number in parentheses is the estimated UMVGL population. Trends are provided for continental populations over the past 30+ years. DEC= significant decline; dec = apparent decline; INC = significant increase; inc = apparent increase; STA = stable; and UNK = unknown.

Black-necked Stilt: 175,000 (500+ breeding). Trend = INC.

American Avocet: 450,000 (1,000 migrants). Trend = STA.

Black-bellied Plover: Eastern continental population is 100,000 (25,806). Trend = DEC.

American Golden-Plover: 500,000 (100,000). Trend = dec.

Semipalmated Plover: 200,000 (21,212). Trend = INC.

Piping Plover: Great Lakes population is 140+. Trend = gradually increasing. Great Plains population is 4,700 (1,400 migrants, largely fly-overs). Trend = fluctuates, but overall STA.

Killdeer: 2,000,000 (163,636 breeding). Trend = DEC.

Spotted Sandpiper: 660,000 (120,000). Trend = STA.

Solitary Sandpiper: Eastern subspecies (*Tringa solitaria solitaria*) population is 126,000 (21,951). Trend = UNK.

Greater Yellowlegs: 137,000 (16,822). Trend = STA.

Willet: Western subspecies (*Catoptrophorus semipalmatus inornatus*), which likely is the only subspecies occurring in the UMVGL region, numbers 160,000 (1,500). Trend = dec.

Lesser Yellowlegs: 660,000 (200,000). Trend = DEC.

Upland Sandpiper: 750,000 (53,165). Trend = INC.

Whimbrel: Midcontinent subspecies (*Numenius phaeopus hudsonicus*) numbers 40,000 (9,900). Trend = dec.

Hudsonian Godwit: Hudson Bay breeding population is 56,000 (27,500). Trend = dec.

Marbled Godwit: Great Plains population is 170,000 (UMVGL breeding population in Minnesota is 1,000 and possibly declining). Trend = dec. James Bay breeding population is 2,000, most of which migrate across Upper Great Lakes states southwest to Mexican wintering areas on the Gulf of California. Trend = STA.

Ruddy Turnstone: Subspecies (*Arenaria interpres morinella*) from the central Canadian Arctic numbers 180,000 and is the likely source for most Great Lakes migrants (estimated at 30,423). Trend = DEC.

Red Knot: Subspecies (*Calidris canutus rufa*) is the only race likely in the UMVGL region now and numbers 42,000 (250). Trend = STA.

Stilt Sandpiper: 1,243,700 (145,316). Trend = dec.

Sanderling: 300,000 (52,174). Trend = dec.

Dunlin: Subspecies (*Calidris alpine hudsonia*) is the expected race migrating through the UMVGL region, and numbers 450,000 (260,366). Trend = STA.

Purple Sandpiper: *Calidris maritima belcheri* subspecies from Hudson Bay numbers 30,000 and is the likely source for most Great Lakes migrants (<300). Trend = dec.

Baird's Sandpiper: 300,000 (48,913). Trend = UNK.

Least Sandpiper: 700,000 (125,472). Trend = STA.

White-rumped Sandpiper: 1,120,000 (275,410). Trend = STA.

Buff-breasted Sandpiper: 56,000 (6,364). Trend = dec.

Pectoral Sandpiper: 1,600,000 (84,211). Trend = DEC.

Semipalmated Sandpiper: 2,260,000 (395,062). Trend = DEC in Atlantic coast region and Midwest and STA elsewhere.

Western Sandpiper: 3,500,000 (5,000). Trend = dec.

Short-billed Dowitcher: Expected subspecies (*Limnodromus griseus griseus* and *L. g. hendersoni*) migrate through the UMVGL region and number 78,000 (57,892). Trend = STA.

Long-billed Dowitcher: 500,000 (58,182). Trend = UNK.

Wilson's Snipe: (2,000,000) (285,714). Trend = STA.

American Woodcock: 3,500,000 (933,333). Trend = DEC.

Wilson's Phalarope: 1,500,000 (193,548). Trend = dec.

Red-necked Phalarope: 2,500,000 (211,268). Trend = DEC.

APPENDIX 2 – SHOREBIRD SPECIES MANAGEMENT GUIDELINES

Following is information on habitat preferences, chronology, and management guidelines for shorebird species that occur in the UMVGL region, organized by foraging guilds. Sources for this information include state bird books, State Breeding Bird Atlases, state and national journals on bird distribution, and eBird. A number of excellent rangewide conservation plans have been developed by the Manomet Center for Conservation Sciences and the Western Hemisphere Shorebird Reserve Network for shorebird species that occur in the UMVGL region, and they are cited below.

Forest/Meadow Prober Guild

American Woodcock (*Scolopax minor*) (breeder, migrant)

Habitat: Favors early successional forest habitats for breeding but also found in open forests and savannas. Most frequently found in bottomland forests or forests adjacent to wet meadows, pastures, and moist fallow fields. During migration, found in similar habitats, but late fall dry spells often force birds into bottomland areas.

Chronology: **Spring:** Late February or early March (south half of the UMVGL region) and mid-to-late March (north half of the UMVGL Region); **Fall:** Through September with most flights occurring in fall following hard freezes in late September or October. A few persist into November and occasionally winter in southern Ohio, Indiana, Illinois, Tennessee, Kentucky, and Missouri. Breeding birds are usually on their nesting grounds as soon as snow cover disappears.

Notes: American Woodcock and Solitary Sandpiper are the only North American shorebirds which habitually favor forest habitat, although Greater and Lesser Yellowlegs and Least Sandpiper are often found in wetland openings within forested landscapes.

Management Recommendations: The American Woodcock Conservation Plan (Kelley and Williamson 2008) documents changes in woodcock densities and habitat that occurred from the early 1970s to the recent past. Population density deficits were calculated, and specific habitat acreage goals for erasing such deficits were developed. Loss and degradation of early successional habitat were believed to be the primary factors responsible for these declines. The plan notes the loss of over 839,000 singing male woodcocks since the early 1970s, a substantial portion of which were in the Upper Midwest within the UMVGL region. The need for several million acres of new woodcock habitat within the UMVGL region is discussed. For a summary of recent progress in implementing the American Woodcock Conservation Plan, see: <http://www.timberdoodle.org>.

Beach Gleaner Guild

Red Knot (*Calidris canutus*) (migrant)

Habitat: **Spring:** Flooded fields, sandy beaches, rocky shorelines, sewage treatment plants; **Late Summer and Fall:** Mostly along sandy shores of the Great Lakes.

Chronology: **Spring:** Early May to early June with peaks along the Great Lakes from 19 May to 1 June; **Fall:** Late July to early October with most movement in August.

Notes: A rare, low density migrant throughout most of the UMVGL region best found on the shores of the Great Lakes (spring and fall) or inland in Minnesota and Wisconsin; in fall on the shores of the largest lakes or reservoirs (Illinois, Iowa). The *rufa* subspecies is listed as Federally Threatened in the U.S.

Management Recommendations: Regional: Preservation/restoration of shallow water coastal marshes with exposed mudflats in the southern Great Lakes region. Manageable numbers only in Lake Ontario Basin, some years in Lake Erie Basin. See the Red Knot Conservation Plan for the Western Hemisphere by Niles et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Two conservation actions from this plan that Great Lakes biologists could assist with include resightings and reporting of banded individuals and reducing disturbance at regular stopover sites at Presque Isle Provincial Park and Prince Edward County, northeast Lake Ontario. The value of this area as a late spring stopover site, its exact extent, and the birds' foraging activities when present, need to be determined. Apart from this area, there is no manageable population in the Great Lakes region.

Sanderling (migrant)

Habitat: **Spring:** Flooded fields, sandy beaches, pothole shores, sewage treatment plants; **Fall:** Mostly along sandy shores of the Great Lakes, occasionally inland on large lakes and reservoirs and along large rivers on sandbars and on dredged disposal islands.

Chronology: **Spring:** Early or mid-May to early June with peaks along the Great Lakes from 15 May to 1 June; **Summer and Fall:** Early July to late October with peak movement from late July through September.

Notes: Fairly common migrant in spring on the Great Lakes and uncommon migrant on the prairies west of the Mississippi River; more common in late summer and fall when most common on Great Lakes beaches.

Management Recommendations: See the Conservation Plan for the Sanderling (*Calidris alba*) by Payne (2010) at: <http://www.whsrn.org/conservation-plans>. Perhaps the greatest need of the Sanderling in the Great Lakes is for undisturbed stretches of beaches or offshore islets where the species can roost or forage without human disturbance. Regular beach-cleaning of beached algae beds by machines should be discouraged except in heavy human-use areas. Beach enclosure areas (dogs, humans) can greatly benefit this flocking species, which has a relatively high tolerance of some human disturbance. Creation of broader, more gently-sloping shorelines at Interstate highway borrow pits throughout the Midwest would provide a great deal of largely undisturbed habitat for this widespread but locally occurring species. Timing drawdowns to the second and third weeks (fourth week in northern half of region) of May would likely benefit inland-migrating Sanderlings. Restoration of coastal lagoons along the Great Lakes shores would benefit this species.

