

CHAPTER 1

Shorebird Plan



OHIO BIRD



CONSERVATION
INITIATIVE

BACKGROUND

This chapter is based on the Upper Mississippi River and Great Lakes Joint Venture (UMRGLRJV) Shorebird Habitat Conservation Strategy (Potter et al. 2007):

http://www.uppermissgreatlakesjv.org/docs/UMRGLR_JV_ShorebirdHCS.pdf

and describes ways that Ohio can contribute to shorebird conservation in the UMRGLRJV through a combination of habitat protection, restoration and management, population monitoring, and research. These actions are needed to help reverse wetland losses, and to preserve and enhance existing shorebird habitats.

While the ultimate goal for Ohio will be to contribute to the maintenance or increase of continental shorebird populations, many other wetland-dependent wildlife species in Ohio will benefit.

We have included information from the JV plan that is most applicable to Ohio, but also suggest reviewing Potter et al. 2007 for

detailed information on their biological models and methodologies, and species accounts for UMRGLRJV focal species. We have summarized UMRGLRJV efforts to “step-down” continental shorebird conservation priorities to the JV. This will ultimately provide conservationists guidance in effectively increasing landscape carrying capacity through the protection, restoration, and enhancement of shorebird habitats. We have summarized where, what, when and how much habitat is needed to increase and sustain populations of priority shorebird species at target levels.

Conservation planning for shorebirds is difficult given the unpredictable nature of their migration routes and stopover duration, but the UMRGLRJV has established a scientific process for habitat objective-setting that includes identification of assumptions. To link population and habitat objectives for a diverse group like shorebirds, breeding and non-breeding focal species were selected for habitat planning. Each breeding focal species represents a specific habitat type. Likewise, foraging guilds that correspond to different cover types were selected for migration habitat planning and monitoring. Migration habitat objectives for Ohio were generated from continental estimates of spring population size. This assumed that the habitat carrying capacity established to accommodate spring populations will suffice during autumn migration. Using information from the UMRGLRJV Shorebird Habitat Conservation Strategy, we have presented goals for shorebird habitat conservation in Ohio.



Sanderlings, Photo: ODNR Division of Wildlife

History and Goals

The U.S. Shorebird Conservation Plan (USSCP) (Brown et al. 2001) was developed as a strategic guide to stabilize declining populations of shorebird species. As one component of the North American Bird Conservation Initiative (NABCI), the USSCP seeks to promote partnerships at a landscape level that emphasize integrated management for multiple bird species. With few modifications, the population assessments and conservation priorities expressed in the USSCP and the UMRGLRJV Shorebird Conservation Plan (de Szalay et al. 2000) were strongly used in the development of the Upper Mississippi and Great Lakes Joint Venture (UMRGLRJV) Shorebird Habitat Conservation Strategy (Potter et al. 2007).

Shorebird Biology and Migration

Shorebirds ([Order Charadriiformes](#)) include diverse groups such as plovers, avocets, stilts, and sandpipers; however, for the purposes of this plan do not include other groups in the [Charadriiformes](#) (e.g., gulls and terns). Nearly all shorebirds are wetland dependent, with the exceptions being Killdeer and two UMRGLRJV and OBCI focal species, Upland Sandpiper and American Woodcock. Because these focal species use more terrestrial habitats, they are also covered in the landbird chapter of this plan.

The Atlantic and Pacific coasts are important migration corridors for shorebirds in North America, but the importance of interior regions of the continent is gaining recognition. Ohio has only one migration staging area identified as regionally significant by the Western Hemisphere Shorebird Reserve Network: the Lake Erie Marshes of Ohio and Michigan (Potter et al. 2007). The JV region also encompasses the entire Lake Erie shoreline within Ohio, plus portions of the Ohio River floodplain which also serve as an important migration corridor for shorebirds.

