

Using Acoustic and Ultrasonic Monitors to Document Bird and Bat Presence along the Great Lakes Coastlines during the 2012 Spring and Fall Migration Seasons



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Partners: US Fish and Wildlife Service, US Geological Survey and the University of Minnesota
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Introduction. Each spring and fall the Great Lakes region is visited by millions of birds and bats during their biannual migration travels. During the spring, hundreds of species of birds fly from their wintering grounds in the Caribbean and Central and South America to their breeding grounds in the United States (U.S.) and Canada. These birds, along with their offspring, return to their wintering grounds each fall. While much less is known about bat migration, we know that bats in the Great Lakes region exhibit two different migration patterns. Regional migrant bats (cave bats that winter in the Great Lakes region) move through the area to and from their wintering habitat. In addition to these regional migrants, there are three species of tree bats that undertake longer migrations each spring and fall, moving between their winter habitat in the southern U.S. to their summer habitat in the northern U.S. and Canada.

Migrating birds and bats often follow migration corridors (similar to our highway system). Migration corridors are not well understood, though it is likely that areas near the Great Lakes coastlines host large concentrated movements of these flying animals during the migration seasons. For example, many birds



Figure 1. Fall bird migration trajectories in relation to the Great Lakes.

from as far north as Alaska begin their fall migration by heading in a southeasterly direction, rather than due south, a trajectory that results in many of these birds encountering the Great Lakes region (Figure 1). The Great Lakes can act as “barriers” to migrating birds and bats because they are devoid of safe places to land and require substantial energy to cross; thus migration movement likely becomes concentrated along the coastlines of the Great Lakes. As the human need for renewable energy, communication

technology, and living space expands, so does fragmentation of habitat and airspace within migration corridors, such as the Great Lakes coastlines.

Birds and bats emit sounds (acoustic and ultrasonic, respectively) as they migrate during the night-time hours. Using monitors that were designed specifically for bird and bat detection is one way the U.S. Fish and Wildlife Service (USFWS) (Region 3) is gathering information about bird and bat migration corridors in the Great Lakes region. This information is part of a larger study (using avian radar systems and historical data) aimed at better understanding when and where birds and bats are moving along these coastlines. This information will aid thoughtful decision making regarding developments such as wind turbines, communication towers, and land development.

Methods. During the 2012 spring and fall migration seasons, monitors were placed near the shorelines of Lakes Michigan, Huron, Erie and Ontario to record nighttime bird and bat sounds (Spring: 32 monitors, Fall: 21 monitors) (Figure 2). In order to determine if there is a gradient of bird and/or bat density as you move inland from the lakeshore, along the west shore of Lake Michigan, additional monitors were placed inland of the near-shore sites, forming six east-west transects. Two transects include a near-shore site and a site 3 miles inland; 4 transects have sites near-shore and 3, 6 and 10 miles inland. These sites, along with sites along the north shore of Lake Michigan and the south shore of Lake Ontario, also collected data throughout the breeding season; however only data from the spring and fall migrations seasons were used in this analysis.

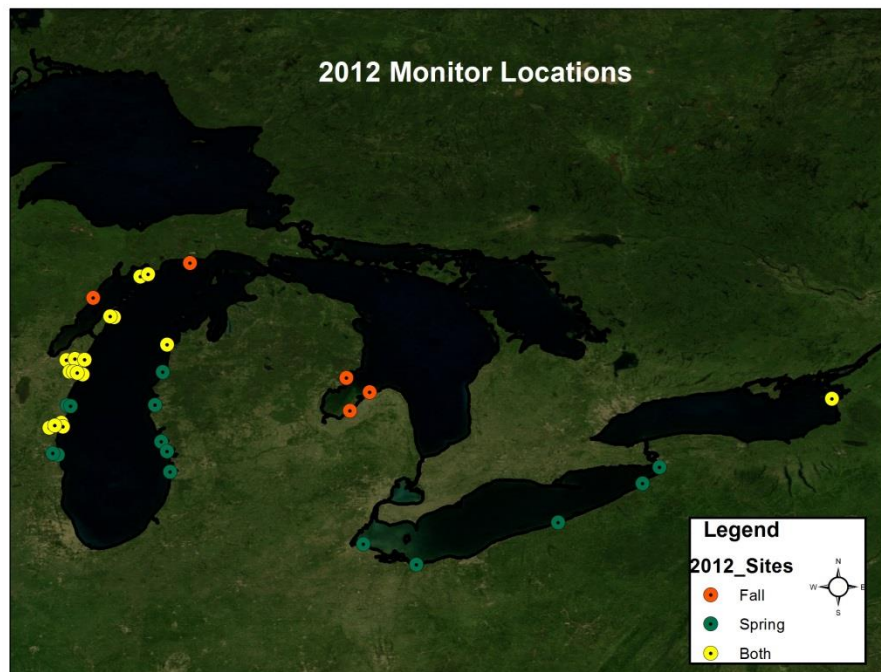


Figure 2. 2012 spring and fall monitor site locations, along Lakes Michigan, Huron, Erie and Ontario.