Ruddy Turnstone (*Arenaria interpres*) (migrant)

Habitat: **Spring:** Flooded fields, along sand beaches, rocky shorelines, jetties, sewage treatment plants; **Fall:** Mostly along sandy and rocky shores of the Great Lakes, jetties.

Chronology: **Spring:** Early May to early June with peaks along the Great Lakes from 19 May to 1 June; **Fall:** Mid-July to late October with peaks in August (adults) and September (juveniles).

Notes: Spring migration is largely through western Minnesota, Iowa, and Missouri, where the species is local and uncommon, and through the Great Lakes with largest numbers occurring in flooded fields in the Green Bay-Kewaunee, Wisconsin, area, the western shores of Lake Erie including Ottawa NWR, and on the western shores of Lake Michigan. The species is uncommon to fairly common on the Great Lakes in fall and rarer inland where it might occur at any wetland or sewage lagoon throughout the region.

Management Recommendations: Along shores of the Great Lakes, regular beach-cleaning of beached algae beds by machines should be discouraged except in heavy human-use areas. Beach enclosure areas (dogs, humans) can greatly benefit this flocking species, which has a relatively high tolerance for human disturbance. Fencing off rocky jetties and piers can provide suitable, undisturbed roosting sites for this migrant. Inland, tilling of low flooded areas benefits this species during its narrow spring migration window. Fall tilling of row crops creates conditions favorable for invertebrates, especially if the remaining vegetation is very low and soils become saturated or flooded by late spring. Creation of small rock pile roost sites within impoundments could benefit this and other shorebird species.

Piping Plover (*Charadrius melodus*) (breeder, migrant)

Habitat: **Spring:** Mainly Great Lakes shores; rare in flooded agricultural fields, drawdowns, edges of lakes, and riverine sandbars. Breeds on broad expanses of Great Lakes beaches, sandy islands, often near mouths of small streams and rivers and tips of islands (high energy areas); **Late Summer and Fall:** Rare on beaches and shores of the Great Lakes, riverine sandbars on large rivers, reservoir shores, managed drawdowns, and in flooded fields.

Chronology: **Spring:** Mid-April to early May; **Fall:** Early or mid-July to mid-September with most birds departing in August and gone by early September.

Notes: The Federally Endangered Great Lakes breeding population is currently restricted entirely to the western three Great Lakes (Superior, Michigan, and Huron), with a few birds of this population along the Missouri River, occasionally breeding in low water years in Nebraska and Iowa. The 2015 Great Lakes breeding population consisted of 73 pairs, a modern high count, which fledged 128 wild chicks. Captive rearing of abandoned eggs resulted in 7 more chicks raised and released into the population. A tiny remnant population (<5 pairs) persists on islands of Lake of the Woods, Minnesota and Ontario, but the Minnesota population seldom exceeds one pair due to severe erosion of breeding sites.

Migration concentration areas include the following sites: Wisconsin—Long Island in the Apostle Islands National Lakeshore; Ontario—a few pairs on Lake Huron at Wasaga Beach, Sauble Beach, and on Manitoulin Island; Michigan—Sleeping Bear Dunes National Lakeshore (including North Manitou Island and Platte River mouth), Ludington State Park, and a few remote beaches on the north end of Lake Michigan, on Lake Superior (near Grand Marais, Michigan), and on Lake Huron (Tawas Point State Park). Great Lakes birds are rarely seen in migration except in the southern Great Lakes; birds of the Threatened Great Plains population migrate through the western portion of the UMVGL region and are occasionally observed along the Missouri River and the shores of major reservoirs, lakes, and potholes.

Only isolated breeding has occurred outside these previously mentioned core areas such as Illinois Beach State Park on Lake Michigan in 2011 and 2015 or in northern Leelenau County, Michigan, in 2013. Continued survival and expansion of this species in the Great Lakes will require intensive management of mammalian and avian predators and human disturbance and a large time commitment by dedicated “nest watch” volunteers. The huge increase in nesting Ring-billed Gulls (*Larus delawarensis*) in the southern Great Lakes may preclude any future reestablishment in that area, which was once the core of the historic breeding range. Breeding Merlins (*Falco columbarius*) have proven to be an effective predator at Sleeping Bear Dunes National Lakeshore. It is thought that the loss of the large Long Point (Ontario) Piping Plover colony in the 1970s was largely due to gull predation and increased predation from raccoons (Cadman et al. 1987).

Management Recommendations: Managers interested in the full range of recommendations for this species should consult the Recovery Plan for the Great Lakes and Northern Great Plains populations of the Piping Plover at: <http://www.fws.gov/midwest/endangered/pipingplover/recplan-fnl.html>. Management of the Great Lakes population is under the auspices of the East Lansing Field Office of the USFWS and the Canadian Wildlife Service.

Willet (*Tringa semipalmata*) (migrant)

Habitat: Marshes, lakes, and large ponds with shallow water areas and an open aspect, sewage lagoons, drawdowns, Great Lakes and sandy beaches on large lakes, and riverine sandbars. Willets prefer sites with at least 5-12 cm (2-5 in) of water.

Chronology: **Spring:** Mid or late April to mid-May with peak 20 April to 5 May. **Fall:** Late June (a few) to late September, with heaviest flights 1-20 July.

Notes: Spring migration is mainly through the western third of the UMVGL region, but some concentrations occur on beaches on southern Lakes Michigan and Erie. Due perhaps to human disturbance, these flocks seldom tarry longer than a few hours. These concentration areas are used again on their return flights in mid-summer, especially at the Indiana Dunes National Lakeshore, but again the birds spend only a few hours or overnight at most. This species likely once bred in the westernmost portions of the UMVGL region; reasons for its disappearance are unknown but may be linked to loss of prairie adjacent to suitable wetlands. As Willets breed within a few miles of the UMVGL region in eastern South Dakota, restoration of wetland and

grassland habitats might eventually attract this species to breed again in northwestern Iowa where it may once have bred.

Management Recommendations: Restoration of broad stretches of sandy beaches, preferably with human and dog exclosure zones, would likely attract migrant flocks of this species. Willets in prairie and western portions of the UMVGL region normally occur on wetlands greater than one-acre in size and often seem to prefer much larger wetland complexes with varying water depths. Willets avoid most cattail-dominated marshes and prefer marsh dominated by low vegetation such as spike-rush. Restoration of this species as a breeder in northwestern Iowa is likely contingent upon restoring large expanses of native grasslands, lightly-grazed to ungrazed but with low, open vegetation surrounding seasonal wetlands. Lowther et al. (2001) noted Willets in North Dakota preferred vegetation at their nests that averaged 10 cm (4 in) in height and that they avoided dense upland vegetation favored by some breeding waterfowl. Another component of ideal Willet breeding habitat is a broad stretch of drying mud, recently exposed mudflats, or beach-like habitat around a seasonal wetland.

Spotted Sandpiper (*Actitis macularius*) (breeder, migrant)

Habitat: Marshes, lakes, and large ponds with shallow water areas, sewage lagoons, drawdowns, Great Lakes and large lake sand beaches, islands, and dunes (for nest sites), dredged disposal sites, gravel pits, and riverine sandbars. River and lake islands in early successional vegetation are favored nest sites.

Chronology: **Spring:** Arrives mid-to-late April (south and central) and early May in north; **Fall:** Departs mid-to-late July through mid-September with stragglers to October in south and central with heaviest flights 20 July to 10 Aug.

Notes: Populations in the lakes and rivers region of BCRs 12 and 23 likely contain the highest concentration of breeding birds on the continent. Recent declines, due in part to lakeside development, brush and forest succession on sandbars and islands, and riparian changes, may be cause for early alarm for this still widespread species.

Management Recommendations: Reed et al. (2013) noted three prerequisites for successful Spotted Sandpiper breeding sites: (1) shoreline (stream or lake) for foraging, drinking, bathing, and displaying; (2) semi-open habitat for nesting; and (3) patches of dense vegetation for brood cover. Dredge disposal islands (i.e., like those found in the Mississippi River) should be periodically cleared of much of their vegetation by mechanical means or natural flooding. Ongoing vegetation succession only favors this species for the first few years following clearing or dredged spoil deposition, when clumps of potential nesting vegetation appear. In many parts of the Midwest, recently abandoned quarries and gravel pits provide ideal habitat conditions for this species due to their normally fenced-in situation, open aspect, and clean water. Due to the lack of top soil in many gravel pits, early successional communities can be self-maintained for many years, but occasional habitat manipulation in the form of heavy brush removal will usually be necessary to prevent forest succession from occurring. A mosaic of open and brushy habitat and open shorelines not heavily vegetated is ideal for this bird. Control of predators such as free-ranging cats, skunks, and raccoons may be necessary in more urban situations for this species to

persist as a breeder. Preservation of small, undisturbed breeding sites such as stream mouths and sandbars as “mini-refuges” on highly developed cottage-lined lakes might allow the species to breed and persist in otherwise unsuitable habitat.

Grasslands/Dry Uplands Guild

Upland Sandpiper (*Bartramia longicauda*) (breeder, migrant)

Habitat: Breeding: Grasslands, prairies, hay and alfalfa fields, moist meadows, airports, grassy openings in jack pine areas, open savannas, increasingly in early stages of bean and other crop fields, especially untilled bean fields with furrows; in migration, also on sod farms, alfalfa fields, rarely beaches and shores.