Ohio is primarily used by shorebirds during spring and fall migration with approximate peaks of shorebird abundance occurring from late April-June and July-October. Ohio is much less used by nesting shorebirds. For example, all 34 species covered by the UMRGLRJV shorebird plan (Potter et al. 2007) are migratory in Ohio (Table 1), and only 6 species have nested in Ohio in recent years. BCRs 13 and 22 are considered highly important for Killdeer in Ohio, which also have common or locally common breeding populations of American Woodcock. Piping Plover has been extirpated as an Ohio breeder (Peterjohn 2001), but is included here since the U.S. Fish and Wildlife Service has designated critical habitat along a portion of the Lake Erie shoreline in Ohio, and Piping Plover do very rarely occur in migration. Killdeer and Wilson's Snipe occur during winter months, but only in very small numbers (Table 1); other shorebirds are typically even more rare in winter. Ohio and the larger UMRGLRJV are considered very important for 7 migrant species: Greater and Lesser Yellowlegs, Least Sandpiper, Pectoral Sandpiper, Dunlin, and Short-billed and Long-billed Dowitchers.

Table 1. Breeding, migration, and wintering status^a of shorebirds in the Bird Conservation Regions (BCRs) within Ohio. Adapted from de Szalay et al. (2000). Several rare and vagrant species are not included and were not covered in deSzalay et al. (2000) or Potter et al. (2007).

Species ^b	UMRGLRJV migration/ breeding/ status	Ohio BCR 13 (Lower Great Lakes and St. Lawrence Plain)	Ohio BCR 22 (Eastern Tall Grass Prairie)	Ohio BCR 24 (Central Hardwoods)	Ohio BCR 28 (Appalachian Mountains)
Black-bellied Plover	M	M	M	M	M
American Golden-Plover	M	M	M	m	m
Semipalmated Plover	M	M	M	m	m
Piping Plover (Great Lakes)	M, B	m	m	-	-
Killdeer	M, B , w	M, B , w	M, B , w	M, B, w	M, B, w
Black-necked Stilt	m, b	m	m	-	-
American Avocet	m	m	m	-	-
Greater Yellowlegs	M	M	M	m	m
Lesser Yellowlegs	M	M	M	m	m
Solitary Sandpiper	M, b	M	M	m	m
Willet	m	m	m	m	m
Spotted Sandpiper	M, B	M, B	M, B	m, b	m, b
Upland Sandpiper	m, b	m, b	m, b	m	m
Whimbrel	m	m	m	m	M
Hudsonian Godwit	M	m	m	m	M
Marbled Godwit	M	m	m	-	-
Ruddy Turnstone	M	M	M	m	m
Red Knot	m	m	m	m	m
Sanderling	M	M	M	m	m
Semipalmated Sandpiper	M	M	M	m	m
Western Sandpiper	m	m	m	m	m
Least Sandpiper	M	M	M	m	m
White-rumped Sandpiper	M	m	M	m	M
Baird's Sandpiper	M	m	m	m	M
Pectoral Sandpiper	M	M	M	m	m
Dunlin	M	M	M	m	m
Stilt Sandpiper	M	M	M	m	M
Buff-breasted Sandpiper	M	M	M	m	m
Short-billed Dowitcher	M	M	M	m	m
Long-billed Dowitcher	M	M	M	m	M
Wilson's Snipe	M, B	M, b	M, b, w	m, w	m, w
American Woodcock	M, B	M, B	M, B	M, B	M, B
Wilson's Phalarope	M, b	m, b	m	m	m
Red-necked Phalarope	m	m	m	-	-

^a Codes: B = breeding, M = migration, W = wintering. **B, M, W** = high concentrations; region extremely important to species relative to majority of other regions. B, M, W = common or locally abundant; region important to species relative to other regions. b, m, w = uncommon to fairly common; region within species' range but occurs in low abundance relative to other regions (Brown et al. 2001).

^b Bold names are focal species selected for habitat planning and monitoring emphasis; Piping Plover and Wilson's Phalarope were considered focal species in the UMRGLRJV (Potter et al. 2007), but not for OBCI.

Shorebird Habitat Requirements

Habitat types important to breeding and migrating shorebirds in Ohio include natural and managed wetlands, flooded agricultural fields, floodplains, sand, and gravel bars of rivers, and shorelines and mudflats of lakes and reservoirs. In addition, open shrubland / shrub/sapling-stage forest are important habitats for breeding and foraging American Woodcock, whereas extensive grassland habitats are required by breeding Upland Sandpipers. Because Ohio has lost approximately 90% of its original wetlands, proper management of remaining wetland habitats at the appropriate times of year is important to meet habitat needs of migrating shorebirds.