Each monitor (Wildlife Acoustics' Song Meter SM2+*) had both acoustic (bird) and ultrasonic (bat) microphones attached to a weatherproof recorder. Monitors were set to turn on and record calls from 30 minutes after local sunset to 2.5 hours after local sunrise; calls that occurred after sunrise were not used for this analysis. To improve overhead recording quality in high-wind and high insect areas, bat microphones were placed approximately 3 feet off the ground and fitted with wind blockers made from PVC pipe and wind-dampening fabric (Figure 3a). Bird microphones were attached to a plate at the top of a 15 foot pole (Figure 3b) when attached to the ground; rooftops were also utilized. Batteries and data cards were changed at approximately 10-day intervals (Figure 3a). Each series of bird (lower frequency, Figure 4a) or bat sound (high frequency, Figure 4b) within a single recording time frame was recorded as one individual "call".

*Use of trade names does not imply endorsement by the USFWS or the University of Minnesota.

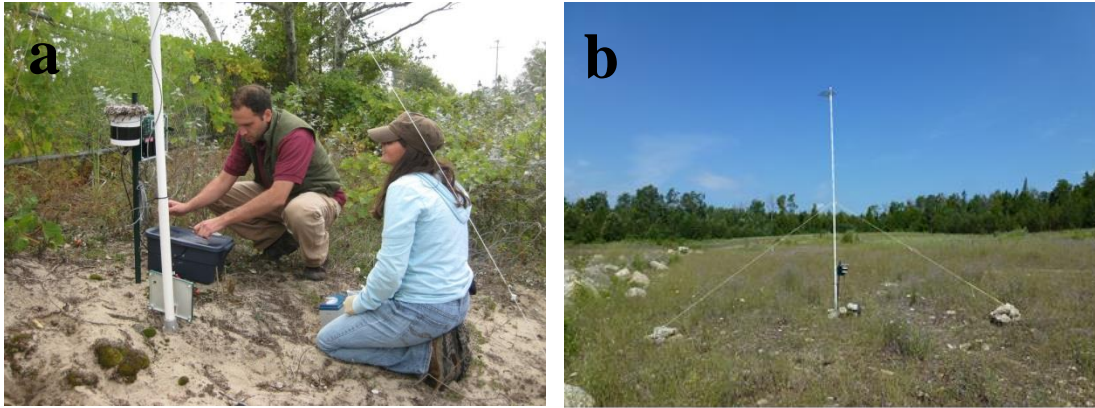


Figure 3. a. USFWS biologists changing batteries and data cards, Point Betsie, MI. **b.** Monitor setup, near Escanaba, MI.

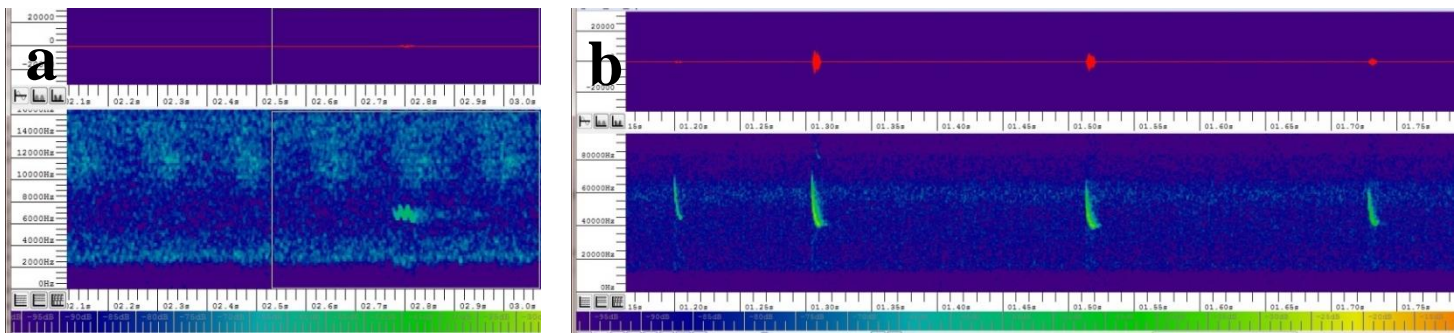


Figure 4. a. Bird spectrograph, fall migration. **b.** Bat spectrograph, fall migration.