Chronology: Spring: Arrives mid-to late April (south and central) and early May in north; **Fall:** departs late July through mid-September with small flocks noted on staging areas in late July and August. Stragglers occur to early October in some years.

Notes: The world population is estimated at roughly 320,000, approximately the number estimated to have bred just in Illinois in the early 1900s! Post-breeding staging areas have not been identified for many sites in the Midwest and may be an essential life cycle component for this species. Loss of open country including farmland in Michigan’s Upper Peninsula and northern Lower Peninsula, Minnesota, and Wisconsin, may seriously isolate breeding populations in the near future. Maintaining the sparsely distributed Ohio, southern Michigan, northern Pennsylvania, and upstate New York populations is essential to providing a linking corridor between Midwestern breeders and populations in Ontario and the St. Lawrence River Valley in upstate New York and Quebec.

Management Recommendations: See the Conservation Plan for the Upland Sandpiper (*Bartramia longicauda*) by Vickery et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Also see Denchant et al. (2000) for additional management recommendations with a wide geographic scope. Light grazing is recommended for most prairie areas where this species breeds. Restored prairies dominated by big bluestem and Indian grass are generally too dense and tall for Upland Sandpipers. Fall burns can create suitable new-growth grassland structure to allow these birds to breed the following spring and the new growth will shelter the adults and newly hatched young in late May and June most years. Later in summer the birds require pastures or grazed grasslands and prairies with less dense vegetation. Occasional rocks, fence posts, or even telephone poles can provide suitable perches for this species that frequently likes to utilize such perches during the mating and nesting periods. Although the absence of such structures may not preclude breeding, their presence in areas of Upland Sandpiper breeding concentrations may be more than just coincidental.

Corace et al. (2016) note that restoring a savannah-type landscape to Upper Midwest jack pine stands would not only benefit the endemic Kirtland's Warbler (*Setophaga kirtlandii*) but also other formerly-widespread species such as the Upland Sandpiper (still occurs locally), which historically shared the same landscape vegetation structure as the warbler and many other associated species.

Killdeer (*Charadrius vociferous*) (breeder, migrant, winter resident)

Habitat: Breeding: Favors agricultural areas and grasslands in plowed fields, edges of fields, prairies, lake, and pond shores. **Migration:** A generalist occurring in flooded fields, plowed fields, drawdowns, sewage ponds, shores of lakes, ponds, and rivers, grasslands, and marshes.

Chronology: Spring: arrives on southern breeding grounds by late February and northern breeding rounds by late March to early April. **Fall:** gathers on staging areas from mid-July to mid-August with most birds gone by early September, with a few birds remaining until near freeze-up in the north and central. Low numbers winter in the south during mild years.

Notes: Our most common breeding shorebird, but numbers undergoing a long-term decline. Identification and protection of staging areas are needed. Loss of isolated wetlands likely adversely affects this species.

Management Recommendations: This is the most widespread breeding shorebird in the Midwest, breeding throughout the region in all but the most heavily forested sections of northern Michigan, Wisconsin, and Minnesota. Slight population declines, as determined by the Breeding Bird Survey, likely reflect the intensification of agriculture, including large scale tiling which now allows farmers to access traditionally wet fields where Killdeer historically could breed successfully without disturbance.

Killdeer are perhaps the most diverse shorebirds in their choice of habitats, ranging from pastureland and farm ponds, sandbars and lakeshores, to urban habitats including office ponds, large sports fields, and the flat roofs of industrial sites. Roof sites with high walls and roads with curbs can prove problematic for young chicks that need to forage soon after they hatch. Urban Killdeer often nest in driveways and along road shoulders. Efforts to move such nests out of harm's way usually result in their loss. Although the Killdeer will likely remain a relatively common breeding bird in the UMVGL region for the foreseeable future, some management activities could locally increase populations of the species.

Recommended activities include delaying agricultural plowing until May (late May in the northern half of the region) so birds can bring off early broods; conducting fall burning of prairies, which don't interrupt the nesting cycle; maintaining light grazing or mowing on wetland and prairie areas; and clearing brush from riverine and lake islands and shorelines to open up habitat. For some wetland habitats where cattail, Phragmites, or reed canary grass have created dense monocultures, mechanical removal or moderate to heavy grazing may be first needed to open up a site and recreate wet meadow habitat with a diverse vegetation component. Identify late summer staging areas and work with land owners to assure their continued presence at these

sites. Just adding one seasonal wetland (.1-.4 ha [0.25 to 1 ac]) per section could double Killdeer breeding pairs in the Midwest.

American Golden-Plover (*Pluvialis dominica*) (migrant)

Habitat: **Spring:** Drawdowns, flooded agricultural and bottomlands fields with an open aspect, plowed moist to wet agricultural fields, especially corn and soybean, grassland burns; **Late Summer and Fall:** Dry fields, sod farms, recently cut alfalfa fields, drawdowns, Great Lakes beaches and reservoir shores.

Chronology: **Spring:** Late March (south) to early June (central and north) with peak flights from late April to early/mid-May. **Fall:** Mid-July to November (south) with peak flights in September and October.

Notes: A local, common migrant in spring, with largest numbers occurring in southeastern Michigan, east-central Illinois, northwest Indiana (Newton and Benton Counties) and northern Ohio (especially in the vicinity of Toledo, Bowling Green, Ottawa NWR) near the Great Lakes; in fall usually uncommon to fairly common, low-density migrant near the Great Lakes and large inland reservoirs.

Management Recommendations: See the Conservation Plan for the American Golden-Plover (*Pluvialis dominica*) by Clay et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Placement of wind turbines away from traditional staging areas in Illinois and Indiana may be critical and needs further investigation. Shallow (2.5-10 cm [1-4 in] deep) spring flooding of agricultural fields, especially soybean and corn stubble fields, so that clods of dirt frequently extend above the surface, should be maintained between 20 April and 25 May in known areas of concentration. A thorough analysis of Illinois and Indiana spring stopover ecology may be found in Stodola et al. (2014). Researchers found that the plovers' stopover duration was 23.7 days using two approaches and ranged from 2 to 29 days and that most birds underwent a complete molt at the staging areas. Rapid drawdown of water after that point should not adversely affect migrants, which are largely gone by then. Late season flooding from 1 October through mid-November has also attracted flocks of this species. Maintaining an open aspect with no trees or shrubs is critical to this wary species. Late season drawdowns also provide suitable "flats" conditions preferred by this plover.

Buff-breasted Sandpiper (*Tryngites subruficollis*) (migrant)

Habitat: **Spring:** Plowed fields, prairie burns, edges of flooded fields and seasonal ponds on recently wet areas; **Fall:** Alfalfa fields, plowed fields, sod farms (preference for some standing water), drawdowns, sandbars, grassy edges of reservoirs, short grass meadows, golf courses, occasionally on pothole shores and beaches, airports, edges of drying ponds and lakes on recently wet areas.

Chronology: **Spring:** Late April to late May with most 15-25 May; **Fall:** From mid-July to early October, but adults mainly 25 July to 15 August and juveniles from 20 August to 10 September.

Notes: Rarely seen in spring except in far west; in fall several known and/or possible flyways include: movements southward in Minnesota along the western shore of Lakes Superior and Sax-Zim area south through Twin Cities and central Iowa with some taking a Mississippi Flyway route in central Missouri and central Illinois; down the Red River—western Minnesota River—Missouri Valley (Squaw Creek NWR), and another down both shores of Lake Michigan with some stopping over in east-central Wisconsin and central Illinois and Indiana and others (route unknown) occurring in the western Lake Erie Basin. Stopover time at a site is seldom more than a few days and usually 1-2 days.

Management Recommendations: See the Conservation Plan for the Buff-breasted Sandpiper (*Calidris subruficollis*) by Lanctot et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Allowing surface water to remain longer on sod farms and short-grass pastures and mudflats or occasionally flooding these habitats with 2.5-5 cm (1-2 in) of water might lengthen stopover time by a few days for this long-distance migrant. Buff-breasted Sandpipers often show a high sensitivity to human disturbance and anything to lessen this might prove beneficial. No siting of wind turbines along known migration routes might prevent fatal collisions for this species, which is often seen flying low during diurnal hours in migrations. An investigation of pesticide uptake by this species visiting sod farms and sewage treatment plants in the southern Great Plains found little cause for concern (Strum et al. 2010).

Mudflat Gleaner Guild

Black-bellied Plover (*Pluvialis squatarola*) (migrant)

Habitat: **Spring:** Flooded agricultural and bottomlands fields with an open aspect, beaches of the Great Lakes, plowed moist to wet agricultural fields, drawdowns; **Late summer and fall:** Dry fields, sod farms, drawdowns, sewage treatment lagoons and dikes, grassland burns, Great Lakes beaches and reservoir shores.

Chronology: **Spring:** Late March (south) to early June (central and north) with peak flight from mid-to-late May. **Late summer and Fall:** Mid-July to October with peak flights from mid-August to late September.