A primary goal of this plan is to ensure that suitable foraging and resting sites are made available to shorebirds throughout the state over a range of climatic conditions. Migration and reproduction are annual events in the shorebird life cycle that demand energy and nutritional requirements above the maintenance level. Understanding the needs of these birds at these times of year will help managers to provide the necessary resources at the proper times. At many intensively managed sites, water level manipulation and other management activities (e.g., burning or disking) can be used to provide habitat for shorebirds and complement other wildlife management objectives.

Most shorebirds using Ohio are long-distance migrants that require suitable wetlands where they can periodically stop to replenish their energetic reserves. These staging areas must have water less than 20 cm (<8 inches) in depth or mud flats, sparse vegetation (<25% cover), undisturbed resting areas, and abundant invertebrate food resources to meet the habitat needs and high energy demands of migratory shorebirds.

Resource availability in inland areas like Ohio is highly dependent on precipitation patterns and greatly varies in time and space. During dry years, naturally-receding wetlands may provide the only available, unmanaged shorebird habitat. In extremely wet years, such areas are generally flooded well into the wet meadow zone rendering their food resources unavailable to most shorebird species. The dynamics of climate cycles and changing availability of feeding areas often causes shorebirds migrating through Ohio to be scattered over larger areas rather than concentrated at a few major stopover sites.

In coastal areas, habitat and food resources can be fairly predictable and abundant. Lake Erie has many important shorebird habitats including coastal marshes, exposed mudflats, and sandy beaches, but these wetlands are highly influenced by changes in lake levels. Changes in long-term precipitation patterns in the Great Lakes Basin affect water levels in Lake Erie, with record high and low water levels differing by as much as 1-2 m (3-6 ft). Annual lake levels can vary 10-30 inches during a year, with levels the lowest in mid-winter and highest in mid-summer. Furthermore, wind-driven tides, called seiches, cause lake levels to fluctuate on a daily basis, sometimes as much as 6-8 feet. Southwest winds expose the bottom of shallow coastal areas and make associated invertebrate food resources available to shorebirds, while prolonged northeast winds can deeply flood these same areas for extended periods. These extremes in water levels have important consequences to habitat availability for migrating shorebirds.

Most of the remaining vegetated marshes along Lake Erie's shoreline have been diked in response to degraded environmental conditions, prolonged high lake levels, and scouring by waves and winter ice. Very few undiked vegetated marshes remain. Water levels in diked marshes can be managed to regenerate vegetation and increase availability of food resources available at correct times, but managers need to be aware of peak migration periods. Relatively low lake levels since 1999 more frequently expose shallow coastal areas and shoreline; unfortunately, many of these areas are being invaded by non-native plants such as phragmites and purple loosestrife.

Shorebird Population Status and Trends

A technical working group of the U.S. Shorebird Conservation Plan assessed the conservation status of shorebirds that breed in North America (Brown et al. 2001). The assessment established five conservation priority categories based on expert knowledge of shorebird population trends, distribution, relative abundance, and habitat threats. These categories were: highly imperiled, high concern, moderate concern, low concern, and lowest concern. At the continental scale, only Piping Plover, Red Knot, and Buff-breasted Sandpiper were considered "highly imperiled". Species considered of "high concern" were American Golden-Plover, Solitary Sandpiper, Upland Sandpiper, Whimbrel, Hudsonian Godwit, Marbled Godwit, Ruddy Turnstone, Sanderling, Western Sandpiper, Dunlin, Short-billed Dowitcher, American Woodcock, and Wilson's Phalarope (Brown et al. 2001). At the scale of the UMRGLRJV, only Piping Plover was considered "highly imperiled"; species considered of "high concern" were Greater Yellowlegs, Solitary Sandpiper, Upland Sandpiper, Whimbrel, Hudsonian Godwit, Marbled Godwit, Buff-breasted Sandpiper, Short-billed Dowitcher, and American Woodcock (Brown et al. 2006). Species considered of "moderate" concern within UMRGLRJV included: Black-bellied Plover, American Golden-Plover, Killdeer, Ruddy Turnstone, Red Knot, Sanderling, Semipalmated Sandpiper, Western Sandpiper, Least Sandpiper, Dunlin, and Stilt Sandpiper (Brown et al. 2001).