Preliminary Results (subject to change)

Spring

A total of 32 monitors were setup during the 2012 spring migration season (April – June 15) along Lake Michigan (north, east and west shore), Lake Erie and Lake Ontario (south shores).

Birds: These monitors recorded a total of 127,673 nighttime bird calls (Appendix A). The highest nightly bird count during the spring season occurred at Lakeshore State Park, located along the western shore of Lake Michigan with 658 calls on May 12th (Appendix B). The highest average nightly bird count occurred at a site 6 miles inland from the western shore of Lake Michigan, at 4-H Camp TaPaWingo, near Mishicot, Wisconsin; the average nightly count at this site was 122 calls. The top five sites with the highest average bird calls/night were associated with the western shore of Lake Michigan at sites near the lakeshore, 6 miles inland, 3 miles inland and 10 miles inland (Figure 5a).

Bats: Monitors recorded a total of 278,436 bat calls during the spring season (Appendix A). The highest nightly bat count occurred at Bailey’s Harbor Boreal Forest & Wetlands State Natural Area,

located along the western shore of Lake Michigan (Door County, Wisconsin) with 3,441 calls recorded on April 12 (Appendix B). The highest average nightly bat count also occurred at this site with average nightly bat calls of 548 calls. Two of the top 5 sites with the highest average bat calls/night were associated with the western shore of Lake Michigan in Door County, Wisconsin (near-shore and 3 miles inland); a third site was located north of these sites, along the north shore of Lake Michigan, on the Garden Peninsula. The other two sites in the top five were along the eastern shore of Lake Michigan and Lake Erie (Figure 5b).

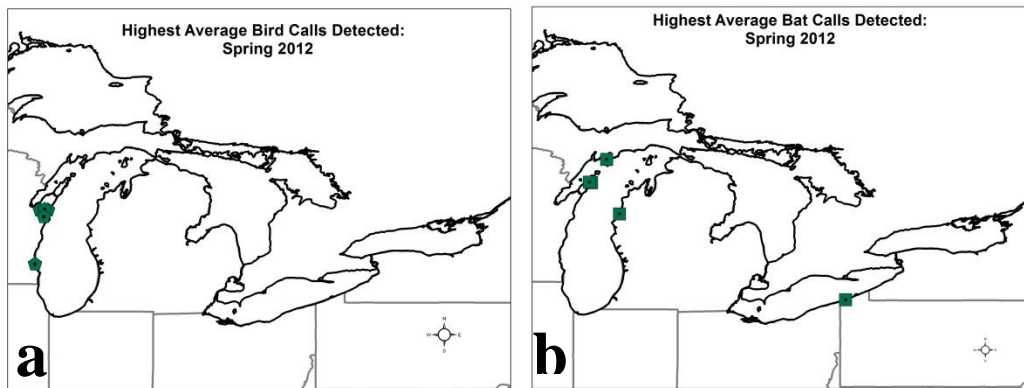


Figure 5. Locations with the highest (top 5) average recorded bird (a) and bat (b) calls during the spring season (April – June 15, 2012).

Fall

A total of 21 monitors were setup during the 2012 fall migration season (August – October) along Lake Michigan (west and north shores), Lake Huron and Lake Ontario.

Birds: A total of 39,457 nighttime bird calls were recorded during the fall migration season (Appendix A). The highest nightly bird count recorded occurred at Forest Beach Migratory Preserve, located near the western shore of Lake Michigan (near Belgium, Wisconsin) with 750 calls on October 12th (Appendix C). The highest average nightly bird count occurred at Belgium Waterfowl Production Area, (also near Belgium, Wisconsin) a site 3 miles inland of the western shore of Lake Michigan, with average nightly counts of 49 calls. Four of the top five sites with the highest average bird calls/night were associated with Lake Michigan: 3 with the western shore (3 miles inland and 10 miles inland) and 1 with the north shore. The other site was along Lake Huron (Figure 6a).