Notes: A local, uncommon migrant in spring with largest numbers occurring in southeast Wisconsin and northern Ohio near the Great Lakes; in fall usually uncommon, low-density migrant, but more widespread than in spring. The species is rare away from large lakes in BCR 12.

Management Recommendations: Regular beach-cleaning of beached algae beds by machines should be discouraged except in heavy human-use areas. Beach exclosure areas (dogs, humans) can greatly benefit this flocking species which has a moderate tolerance to some human disturbance. Fall tilling of croplands that often flood in spring can provide a burst of food for invertebrates that greatly increase a site's attractiveness to this and other shorebird species. Locally, spring prairie burns may provide ideal foraging situations if the burns are hot enough to create a very open aspect with little remaining brush and tall stems. Maintaining shallowly flooded crop lands until late May benefits this plover.

Semipalmated Plover (*Charadrius semipalmatus*) (migrant)

Habitat: **Spring:** Flooded agricultural and bottomlands fields, drawdowns, edges of ponds, lakes, marshes, riverine sandbars, occasionally Great Lakes shores; **Late summer and fall:** Sod farms, drawdowns, Great Lakes beaches, marshes, and reservoir shores, edges of ponds, lakes, mudflats, riverine sandbars.

Chronology: **Spring:** Late March (south) to early June (central and north) with peak flights from late April to mid-May. **Late Summer and Fall:** Early July to October with peak flights from 25 July to late August.

Notes: A widespread, uncommon to fairly common migrant spring and fall; less common in heavily forested areas of BCR 12.

Management Recommendations: Maintain large expanses of open mud with adjacent shallow water pools mimicking coastal tidal conditions for ideal plover foraging habitat. Such habitat can be enhanced by preserving clumps of cordgrass, bulrush, or other tall marsh emergent vegetation for wind and predator screening and roosting. Identification and preservation of traditional staging areas, if they occur inland, is a primary need for this species' long-term management.

Shallow-water Marsh/Shallow Open Water Forager Guild

Black-necked Stilt (*Himantopus mexicanus*) (breeder, migrant)

Habitat: Marshes or shallow hemimarshes and ponds with exposed flats and shallow water areas, sewage lagoons, pothole and pond edges. Broad expanses of open marsh (tall emergent, including bulrush, cordgrass, etc.) seem essential for young to hide in to avoid predation.

Chronology: May through August, but little studied in the UMVGL region.

Notes: A western and southern species with a recently expanding range now colonizing widely scattered sites in North America, this recent arrival to the Midwest now breeds in small numbers in southeastern Missouri (in the "Boot" and north along the Mississippi River), southern and central Illinois, and southwest and west-central Indiana with isolated nestings recently at Pt. Mouille, Michigan, and Horicon NWR, Wisconsin. The recent range expansion parallels an upswing in the population in the lower Mississippi River Valley where expansion of rice cultivation has proven beneficial to this species in southern Illinois, southeastern and eastern Missouri, southwest and west-central Indiana, central Wisconsin (Horicon area), and in southeastern Michigan. Southern Illinois and Indiana population seems firmly established with as many as 25 pairs at various sites. Stilts are very rarely seen as a migrant away from breeding sites.

Management Recommendations: This wary (during breeding) bird requires an undisturbed combination of shallow water wetlands with adjacent short emergent vegetation on dikes, levees,

or small islands for nest placement along with patches of tall emergent vegetation for brood rearing and predator avoidance.

American Avocet (*Recurvirostra americana*) (migrant)

Habitat: Marshes or shallow hemimarshes and ponds with exposed flats and shallow water areas, sewage lagoons, pothole and pond edges. Avocets favor small islets, muskrat dens, or mounds of earth in marshes and shallow lakes for nesting.

Chronology: **Spring:** Mid-April to late May with a peak in the region from 24 April to 5 May. **Fall:** More dispersed with birds recorded mid-July to mid-October with most birds moving in August and September.

Notes: Sporadic breeder in far western portions of the region. Migrants occur mainly west of the Mississippi River or occasionally in flocks on southern Lake Michigan and Lake Erie where their spring stopover time at any site is usually no more than a day and often just a few hours.

Management Recommendations: Creation of undisturbed shallow water drawdowns or permanent shallow water reservoirs and/or seasonal wetlands might attract this rare migrant for a few hours or occasionally for a few days.

Wilson's Snipe (*Gallinago delicata*) (breeder, migrant, winter resident)

Habitat: Wet meadows, short-cropped pastures, flooded fields (especially those with furrows), marshes, wet prairies, and the margins of almost any wetland. Wet organic soils rich with food and clumps of cover during migration and breeding (Tuck 1972).

Chronology: **Spring:** Mid-to-late March through early May, a few later. **Fall:** Late July to freeze-up in November with a few birds wintering in the south and central portions of the region along small streams, sewage outlets, and springs.

Notes: Northern Ohio, especially the Western Basin and the Pymatuning area in the northeast corner, were once breeding strongholds for this species, which has decreased greatly in the past several decades. Migrants are still fairly common to locally common throughout the region, even in forested areas where small non-forested wetlands exist, but Breeding Bird Survey data show the overall numbers are in decline.

Management Recommendations: Maintenance and restoration of seasonal wetlands for migrants. Light to moderate grazing of wetlands preserves sufficient cover, favors grasses and sedges, and prevents tall emergent herbaceous and woody species from overtaking such preferred habitat. Maintenance of a large-scale wetland landscape with a mosaic of shallow water marsh communities and open shallow waters and mudflats would create high quality breeding habitat for this species. The species avoids monotypical cattail stands for breeding.

Western Sandpiper (*Calidris mauri*) (migrant)

Habitat: **Spring:** Flooded fields, margins of potholes, sewage treatment plants;

Fall: Mostly along sandy shores of the Great Lakes, occasionally inland on large lakes and reservoirs, mudflats, margins of potholes and along large rivers on sandbars and on dredged disposal islands.

Chronology: **Spring:** Early or mid-May to early June with peaks along the Great Lakes from 15 May to 1 June; **Fall:** Early July to late October with peak movement from early July (adults) through September (juveniles).

Notes: Rare spring migrant along the western margins of the region; rare to occasionally uncommon east of the Mississippi River in fall, especially on the shores of Lakes Michigan and Erie.

Management Recommendations: See the Conservation Plan for the Western Sandpiper (*Calidris mauri*) by Fernandez et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Preservation/restoration of shallow water coastal marshes with exposed mudflats in the southern Great Lakes region and inland wetlands with broad shorelines and exposed flats from Iowa east to Ohio.

Semipalmated Sandpiper (*Calidris pusilla*) (migrant)

Habitat: **Spring:** Flooded fields, margins of potholes, lakes, sewage treatment plants;

Fall: Widespread in most shorebird habitats from the sandy shores of the Great Lakes to inland on large lakes and reservoirs, mudflats, margins of potholes and along large rivers on sandbars and on dredged disposal islands.

Chronology: **Spring:** Late April to early June with peaks along the Great Lakes from 5 May to 1 June; **Fall:** Early July or even late June to late September, a few into October with peak movements from late July (adults) and August with juveniles remaining well into September in the north and October in the south.

Notes: Fairly common to common spring migrant throughout the region; common in fall throughout except scarcer in well-wooded regions. One of our most common and widespread shorebirds, but a recent decline along the Atlantic coast is a cause for alarm.

Management Recommendations: Preservation/restoration of shallow water coastal marshes with exposed mudflats in the southern Great Lakes region and preservation/restoration of inland wetlands with broad shorelines and exposed flats should benefit this species. Drawdowns that support other mudflat-foraging shorebirds will benefit this species.

Least Sandpiper (*Calidris minutilla*) (migrant)

Habitat: **Spring:** Flooded fields, margins of potholes, lakes, sewage treatment plants;

Fall: Widespread in most shorebird habitats from the sandy shores of the Great Lakes to inland on large lakes and reservoirs, mudflats, margins of potholes and along large rivers on sandbars and on dredged disposal islands.

Chronology: **Spring:** Late April to early June with peaks along the Great Lakes from 5 May to 20 May; **Fall:** Early July to late October, a few even into November with peak movements from mid-to late July (adults) and August with juveniles remaining well into September in the north and October/November in the south.

Notes: Fairly common to common spring migrant throughout the region; common in fall throughout except scarcer in well-wooded regions. Least Sandpipers are one of our most common and widespread shorebirds.

Management Recommendations: Preservation/restoration of shallow water coastal marshes with exposed mudflats in the southern Great Lakes region and preservation/restoration of inland wetlands with broad shorelines and exposed flats should benefit this species.

White-rumped Sandpiper (*Calidris fuscicollis*) (migrant)

Habitat: **Spring:** Flooded fields, margins of potholes, lakes, occasionally grassy pastures and plowed fields, sewage treatment plants; **Fall:** Widespread from the sandy shores of the Great Lakes to inland on large lakes and reservoirs, mudflats, and the margins of potholes.

Chronology: **Spring:** Mid-to-late May to early June with peaks along the Great Lakes from 25 May to 5 June; **Fall:** Mid-July to late October, a few even into November with peak movements from mid-to late July to mid-August(adults) and with juveniles peaking in September.