Shorebird Area Importance

The continental assessment by Brown et al. (2000) also evaluated area priority, where "area importance" (AI) scores were applied to each BCR (Table 2). AI scores were derived from knowledge and expert opinion of shorebird distributions, frequencies of occurrence, and relative abundance within BCRs. The scores reflect perceived importance of management and protection activities relative to other regions, plus the seasons during which a BCR is important, including breeding, migration, and winter (Brown et al. 2001). The USSCP system applies scores (1-5) to individual BCRs and shorebird planning regions according to the following criteria: 5 = high concentrations are known to occur, region has high importance to the species, and is critical to supporting hemispheric populations, 4 = common or locally abundant within the region, with large numbers known or suspected to occur, and the region is known or suspected to be important to supporting hemispheric or regional species populations, 3 = uncommon to fairly common within the region, region is within the species' range and the species occurs regularly within the region, but with low abundance, 2 = occurs rarely and with low frequency within the region, but the region is within the expected range of the species, and management is generally not warranted for the species within the region, 1 = occurs only unpredictably, irregularly, or as a vagrant within the region, which is outside the expected range of the species.

Table 2. Shorebird area importance (AI) scores^a for Bird Conservation Regions (BCR) within Ohio. Based on scoring system of Brown et al. (2000).

	BCR 13 Lower Great Lakes / St Lawrence Plain	BCR 22 Eastern Tall Grass Prairie	BCR 24 Central Hardwoods	BCR 28 (Appalachian Mountains)
Black-bellied Plover	4	4	3	3
American Golden-Plover	4	4	3	3
Semipalmated Plover	4	4	3	3
Piping Plover	1	1	-	-
Killdeer	5	5	4	4
Greater Yellowlegs	4	5	4	4
Lesser Yellowlegs	4	5	4	4
Solitary Sandpiper	4	4	4	4
Willet	3	3	2	2
Spotted Sandpiper	4	4	4	4
Upland Sandpiper	3	3	3	3
Whimbrel	3	3	3	3
Hudsonian Godwit	3	4	1	1
Marbled Godwit	3	4	1	1
Ruddy Turnstone	4	4	3	3
Red Knot	3	3	1	1
Sanderling	3	4	3	3
Semipalmated Sandpiper	4	4	4	4
Western Sandpiper	3	3	3	3
Least Sandpiper	5	5	4	4
White-rumped Sandpiper	3	4	3	3
Baird's Sandpiper	3	4	3	3
Pectoral Sandpiper	5	5	3	3
Dunlin	5	4	3	3
Stilt Sandpiper	4	4	3	3
Buff-breasted Sandpiper	4	4	3	3
Short-billed Dowitcher	5	4	3	3
Long-billed Dowitcher	5	5	3	3
Wilson's Snipe	4	4	3	3
American Woodcock	4	4	4	4
Wilson's Phalarope	3	4	1	1
Red-necked Phalarope	1	1	1	1

^a Larger AI scores represent greater importance of the area to high concentrations and supporting hemispheric populations.

^b Bold names and scores are Ohio focal species selected for planning and monitoring emphasis; Piping Plover and Wilson's Phalarope were considered focal species in the UMRGLRJV (Potter et al. 2007).

OHIO HABITAT CONSERVATION STRATEGIES FOR SHOREBIRDS

Habitat Inventory and Protection Goals

Wetland complexes and associated uplands in Ohio that are considered important for shorebirds and other wetland birds need to be comprehensively identified. As of February 2010, Ducks Unlimited (Michigan Office) has nearly completed an update of the statewide wetland inventory using National Wetland Inventory methodology and this will be an important step for evaluating the status of Ohio's wetland habitat. Where feasible, sites identified will need restoration and/or long-term protection by federal and state agencies and conservation organizations (e.g., ODNR, OEPA, USDA, Ducks Unlimited, The Nature Conservancy) through fee-title acquisition, conservation easement, or landowner agreement.

Although Ohio has relatively few sites that attract large numbers of shorebirds on a regular basis, several areas are important for achieving UMRGLRJV goals. These areas include National Wildlife Refuges (Ottawa, Cedar Point, West Sister Island), State Wildlife Areas (Big Island, Killdeer Plains, Magee Marsh, Metzger Marsh, Pickerel Creek), Conneaut Harbor, Hoover Reservoir, and several private hunting clubs.