Bats: A total of 372,554 bat calls were recorded by our monitors throughout the fall time period (Appendix A). The highest nightly bat count occurred along the north shore of Lake Michigan at Portage Bay Campground on the Garden Peninsula. This site had 3,522 bat calls recorded on September 12th (Appendix C). The highest average nightly bat count occurred at another site located along the north shore of Lake Michigan at Seul Choix Point Lighthouse with an average nightly count of 1,096 calls. The top 5 sites with the highest average bat calls/night were all associated with Lake Michigan: north shore (2), western shore (3) (along the lakeshore, 3 miles and 6 miles inland) (Figure 6b).

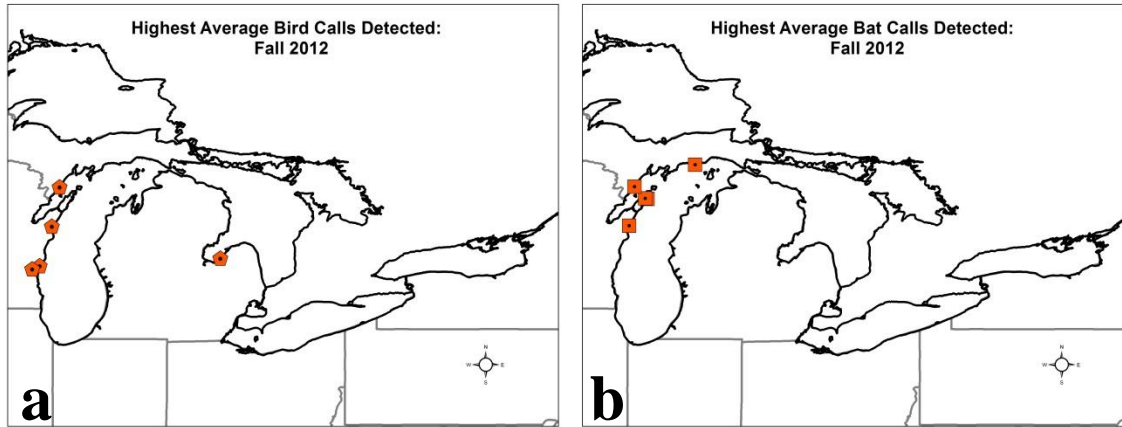


Figure 6. Locations with the highest (top 5) average recorded bird (a) and bat (b) calls during the spring season (April – June 15, 2012).

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A sincere thank you to:

4-H Camp TaPaWingo, WI; City of Ferrysburg, MI; City of Kewaunee, WI; Forest Beach Migratory Preserve, WI; Friends of Point Betsie Lighthouse, MI; Maywood Environmental Park, WI; Michigan Department of Natural Resources (Albert E. Sleeper State Park, Charles Mears State Park, Fish Point State Wildlife Area, Holland State Park, JW Wells State Park, Muskegon State Park, Orchard Beach State Park); New York State Office of Parks, Recreation and Historic Preservation (Evangola State Park, Robert G. Wehle State Park); Ohio Department of Natural Resources (Old Woman Creek National Estuarine Research Reserve); Ozaukee High School, WI; Pennsylvania Department of Conservation and Natural Resources (Erie Bluffs State Park); Portage Bay Campground, MI; Portage Bay State Forest Campground, MI; Riveredge Nature Center, WI; Seul Choix Point Lighthouse/Gulliver Historic Society, MI; Sheboygan Water Utility, WI; The Nature Conservancy, WI; Tift Nature Preserve, WI; Urban Ecology Center, WI; USFWS (Belgium Waterfowl Production Area, WI, Cedar Meadow National Wildlife Refuge, OH, Green Bay Field Office, WI); US Gypsum, MI; Wisconsin Department of Natural Resources (Bailey’s Harbor Boreal Forest & Wetlands State Natural Area, Fayette Historic State Park, Lakeshore State Park, Point Beach State Forest).

Appendix A. Bird and bat monitor locations, corresponding shorelines, and preliminary bird and bat call totals (not adjusted for the numbers of night's monitors were operating) for 2012. 'NA' indicates data needing further analysis or monitor not present. Sites are listed geographically. This information is not suited or intended for commercial (wind farms, radio towers, etc.) siting decisions.