Notes: Usually uncommon (east of Lake Michigan) to fairly common (west of Lake Michigan) spring migrant; uncommon in fall throughout and usually absent in well-wooded regions. Although no diminution of their numbers has been noted, this species relies on late spring season water and is a major candidate for population reduction as patterned tiling envelops the landscape, causing water to run off flooded fields more quickly.

Management Recommendations: Preservation/restoration of shallow water coastal marshes with exposed mudflats in the southern Great Lakes region and preservation/restoration of inland wetlands with broad shorelines and exposed flats should benefit this species. Maintenance of late season flooded fallow and active agricultural fields in spring between 20 May and 1 June would greatly benefit this late-season migrant. Fall drawdowns from mid-August through mid-October may also be beneficial.

Baird's Sandpiper (*Calidris bairdii*) (migrant)

Habitat: **Spring:** Flooded fields, margins of potholes, lakes, occasionally grassy pastures and plowed fields, sewage treatment plants; **Fall:** Widespread from the sandy shores of the Great Lakes to inland on large lakes, rivers, and reservoirs, mudflats, and the margins of potholes.

Chronology: **Spring:** Mid-to-late March (a few) to early June with peaks late April to mid-May; **Fall:** Early-July to late October, a few even into November with peak movements from mid-late August(adults) and September (juveniles).

Notes: Very rare spring migrant from Lake Michigan eastward, but increasingly common as one travels westward from Lake Michigan; more widespread in fall where uncommon to locally fairly common, particularly on the shores of the southern Great Lakes and usually absent in well-wooded regions.

Management Recommendations: Preservation and restoration of broad sandy beaches and associated coastal lagoons where the species can forage along the high end of the wave zone is needed for the shores of the Great Lakes. Inland, mid-summer/early autumn drawdowns which expose large expanses of flats and naturally receding potholes provide beneficial habitat for this species, which favors a more open aspect than most other peeps.

Pectoral Sandpiper (*Calidris melanotos*) (migrant)

Habitat: **Spring:** Flooded or wet fields, margins of potholes, moist grassy pastures, wet prairies, sewage treatment plants; **Late Summer and Fall:** Mostly on mudflats, drawdowns, reservoir margins along sandy shores of the Great Lakes, and along large rivers in wetlands. Occasionally occurs on temporarily flooded golf courses and sod farms.

Chronology: **Spring:** Late March to mid-May with peak in mid-to-late April. **Late Summer and Fall:** Early July to late October, rarely November with peak movement from early July (adults) through September (juveniles).

Notes: Common spring migrant and fall migrant, especially adjacent to the shores of Lake Erie and inland in Indiana, Illinois, and Iowa. Ohio is particularly important for this species, both spring and fall. On average, males depart for breeding grounds 7-10 days before females and also depart in the fall before the females depart.

Management Recommendations: Creation/maintenance of short grass shallow water areas, especially adjacent to shallow water ponds and wetlands creates ideal habitat. Light to moderate grazing can also create excellent pond margins for this formerly abundant (now only common) species. Restoration of ephemeral wetlands would benefit spring migrants.

Dunlin (*Calidris alpina*) (migrant)

Habitat: **Spring:** Flooded fields, drawdowns, sand beaches, rocky shorelines, jetties, sewage treatment plants; **Late Summer and Fall:** Mostly along shores of the Great Lakes, jetties, mudflats, reservoir edges.

Chronology: **Spring:** Early May to early June with peaks along the Great Lakes from 20 May to 1 June; **Late Summer and Fall:** Regular, widespread migrant mid-July to late October with peaks in August (adults) and September and October (juveniles).

Notes: Spring migration is largely through western Minnesota, Iowa, and Missouri where uncommon and through the Great Lakes with largest numbers occurring in flooded fields in the Green Bay-Kewaunee, Wisconsin, area, the western shores of Lake Erie including Ottawa NWR, and the western shores of Lake Michigan. The species is fairly common on the Great Lakes in fall and uncommon to fairly common inland where it might occur at any wetland or sewage lagoon throughout the region.

Management Recommendations: See Conservation Plan for Dunlin with Breeding Populations in North America (*Calidris alpina articola*, *C. a. pacifica*, and *C. a. hudsonia*) by Fernandez et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Creation of large mudflats from reservoir drawdowns will often attract this species spring and fall. Shallow sheet flow and flooded fields in agricultural areas readily attract this species in spring. It is important to maintain shallow water on such landscapes into late May, even early June if targeting this species as peak flights usually occur 20 May to 5 June in the UMVGL region.

Hudsonian Godwit (*Limosa haemastica*) (migrant)

Habitat: Great Lakes marshes with exposed flats, wet meadows and wet prairies, edges of potholes and small lakes, flooded fields, drawdowns. Wet meadows with 5-12.5 cm (2-5 in) of water are favored haunts.

Chronology: **Spring:** Two waves with first movement noted mid-to late Apr. and another movement mid-to-late May; **Fall:** 20 August to 1 November with heaviest flights noted early September to mid-October.

Notes: Spring migration is largely through western Minnesota, Iowa, and Missouri with a smaller flight through central Illinois and east central Wisconsin; fall migration is heaviest through northern Ohio (Ottawa NWR and vicinity) with a light flight through western Minnesota, rarely Iowa and Missouri. The dual spring pattern is likely caused by the presence of two subpopulations, one heading to James and Hudson Bays to breed and the other to western Alaska. The birds often utilize the same stopover sites year to year; identification and preservation/management of these sites is of paramount importance. Large sheet flows in agricultural areas in spring may attract this species, especially if disturbance is low.

Management Recommendations: See the Conservation Plan for the Hudsonian Godwit (*Limosa haemastica*) by Senner et al. (2010) at: <http://www.whsrn.org/conservation-plans>.

Marbled Godwit (*Limosa fedoa*) (breeder, migrant)

Habitat: **Breeding:** Wetland complexes with shallow potholes and small lakes and adjacent upland grasslands are ideal; **Migration:** Wet meadows and wet prairies with 5-12.5 cm (2-5 in) of water are favored haunts as are flooded fields, potholes, large marshes with exposed flats, rarely beaches and lake shores.

Chronology: **Spring:** Two waves with first movement noted mid-to late April and another movement mid-to late May; **Late Summer and Fall:** Late June or early July to 1 November with heaviest flights noted in July.

Notes: Spring migration is largely through central and western Minnesota, Iowa, and Missouri with a smaller flight through central Illinois and east central Wisconsin and western Lake Superior; fall migration is heaviest through northern Ohio (Ottawa NWR and vicinity) with a light flight through western Minnesota, rarely Iowa and Missouri. The dual spring pattern is likely caused by the presence of two subpopulations, the first heading to breed on the northern Great Plains and the second a late May movement to James Bay to breed. Birds thought to be of the latter population (a distinct subspecies) stopover on Interstate Island in the St. Louis River estuary of Minnesota and Wisconsin and on Long Island in the Apostle Island chain in Wisconsin and winter in Baja California in western Mexico. A few pairs breed in the far northwestern part of the UMVGL region in Minnesota on small wetlands and adjacent uplands grazed by cattle. A discussion of the unusual crisscrossing migration pattern and wintering areas of North American Marbled Godwits can be found in Olson et al. (2014).

Management Recommendations: See the Conservation Plan for the Marbled Godwit (*Limosa fedoa*) by Melcher et al. (2010) at: <http://www.whsrn.org/conservation-plans>. Maintenance of a combination of light to moderately grazed pastures with scattered ephemeral and semi-permanent/permanent wetlands for early spring foraging provides suitable habitat for this species' breeding areas in the far northwest of the region. Large sheet flows in agricultural areas in spring may attract this species, especially if disturbance is low. Small numbers of Marbled Godwits breed in the northwestern portion of BCR 23 from Stearns and Kandiyohi Counties, Minnesota. Based on a 2009-2012 survey of this area (R. Russell, unpublished data), perhaps 20-30 pairs breed in this BCR. Breeding birds favor pastureland, native grasslands, wetland complexes, and sewage treatment dikes. The conversion of grasslands to row crops and the loss of open field dairying have caused a local population decline in Stearns County.

Marbled Godwits require both the presence of wetlands and grasslands during their breeding cycle. Early-arriving migrants often spend the majority of their time foraging in wetlands until adjacent grasslands grow enough cover for the species to move to the uplands. Preservation of wetland complexes with sufficient grassland buffers to account for the species' breeding season needs is required. Additionally, light to moderate grazing will maintain wet meadow/grassland habitat at low enough levels for the species to forage in early in spring, but provide dense enough cover for chick rearing later in the spring.

Stilt Sandpiper (*Calidris himantopus*) (migrant)

Habitat: **Spring:** Drawdowns, moist plowed fields, wet prairie burns, edges of flooded fields, potholes, marshes, and seasonal ponds; **Fall:** Marshes, sewage ponds, lake and reservoir edges, grassy edges of reservoirs, rarely on beaches. Ideal habitat appears to be a shallow water hemimarsh with an abundance of cattail or bulrush clumps, which the species utilizes for foraging and protection against predators.