The UMRGLRJV has summarized goals for habitat enhancement for Ohio by bird conservation region (Potter et al. 2007; Table 3). The JV suggests protecting over 8,468 ha of habitat for Ohio breeding species and over 7,153 ha for migrating species in Ohio. The goals set by the UMRGLRJV Shorebird Conservation Strategy are based on focal species. Breeding focal species were chosen for habitat planning and population monitoring while migrating species were chosen for habitat-limiting factors, monitoring and migration chronology. Information on focal species and their habitat requirements can be found in Potter et al. (2007).

Table 3. Ohio shorebird habitat maintenance and protection objectives (ha) by Bird Conservation Region (BCR) to meet carrying capacity for breeding (B) and migrating (M) population goals in the Upper Mississippi River and Great Lakes Joint Venture region. Distribution of protection effort based on JV focal species^a breeding population estimates (B), migration areas importance scores (M), and habitat models; see Potter et al. (2007) for methods. Habitat objectives are given in hectares (1 ha = 2.47 acres). See Table 1 in Chapter 5 for habitat descriptions.

BCR	Dry mudflat / agriculture		Wet meadow with open water		Wet mudflat / moist soil plants	Shallow water (<5 cm)	Moderate water (5-20 cm)	Beach	
	B	M	B	M	M	M	B	M	
13	230	497	832	2,216	897	239	1	69	
22	7,345	55	0	236	105	28	2	8	
28	57	357	0	1,673	611	97	0	63	
Total	7,633	910	832	4,125	1,613	364	3	141	

^a Ohio breeding focal species included Killdeer (dry mudflat), and Wilson's Snipe (wet mudflat). Focal species representing migration guilds included American Golden Plover (dry mudflat), Dunlin (wet mudflat), Short-billed Dowitcher, and Sanderling (beach); Piping Plover (beach) and Wilson's Phalarope (moderate water) were considered focal species in the UMRGLRJV (Potter et al. 2007).

Habitat Restoration

The North American Waterfowl Management Plan (NAWMP 2004) is a continent-wide conservation plan implemented in 1986 and signed by the U.S. and Canada (and later Mexico) to restore waterfowl populations through regional partnerships called Joint Ventures. Because of its record of success, additional continental bird conservation plans, including the UMRGLRJV Shorebird Plan, have been modeled after the NAWMP and implemented through the Joint Ventures. Although the type of habitat provided for waterfowl may differ from what is optimal for shorebirds, proper planning and coordination of wetland restoration and management can benefit both waterfowl and shorebirds.

Ohio goals for habitat restoration and enhancement developed by UMRGLRJV (Potter et al. 2007; Table 4) recommend restoring 11,950 ha for breeding shorebirds and over 5,500 ha for migratory species. Areas with greater potential for wetland restoration in Ohio may be based on the presence of hydric soils (Figure 1). Restoration potential is based on the percent hydric soils (wet/previous wetland; STATSGO 1991) and the relative importance of location. Wet-soil areas >50 km from known shorebird concentration sites received a higher priority rating (yellow-red) and wet sites <50 km from current staging areas were rated moderate priority (blue); white areas on the map have lower wetland restoration potential.

Table 4. Ohio shorebird habitat restoration and enhancement objectives (ha) by Bird Conservation Region (BCR) to meet carrying capacity for breeding (B) and migrating (M) population goals in the Upper Mississippi River and Great Lakes Joint Venture region. Distribution of restoration effort is based on JV focal species breeding population deficits (B), migration population deficits (M), and habitat models. Habitat objectives are given in hectares (1 ha = 2.47 acres). See Table 1 in Chapter 5 for habitat descriptions.

BCR	Dry mudflat / agriculture		Wet meadow with open water	Wet mudflat / moist soil plants	Shallow water (<5 cm deep)	Moderate water (5-20 cm deep)	Beach
	B	M	B	M	M	M	M
13	331	303	975	2,032	276	218	170
22	10,560	32	0	215	33	25	22
28	82	184	0	1,504	198	96	168
Total	10,974	520	975	3,751	507	338	360

^a Ohio breeding focal species included Killdeer (dry mudflat) and Wilson's Snipe (wet mudflat). Focal species representing migration guilds included American Golden Plover (dry mudflat), Dunlin (wet mudflat), Short-billed Dowitcher, and Sanderling (beach); Piping Plover (beach) and Wilson's Phalarope (moderate water) were considered UMRGLRJV focal species (Potter et al. 2007). Population deficit = population goal - current estimate.