Monitor Location	Shoreline	SPRING TOTALS		FALL TOTALS	
		Birds	Bats	Birds	Bats
JW Wells State Park	Lake Michigan (north)	NA	NA	3248	31713
Portage Bay Campground	Lake Michigan (north)	3602	18382	1747	20493
Fayette State Park	Lake Michigan (north)	4215	14270	1132	3919
Seul Choix Lighthouse	Lake Michigan (north)	NA	NA	1664	100807
Bailey's Harbor Boreal Forest, SWA ¹	Lake Michigan (west)	685	41611	373	30159
The Nature Conservancy (3 miles inland) ¹	Lake Michigan (west)	6115	30744	1666	40296
City of Kewaunee (nearshore) ²	Lake Michigan (west)	8026	4412	NA	7405
Bruemmer Park (3 miles inland) ²	Lake Michigan (west)	8198	12153	3395	15061
Kewaunee Fish & Wildlife Area (6 miles inland) ²	Lake Michigan (west)	4848	12648	1865	27223
Kewaunee, Private Residence (10 miles inland) ²	Lake Michigan (west)	6640	2652	2518	6791
Point Beach State Park ³	Lake Michigan (west)	6480	13742	1119	16878
Private Residence (3 miles inland) ³	Lake Michigan (west)	NA	305	317	555
4-H Camp TaPaWingo (6 miles inland) ³	Lake Michigan (west)	9290	3017	1363	3773
Private Residence (10 miles inland) ³	Lake Michigan (west)	3594	3164	292	8461
Sheboygan Water Utility	Lake Michigan (west)	2675	1095	NA	NA
Maywood Environmental Park	Lake Michigan (west)	3995	10026	NA	NA
Forest Beach Migratory Preserve ⁴	Lake Michigan (west)	2376	1698	2175	260
Belgium WPA (3 miles inland) ⁴	Lake Michigan (west)	1999	123	4499	NA
Ozaukee High School (6 miles inland) ⁴	Lake Michigan (west)	2053	333	NA	NA
Riveredge Nature Center (10 miles inland) ⁴	Lake Michigan (west)	2951	12050	2673	9936
Lake Shore State Park	Lake Michigan (west)	7871	3000	NA	NA
Urban Ecology Center, Washigton Park	Lake Michigan (west)	3068	1902	NA	NA
Point Betsie Lighthouse	Lake Michigan (east)	3744	9432	NA	NA
Orchard Beach State Park	Lake Michigan (east)	2915	16423	NA	NA
Charles Mears State Park	Lake Michigan (east)	1831	6097	NA	NA
Muskegon State Park	Lake Michigan (east)	4116	2340	NA	NA
North Beach Park	Lake Michigan (east)	1840	5433	NA	NA
Holland State Park	Lake Michigan (east)	2235	3255	NA	NA
US Gypsum 1	Lake Huron	NA	NA	865	5252
US Gypsum 2	Lake Huron	NA	NA	1455	8109
Fish Point State Wildlife Area	Lake Huron	NA	NA	3530	3521
Albert E. Sleeper State Park	Lake Huron	NA	NA	1446	26238
Cedar Meadow National Wildlife Refuge	Lake Erie (west)	1763	7332	NA	NA
Old Women Nat.Est. Pres.	Lake Erie (west)	1819	10455	NA	NA
Erie Bluff's SP	Lake Erie (east)	5178	14429	NA	NA
Evangola State Park	Lake Erie (east)	5151	12521	NA	NA
Tiff Nature Preserve	Lake Erie (east)	5728	1699	NA	NA
Robert G. Wehle State Park	Lake Ontario (east)	2672	1693	2115	5703
	Season Totals	127673	278436	36209	340840
^{1,2,3,4} Indicates sites associated with transects		Unless indicated, all sites are located near the lakeshore			

Appendix B. Bird and bat monitor locations, corresponding shorelines, and bird and bat peak date of passage during spring 2012 and corresponding abundance. Sites are listed geographically. This information is not suited or intended for commercial (wind farms, radio towers, etc.) siting decisions.