Chronology: **Spring:** Mid-April to early June with most 5-15 May; **Late Summer and Fall:** Adults from early to mid-July to late October but most adults primarily 20 July to 10 August and juveniles from 20 August to 20 September.

Notes: Rarely seen in spring east of Illinois. In the fall, the western Lake Erie Basin seems to be a particularly important area for this species. The species can occur in rather unexpected areas, such as the Upper Peninsula of Michigan and northern Minnesota, when suitable habitat conditions exist. Inland numbers at Illinois and Iowa reservoirs indicate a need for maintaining more water and exposed flats on the landscape in the August-October period.

Management Recommendations: Creation/maintenance of hemimarsh shallow water foraging areas with 5-15 cm (2-6 in) of water and tall stands of emergent vegetation such as bulrush and cordgrass for predator and wind avoidance offers excellent habitat for this species.

Short-billed Dowitcher (*Limnodromus griseus*) (migrant)

Habitat: **Spring:** Drawdowns, moist plowed fields, wet prairie burns, edges of flooded fields, potholes, marshes, and seasonal ponds; **Fall:** Marshes, sewage ponds, drawdowns, lake and reservoir edges, grassy edges of reservoirs, rarely on beaches. Ideal habitat appears to be shallow water hemimarsh with lots of cattail or bulrush clumps, which the species uses for foraging and protection against predators.

Chronology: **Spring:** Late April to early June with most 5-20 May; **Summer and Fall:** Mid-early July to early September with a few to late September. Adult birds peak from late July to mid-August west of the Mississippi and somewhat earlier in Ohio with young birds peaking in the east in August and mid-August to mid-September west of the Mississippi River.

Notes: This is the earlier migrating of the two Dowitcher species in fall and there is only a small period of overlap in August and September with both species present. The majority (all?) of the Short-billed Dowitchers that occur in the Midwest belong to the well-studied western Hudson Bay breeding subspecies (*Limnodromus griseus hendersoni*) while the eastern Canadian breeding subspecies *L. g. griseus* occurs in small numbers in New York, Vermont, and perhaps western Pennsylvania.

Management Recommendations: Restore/maintain shallow water hemimarshes for foraging and create potential roost sites such as an offshore small rock pile within a marsh system; restore ephemeral wetlands. Maintain water levels 5-15 cm (2-6 in) deep for this species.

Long-billed Dowitcher (*Limnodromus scolopaceus*) (migrant)

Habitat: **Spring:** Drawdowns, in moist plowed fields, wet prairie burns, edges of flooded fields, potholes, marshes, and seasonal ponds; **Fall:** Marshes, sewage ponds, lake and reservoir edges, grassy edges of reservoirs, rarely on beaches. Ideal habitat appears to be a shallow water hemimarsh with an abundance of cattail or bulrush clumps which the species utilizes for foraging and protection against predators. Although habitat differentiation between the two Dowitcher

species has been noted in coastal areas, a study is needed to ascertain habitat requirements and overlap (if it exists) in the Midwest.

Chronology: **Spring:** This is the earlier-migrating Dowitcher species in spring, with first birds appearing in late March or early April and peaking mid-to-late April through early May. **Fall:** Birds return relatively late for a shorebird with only a few birds appearing in late July. Peak adult flights occur in August with many adults remaining into late September or even early October. Juveniles peak from about 7 to 20 September in most parts of the region. The species remains fairly common through October in the central and southern portions of the region with some birds remaining into November during mild falls. Due to peak flights occurring so late in the fall, management of habitat for this species may conflict with water management strategies for waterfowl. Many refuge managers raise water levels beginning in mid-fall to attract waterfowl to impoundments which had been drawn down in summer for various reasons such as for growing crops, attracting shorebirds and wading birds, invasive fish control, or stimulating native plant growth.

Notes: This is a rare spring migrant east of the Mississippi River and peak flights only occur in our region in southwestern Minnesota, western Iowa, western Missouri, and in eastern Nebraska and eastern Kansas. In fall, the majority of the birds in our region gravitate to the southeast with Ohio and the Lower Peninsula of Michigan serving as important stopovers for this species. This is the later migrating of the two Dowitcher species in fall and there is only a small period of overlap in August and September when both species are present.

Management Recommendations: Restore/maintain shallow water hemimarshes for foraging and create potential roost sites such as an offshore small rock pile within a marsh system; restore ephemeral wetlands. Stilt Sandpiper habitat needs are similar and habitat for the two species could be managed together. Maintain water levels 5-15 cm (2-6 in) deep for this species.

Greater Yellowlegs (*Tringa melanoleuca*) (migrant)

Habitat: Marshes or shallow hemimarshes and ponds with exposed flats and shallow water areas, sewage lagoons, drawdowns, lake, pothole, sandbars, and pond edges. Prefers sites with at least 8 cm (3 in) of water. Logs and small points of exposed mud, rocks, or sandbars for roosting create near ideal sites.

Chronology: **Spring:** Late March (south) to mid-May with a peak in the region from 10 April to 5 May. **Fall:** Mid-July to October with heaviest flights in September and early October. A few birds remain until freeze-up.

Notes: Widespread migrant apt to be found on most any lake and pond with some shallow flats and marshes at some point during the migrations.

Management Recommendations: Maintain water levels 5-15 cm (2-6 in) deep for this species. Restoration/preservation of wetlands > .4 ha (1 ac) favor this species which is often reluctant to use smaller wetlands.

Lesser Yellowlegs (*Tringa flavipes*) (migrant)

Habitat: Marshes or shallow hemimarshes and ponds with exposed flats and shallow water areas, sewage lagoons, drawdowns, lake, pothole, sandbars, open forest wetlands, and pond edges. Prefers sites with at least 8 cm (3 in) of water. Logs and small points of exposed mud, rocks, or sandbars for roosting create near ideal sites.

Chronology: **Spring:** Late March (south) to mid-May (north) with a peak in the region from 10 April to 5 May. **Fall:** Late June (a few) to October and November with heaviest flights in August and September.

Notes: A widespread migrant found during migration on most any lake and pond in the UMVGL region that has some shallow flats or marshes present. Continentally important numbers of this species occur periodically in the Illinois River Valley when conditions allow (i.e., 15,000 at Rice Lake, Illinois, 4 August 1987).

Management Recommendations: See the Conservation Plan for the Lesser Yellowlegs (*Tringa flavipes*) by Clay et al. (2012) at: <http://www.whsrn.org/conservation-plans>. Maintain water levels 5-10 cm (2-4 in) deep. Restoration of spring ephemeral wetlands greatly benefits this species.

Solitary Sandpiper (*Tringa solitaria*) (breeder, migrant)

Habitat: Marshes or shallow hemimarshes and ponds with shallow water areas, sewage lagoons, drawdowns, lake, pothole, sandbars, and pond edges. Also occurs in wooded swamps and streams, roadside ditches, and on ephemeral forest ponds. Prefers sites with 2.5-7.5 cm (1-3 in) of water.

Chronology: **Spring:** mid-to-late April to mid-May with peak 25 April to 10 May. **Fall:** Late June (a few) to October with heaviest flights 25 July to 10 August.

Notes: A widespread migrant apt to be found on almost any lake, pond, or forested pool in the region at some point during the migrations. Highest numbers recorded on the continent have been found in Illinois (>400 at a single site) leading to speculation that the UMVGL region may be extremely important as stopover habitat for this species.

Management Recommendations: Restoration of ephemeral ponds in woodlands and streamside shallows would benefit this species. Known to breed rarely but possibly regularly in northern Minnesota in BCR 12. The species should be looked for in similar bog-type habitat and riverine marshes elsewhere across this BCR in northern Michigan and Wisconsin. The Minnesota Breeding Bird Atlas tallied a few additional suspected nesting sites for this species. Management possibilities for this species' breeding habitat within the region are limited; however, protection of large wetland/bog complexes such as Minnesota's Big Bog in Koochiching County, are worthy efforts that may protect potential/existing breeding sites.

Wilson's Phalarope (*Phalaropus tricolor*) (breeder, migrant)

Habitat: Breeding shallow wetlands with scattered clumps of grassy vegetation such as cattails, bulrushes, prairie cordgrass, moderately grazed edges of wetlands, also sewage treatment ponds, wet prairies, prairie potholes; in migration at flooded fields, drawdowns, dredged disposal areas, hemimarshes with exposed flats, sewage treatment ponds, wet prairies, reservoirs with exposed shoreline, rarely in Great Lakes coastal marshes.

Chronology: **Spring:** Late April to late May with most moving 5-15 May; **Fall:** Migration window extends from early July through mid-September with peak flights in August.

Notes: Scattered pairs or small colonies occasionally breed at wet prairie restorations and large marsh complexes in BCRs 22 and 23 in Indiana (rare), Illinois (rare), Minnesota, Iowa, and Nebraska (rare). This species has suffered greatly from wetland losses in our region. It requires the grassy fringes of prairie marshes and wetlands for breeding. Often such habitat is absent from older refuges and preserved sites that concentrated on saving the water and not the surrounding lands.