Habitat Management Philosophy

Management of shorebird habitats requires using a wide range of techniques in diverse habitats, and achieving regional priorities requires management for different species at different seasons. Integrated management of Ohio habitats used by shorebirds and other wetland-dependent wildlife is a goal of this plan. This section summarizes the UMGLV Shorebird Plan's wetland habitat management principles (Potter et al. 2007).

Site specific management plans must be designed by local managers, but these general principles will apply to many situations where integrated wetland management for shorebirds and other wetland wildlife is the goal.

- 1) Wetland habitats should be managed as dynamic systems.
- 2) Naturally self-maintaining systems should be preserved and are generally preferable to sites requiring ongoing, intensive management.
- 3) Management for diverse species groups is generally preferable to management for single species, except for species at high risk.
- 4) Management activities should be seasonally timed to have the maximum impact on critically limiting resources.
- 5) Shorebird management should be a priority on publicly managed wetlands.
- 6) Greater efforts are needed to support improved shorebird management activities on private lands.
- 7) Successful management for shorebirds requires a detailed understanding of historical conditions at each site and across entire landscapes.
- 8) Multiple use management of habitats requires careful balancing of public access with acceptable levels of human disturbance to shorebirds.

Wetland Complex Principle: The Value of Wetland Stages

Providing a complex of wetlands is important - what resources one wetland may be lacking, another one can provide. Managers can learn to provide the necessary resources for migrating shorebirds by recognizing the importance of providing a variety (complex) of wetland habitats during the annual peaks of shorebird abundance. Shorebird abundance in Ohio peaks during April -June and July-November. Managers need to provide a variety of appropriate water depths and vegetation heights/densities at those times to ensure that the life-requirements of a variety of shorebirds are made available. Water levels in constructed impoundments can be manipulated slowly, gradually, and at varied times to mimic natural hydrology. If appropriately timed, these gradual changes provide food and foraging depths for a variety of bird species and their varying migration periods.

Importance of Disturbance

Providing basic habitat requirements is of no value if the habitat is not reasonably protected from human disturbance. Except for egg production, flight requires more energy than any other activity. If disturbance from public recreation or management activities prevents birds from utilizing habitat at crucial times of year, this disturbance can be detrimental to shorebirds. Managers need to minimize the time that shorebirds spend flying and maximize the time they spend feeding and resting. For high to moderate shorebird use areas, managers should try to prohibit access (or allow very limited access) within approximately 500 feet during peak shorebird migration, especially August to early October; user groups of concern include dog walkers, fisherman, hunters, boaters, and bird watchers.

POPULATION MONITORING

Monitoring Progress for Population Goals

Measures of abundance are crude for most shorebird species, but we assume they provide an adequate starting point for goal setting and determining monitoring needs. However, an effective monitoring strategy is required to measure progress toward meeting population and habitat objectives within Ohio.

Current surveys include species-specific monitoring of breeding populations, such as the Woodcock Singing-ground Survey, to more general monitoring programs like the International Shorebird Survey (ISS) and Breeding Bird Survey (BBS). These long term programs collectively provide information on distribution, densities, and population trends. The Woodcock Singing-ground Survey is a systematic effort producing relatively high quality data for this species, at least at regional and continental levels. Due to the low density of survey routes, however,



American woodcock, Photo: Paul Rodewald

these data are less useful at smaller scales. The ISS may be used for peak migration staging numbers, migration timing, and responses to management actions at specific sites. It cannot be used to estimate population trends because survey design is not systematic or randomized and is therefore subject to large observer bias. The BBS is more statistically rigorous but is conducted from roads which have historically avoided wetland areas and wetlands are under-represented. It is useful for inland and upland species like Killdeer and Upland Sandpiper, but detection and route locations are inadequate for other shorebirds that occur in the Great Lakes coastal zone or remote wetland sites.