Management Recommendations: See the Conservation Plan for the Wilson's Phalarope (*Phalaropus tricolor*) by Lesterhuis and Clay (2010) at: <http://www.whsrn.org/conservation-plans>. This species does best with low vegetation with an open aspect. Light or even moderate grazing and/or burning (especially fall burning) is an effective way to open up the edges of marshes which can also result in increased teal and other duck species nesting. Some exposed mudflats, especially with scattered small stagnant pools and water depths less than 5 cm (2 in) are best, but species will forage in deeper potholes and ponds. In shallows, phalaropes prefer areas with only slightly sloping shorelines and at least 1.5 m (5 ft.) of exposed shore, preferably 3 m (10 ft.) or more. Unmowed grassy patches near sewage treatment plants have also proven beneficial to this species.

Red-necked Phalarope (*Phalaropus lobatus*) (migrant)

Habitat: Prairie potholes, flooded fields, drawdowns, sandbars, dredged disposal areas, hemimarshes with exposed flats, sewage treatment ponds, wet prairies, reservoirs with exposed shoreline, rarely in Great Lakes coastal marshes.

Chronology: **Spring:** Mid-May to 1 June; **Late Summer and Fall:** Migration window extends from late July through October (south), but most move through 20 August to 10 September.

Notes: Generally a very rare spring and rare to uncommon fall migrant east of the Mississippi River, locally uncommon spring and low density fall migrant west of the Mississippi River. This species' abundance varies greatly year-to-year but rarely ever reaches even uncommon status in most of the UMVGL region.

Management Recommendations: See the Red-necked Phalarope Research, Monitoring, and Conservation Plan for the Northeastern United States and Maritimes Canada by Brown et al. (2010) at: <http://www.whsrn.org/conservation-plans>. This species favors wetlands with low

vegetation and an open aspect. In shallows phalaropes prefer areas with only slightly sloping shorelines and at least 1.5m (5ft) of exposed shore, preferably 3m (10ft) or more. Invasive trees such as willows and dogwoods should be controlled as best as possible or removed from the site.

Rocky Areas/Cobble Beaches/Jetties of the Great Lakes Shores Guild

Whimbrel (*Numenius phaeopus*) (migrant)

Habitat: Beaches and rocky shorelines of the Great Lakes and large interior lakes, also inland in wet meadows, on mudflats, edges of large marshes, drawdowns, flooded and plowed fields.

Chronology: **Spring:** A major flight of Hudson and James Bay breeders and including some Alaskan/Yukon bound birds moves rapidly from New Jersey and Delaware Bay northwest through the Great Lakes in a narrow migratory window between 20 and 27 May most years; northbound inland birds move as early as 15 April in western Missouri and southern Illinois; **Fall:** Rare and widely dispersed with a slight concentration on the Great Lakes shores with first arrivals appearing in mid-to late July and records continuing with no apparent concentration through September.

Notes: Inland, numbers appear to be gradually increasing where the species may be benefiting from large-scale wetland restorations.

Management Recommendations: See the Conservation Plan for the Whimbrel (*Numenius phaeopus*) by Wilke and Johnston-Gonzalez (2010) at: <http://www.whsrn.org/conservation-plans>. Reduce disturbance at northern Great Lakes stopover sites; create/restore large wetland complexes inland. Preservation of stopover habitat including undeveloped offshore islands and rocks in the western Lake Erie Basin, along the western shore of Lake Huron, and along both sides of northern Lake Michigan would likely benefit the species.

Purple Sandpiper (*Calidris maritima*) (migrant, winter)

Habitat: Great Lakes rocky shores and jetties, occasionally on beaches.

Chronology: **Fall:** Mid-to-late October to January, rarely wintering over until March or April. Most frequently reported in November in the southern Great Lakes, especially Lake Erie.

Notes: A rare migrant, found most often in late fall and early winter; rarely observed outside the Great Lakes or during the spring. Harbor and jetty construction has likely expanded the habitat for this species in the rock-scarce southern Great Lakes.

Management Recommendations: The construction of rock jetties and breakwaters provides habitat for a few individuals of this species. Restricting access (reducing disturbance) to such habitats in late fall and winter might allow this species to overwinter in the southernmost Great Lakes, but there are no manageable populations in the UMGVL region except in the Niagara River/Niagara Falls area where natural habitats are favored.

APPENDIX 3 – MONITORING PROGRAMS FOR UPPER MISSISSIPPI VALLEY/GREAT LAKES REGION SHOREBIRD SPECIES

Following is a list of monitoring programs that collect population data on shorebird species that occur in the UMVGL region. Codes for the monitoring programs are:

Arctic: The Program for Regional and International Shorebird Monitoring (PRISM) has an Arctic monitoring component to: 1) estimate population size; 2) monitor trends in population size; 3) determine distribution, abundance, and habitats used throughout the year; and 4) assist local managers in meeting shorebird conservation goals. The Arctic PRISM Breeding Survey is co-sponsored by the Canadian Wildlife Service, U.S. Geological Survey, and U.S. Fish and Wildlife Service.

BBS: The North American Breeding Bird Survey (BBS) is a long-term, large-scale, international avian monitoring program initiated in 1966 to track the trends and status of North American breeding bird populations. See: <http://www.pwrc.usgs.gov/BBS>

CBC: The Christmas Bird Count is sponsored by the National Audubon Society, and occurs from mid-December to early January, mainly across North America (2,369 15-mile diameter circles in 2013). See: www.audubon.org/conservation/science/christmas-bird-count

ISS: The International Shorebird Survey is sponsored by the Manomet Center for Conservation Sciences. This survey is a site-specific monitoring effort, conducted every 10 days during migrations throughout the Americas. Data may now be entered through an International Shorebird Survey eBird portal. See: <https://www.manomet.org/program/shorebird-recovery/international-shorebird-survey-iss>

SHWGS: Southern Hemisphere Wintering Grounds Surveys have been conducted periodically over the years by the Canadian Wildlife Service, U.S. Fish and Wildlife Service, and various Southern Hemisphere wildlife agencies.

SSS: Species Specific Surveys. Various species like the Red Knot, Piping Plover, American Woodcock, and others have specific surveys designed for monitoring breeding, migration, and/or wintering populations.

<u>Species</u>	<u>Monitoring Program</u>
Black-necked Stilt	BBS, CBC
American Avocet	BBS, CBC
Black-bellied Plover	Arctic, CBC
American Golden-Plover	Arctic, SHWGS
Semipalmated Plover	Arctic, CBC
Piping Plover	SSS (annual breeding survey for 3 populations; international and U.S. wintering surveys)
Killdeer	BBS, CBC
Spotted Sandpiper	BBS, CBC
Solitary Sandpiper	CBC, SHWGS (partial, E. Colombia rice fields)
Greater Yellowlegs	CBC
Willet	BBS, CBC (subspecies <i>inornata</i> only)
Lesser Yellowlegs	CBC
Upland Sandpiper	BBS, SHWGS
Whimbrel	Arctic, ISS
Hudsonian Godwit	SHWGS
Marbled Godwit	BBS (Great Plains population), CBC
Ruddy Turnstone	Arctic, CBC
Red Knot	Arctic, ISS
Stilt Sandpiper	Arctic, SHWGS
Sanderling	Arctic, CBC, SHWGS
Dunlin	Arctic, CBC
Purple Sandpiper	Arctic, CBC
Baird's Sandpiper	Arctic, SHWGS
Least Sandpiper	Arctic, CBC
White-rumped Sandpiper	Arctic, SHWGS
Buff-breasted Sandpiper	Arctic, SHWGS
Pectoral Sandpiper	Arctic, SHWGS
Semipalmated Sandpiper	Arctic, ISS, SHWGS
Western Sandpiper	Arctic, CBC, ISS
Short-billed Dowitcher	CBC
Long-billed Dowitcher	Arctic, CBC
Wilson's Snipe	Arctic, BBS (poor), CBC, SHWGS (proposed)
American Woodcock	BBS (poor), CBC, SSS
Wilson's Phalarope	BBS, ISS
Red-necked Phalarope	Arctic

Figure 1: Upper Mississippi Valley/Great Lakes Shorebird Conservation Planning Region