Monitoring Objectives

Develop a monitoring program to validate and improve estimates of breeding and migrating shorebird populations and trends in the JV region, with emphasis on JV focal species. This effort will include estimates of population size, migration timing, duration of stay, and use-days for migrating shorebirds, plus status and trends of breeding species.

UMRGLRJV has developed specific short-term (< 5 years) survey needs for different shorebird groups to fill immediate information gaps (Potter et al. 2007).

- Coastal migrants -- Sanderling, Dunlin, Piping Plover, Ruddy Turnstone, Semipalmated Sandpiper, and Black-bellied Plover. Surveys should be conducted during autumn and spring via a stratified random sampling at the state level using a network of volunteers.
- Interior-migrating plovers -- American Golden-Plover, Black-bellied Plover, and Killdeer. Surveys should be conducted during spring migration only and focus on interior wetlands and flooded agricultural fields. Surveys should be conducted on stratified random plots or roadside transects within areas of Illinois, Indiana, and Ohio known historically to be staging areas.
- Other interior-migrating shorebirds -- Wilson's Phalarope, Pectoral Sandpipers, and Greater and Lesser Yellowlegs. Surveys should be conducted during spring migration and focus on interior wetlands, coastal marshes and estuaries using cluster sampling or a stratified random plot design.

The UMRGLRJV recommended specific long-term annual surveys of breeding populations of Upland Sandpiper and Wilson's Snipe, but these species are rare breeders in Ohio (Peterjohn 2001) making surveys unfeasible. However, the Ohio Breeding Bird Atlas II (2006-2010) will provide a unique opportunity to locate new breeding individuals or populations.

State Breeding Bird Atlases can provide state-level information on breeding distribution, rough and status, and long-term trends for and changes in distribution between atlas efforts for Killdeer, Spotted Sandpiper, and American Woodcock. However, within Ohio only very limited opportunity currently exists to obtain meaningful population trend estimates in interior habitats due to annual variation in weather and habitat conditions.

Finally, in addition to documenting area use, the UMRGLRJV recommended that JV partners strive to evaluate habitat quality as it relates to productivity and survival. Smaller scale monitoring projects that target JV focal species may be necessary to better understand the effect of local conservation efforts on the fitness of shorebirds. Baseline information on vital rates (breeders) and physical condition (migrants and breeders) must be determined and a monitoring protocol eventually established.

Most inland shorebird habitat in Ohio is dispersed and ephemeral. Thus, shorebirds using interior areas of the state tend to opportunistically exploit available habitat within the landscape, rather than consistently concentrating at a few sites as is done along Lake Erie. This makes population monitoring a challenge. The only large-scale survey for tracking numbers and distribution of migrating shorebirds that currently covers the UMRGLRJV is the International Shorebird Survey (ISS). Based at the Manomet Center for Conservation Sciences, the ISS uses a network of ~800 cooperators to census shorebirds at over 500 locations. ISS data are useful in providing information on use, peak numbers, timing of migration, and responses to management activities at individual survey sites. Ohio currently has the greatest ISS coverage (54 sites) within the UMRGLRJV, followed by Michigan (23), New York (12), and Illinois (11). Until improvements to the ISS or other migration-staging surveys are completed, migrant population

estimates for the JV region will be updated based on changes in continental breeding population estimates.

RESEARCH NEEDS FOR SHOREBIRDS

To further shorebird conservation in the UMRGLRJV, research and information needs were identified by Potter et al. (2007) with a specific emphasis on UMRGLRJV focal species. OBCI can in the future make this list more specific to Ohio.

Research should be developed to build or refine biological models that relate breeding shorebird population responses to landscape/habitat changes. This requires identification and understanding of how habitat factors influence vital rates (e.g., survival, nesting/fledging success) plus knowledge of how vital rates affect population growth and sustainability.

Research should be developed to improve bioenergetics models used to evaluate landscape/habitat carrying capacity for migrating shorebirds including analyses of energetic carry capacity, and habitat characteristics important to shorebird abundance and population dynamics (e.g., distribution and abundance of shorebirds in relation to indices like wetland abundance and landscape composition).

A combined monitoring and research protocol should be developed to better track priority migrating shorebirds (JV focal species) in order to identify 1) primary and secondary use areas, 2) characteristics that influence habitat suitability, 3) energetic condition as related to habitat suitability, and 4) change in habitat abundance.

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