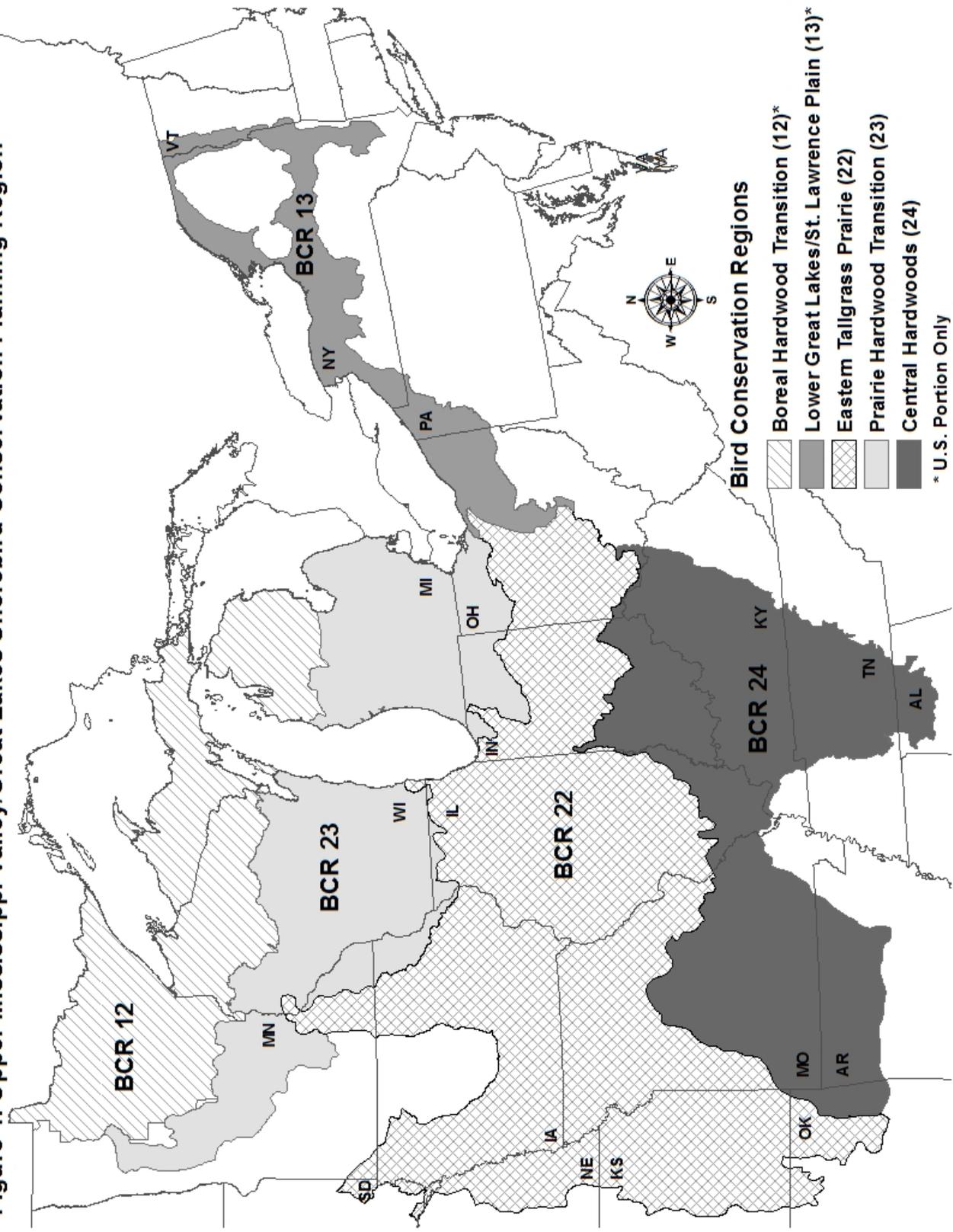


Table 1. Seasonal Occurrence, Conservation Concern Categories, and Stewardship Status for Shorebirds in the Upper Mississippi Valley/Great Lakes Region, 2016.

Common Name	Scientific Name	Subspecies/Population	Seasonal Occurrence by Bird Conservation Region (BCR) ^a				National Conservation Concern Category ^c	UMVGL Regional Stewardship Species ^d	UMVGL Regional Conservation Concern Priority
			BCR 12 ^b	BCR 13 ^b	BCR 22 ^b	BCR 23 ^b			
Black-necked Stilt	<i>Himantopus mexicanus</i>				m	m		Least Concern	
American Avocet	<i>Recurvirostra americana</i>				m	m		Climate Change Vulnerability ^d	
Black-bellied Plover	<i>Pluvialis squatarola</i>	<i>cynosurae</i>	M	M	M	M		Climate Change Vulnerability ^d	X
American Golden-Plover	<i>Pluvialis dominica</i>		m	M	M	M	m	Management Attention Needed	X
Semipalmated Plover	<i>Charadrius semipalmatus</i>		m	M	M	M	m	Least Concern	
Piping Plover	<i>Charadrius melodus</i>	(Great Lakes)	B, m	m	M	M		Listed Under Endangered Species Act	X
Piping Plover	<i>Charadrius melodus</i>	(Great Plains)			m	m		Listed Under Endangered Species Act	
Killdeer	<i>Charadrius vociferus</i>		B, M	B, M	B, M	B, M	B, M	Common Shorebird in Decline	X
Spotted Sandpiper	<i>Actitis macularia</i>		B, M	B, M	B, M	B, M	b, M	Least Concern	
Solitary Sandpiper	<i>Tringa solitaria</i>	<i>solitaria</i>	b, M	M	M	M	M	Least Concern	
Greater Yellowlegs	<i>Tringa melanoleuca</i>		M	M	M	M	M	Least Concern	
Willet	<i>Tringa semipalmata</i>	<i>inornata</i>	M	M	M	M	M	Management Attention Needed	
Lesser Yellowlegs	<i>Tringa flavipes</i>		M	M	M	M	M	Management Attention Needed	X
Upland Sandpiper	<i>Bartramia longicauda</i>		b, m	b, m	b, m	b, m	b, m	Least Concern ^e	X
Whimbrel	<i>Numenius phaeopus</i>		M	m	m	m	m	Immediate Management Action Required	X
Hudsonian Godwit	<i>Limosa haemastria</i>	<i>hudsonicus</i>	m	m	M	m	m	Management Attention Needed	X
Marbled Godwit	<i>Limosa fedoa</i>	<i>fedoa</i> (Plains breeding)	b, m	m	M	m	m	Management Attention Needed	X
Marbled Godwit	<i>Limosa fedoa</i>	<i>fedoa</i> (James Bay breeding)	M	m	m	m	m	Management Attention Needed	
Ruddy Turnstone	<i>Arenaria interpres</i>	<i>marinella</i>	M	M	M	M	M	Immediate Management Action Required	X
Red Knot	<i>Calidris canutus</i>	<i>rufa</i>	m	m	m	m	m	Listed Under Endangered Species Act	X
Red Knot	<i>Calidris himantopus</i>		m	M	M	M	m	Least Concern	
Stilt Sandpiper	<i>Calidris alba</i>	USA/Canada nonbreeding	M	m	M	M	m	Management Attention Needed	X
Sanderling	<i>Calidris alba</i>							Long-term Planning & Responsibility (Warrants Monitoring)	
Dunlin	<i>Calidris alpina</i>	<i>hudsonia</i>	M	M	M	M	m	Long-term Planning & Responsibility (Warrants Monitoring) ^f	X
Purple Sandpiper	<i>Calidris maritima</i>							Least Concern	
Baird's Sandpiper	<i>Calidris bairdi</i>	<i>maritima/belcheri</i>	M	m	M	M	m	Least Concern	
Least Sandpiper	<i>Calidris minutilla</i>		M	M	M	M	M	Least Concern	
White-rumped Sandpiper	<i>Calidris fuscicollis</i>		M	m	M	M	m	Least Concern	X
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>		M	m	M	M	m	Management Attention Needed	X
Pectoral Sandpiper	<i>Calidris melanotos</i>		M	M	M	M	M	Management Attention Needed	X
Semipalmated Sandpiper	<i>Calidris pusilla</i>		M	M	M	M	M	Management Attention Needed	X
Western Sandpiper	<i>Calidris mauri</i>		m	m	m	m	m	Climate Change Vulnerability ^d	
Short-billed Dowitcher	<i>Limnodromus griseus</i>	<i>griseus/hendersoni</i>	m	M	M	M	m	Management Attention Needed	X
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>		m	M	M	M	m	Least Concern	
Wilson's Snipe	<i>Gallinago delicata</i>		B, m	B, M	b, M	B, M	B, M	Least Concern	
American Woodcock	<i>Scolopax minor</i>		B, M	B, M	B, M	B, M	b, M	Management Attention Needed	X
Wilson's Phalarope	<i>Phalaropus tricolor</i>		b, m	m	m	b, m	b, m	Least Concern ^e	X
Red-necked Phalarope	<i>Phalaropus lobatus</i>	USA/Canada nonbreeding	m	m	m	m	m	Common Shorebird in Decline ^f	

^a b, m = BCR is of minor importance during the breeding or migration season to the species, subspecies, or population relative to other BCRs; B, M = BCR is of major importance during the breeding or migration season to the species, subspecies, or population relative to other BCRs. Occurrence is shown for BCRs that support ≥1% of population. Blank cell = supports < 1% of population.

^b BCR 12 = Boreal Hardwood Transition (U.S. portion only); BCR 13 = Lower Great Lakes/St. Lawrence Plain (U.S. portion only); BCR 22 = Eastern Tallgrass Prairie; BCR 23 = Prairie Hardwood Transition; BCR 24 = Central Hardwoods.

^c Refers to national conservation concern category based on Watch List 2014 assessment (U.S. Shorebird Conservation Plan Partnership 2015).

^d There is no ability to address climate change vulnerability for this species in the UMVGL region, but other management for the species is possible in the region.

^e Although this species is of Least Concern nationally, it needs, and can receive, management attention in the UMVGL region.

^f While the species occurs in the UMVGL region, its limiting factors lie largely outside of the region.

^g Stewardship species, with >20% of its population occurring in the UMVGL Region (see Appendix 1).

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