Monitor Location	Shoreline	SPRING BIRDS		SPRING BATS	
		Peak Date	Peak Abund.	Peak Date	Peak Abund.
J.W. Wells State Park	Lake Michigan (north)	NA	NA	NA	NA
Portage Bay Campground	Lake Michigan (north)	Apr-12	254	1176	May-12
Fayette State Historic Park	Lake Michigan (north)	May-12	156	1848	May-12
Seul Choix Point Lighthouse	Lake Michigan (north)	NA	NA	NA	NA
Bailey's Harbor Boreal Forest & Wetlands SNA ¹	Lake Michigan (west)	Jun-12	109	3441	Apr-12
The Nature Conservancy (3 miles inland) ¹	Lake Michigan (west)	May-12	191	2077	Jun-12
City of Kewaunee ²	Lake Michigan (west)	May-12	575	542	Jun-12
Bruemmer Park (3 miles inland) ²	Lake Michigan (west)	May-12	324	787	May-12
Kewaunee Fish & Wildlife Area (6 miles inland) ²	Lake Michigan (west)	May-12	188	916	Jun-12
Kewaunee, Private Residence (10 miles inland) ²	Lake Michigan (west)	May-12	437	332	Jun-12
Point Beach State Forest ³	Lake Michigan (west)	May-12	411	1315	Jun-12
Private Residence (3 miles inland) ³	Lake Michigan (west)	NA	NA	29	Jun-12
4-H Camp TaPaWingo (6 miles inland) ³	Lake Michigan (west)	May-12	446	245	Jun-12
Private Residence (10 miles inland) ³	Lake Michigan (west)	May-12	144	244	Jun-12
Sheboygan Water Utility ⁴	Lake Michigan (west)	May-12	280	183	May-12
Maywood Environmental Park ⁴	Lake Michigan (west)	May-12	218	909	May-12
Forest Beach Migratory Preserve ⁵	Lake Michigan (west)	May-12	160	201	May-12
Belgium WPA (3 miles inland) ⁵	Lake Michigan (west)	May-12	149	109	NA
Ozaukee High School (6 miles inland) ⁵	Lake Michigan (west)	May-12	291	52	Jun-12
Riveredge Nature Center (10 miles inland) ⁵	Lake Michigan (west)	May-12	141	725	Jun-12
Lakeshore State Park ⁶	Lake Michigan (west)	May-12	658	448	May-12
Urban Ecology Center (3 miles inland) ⁶	Lake Michigan (west)	Apr-12	375	541	Apr-12
Point Betsie Lighthouse	Lake Michigan (east)	Apr-12	250	745	May-12
Orchard Beach State Park	Lake Michigan (east)	Apr-12	587	777	May-12
Charles Mears State Park	Lake Michigan (east)	Apr-12	161	595	May-12
Muskegon State Park	Lake Michigan (east)	Jun-12	210	414	May-12
North Beach Park	Lake Michigan (east)	Apr-12	158	529	Apr-12
Holland State Park	Lake Michigan (east)	Apr-12	141	397	May-12
US Gypsum 1	Lake Huron	NA	NA	NA	NA
US Gypsum 2	Lake Huron	NA	NA	NA	NA
Fish Point State Wildlife Area	Lake Huron	NA	NA	NA	NA
Albert E. Sleeper State Park	Lake Huron	NA	NA	NA	NA
Cedar Meadow National Wildlife Refuge	Lake Erie (west)	May-12	484	1015	May-12
Old Women Nat'l Estuarine Research Reserve	Lake Erie (west)	Apr-12	136	658	Apr-12
Erie Bluff's State Park	Lake Erie (east)	Apr-12	306	1174	May-12
Evangola State Park	Lake Erie (east)	May-12	388	1018	May-12
Tiffit Nature Preserve	Lake Erie (east)	May-12	318	209	May-12
Robert G. Wehle State Park	Lake Ontario (east)	May-12	125	124	May-12

^{1,2...6}Indicates sites associated with transects

Unless indicated, all sites are located near the lakeshore

Appendix C. Bird and bat monitor locations, corresponding shorelines, and bird and bat peak date of passage during fall 2012 and corresponding abundance. Sites are listed geographically. This information is not suited or intended for commercial (wind farms, radio towers, etc.) siting decisions.

Monitor Location	Shoreline	FALL BIRDS		FALL BATS	
		Peak Date	Peak Abund.	Peak Date	Peak Abund.
J.W. Wells State Park	Lake Michigan (north)	Oct-12	368	2870	Aug-12
Portage Bay Campground	Lake Michigan (north)	Oct-12	163	3522	Sep-12
Fayette State Historic Park	Lake Michigan (north)	Oct-12	103	1752	Aug-12
Seul Choix Point Lighthouse	Lake Michigan (north)	Aug-12	182	3285	Aug-12
Bailey's Harbor Boreal Forest & Wetlands SNA ¹	Lake Michigan (west)	Aug-12	151	1540	Aug-12
The Nature Conservancy (3 miles inland) ¹	Lake Michigan (west)	Aug-12	90	2663	Aug-12
City of Kewaunee ²	Lake Michigan (west)	NA	NA	414	Aug-12
Bruemmer Park (3 miles inland) ²	Lake Michigan (west)	Oct-12	213	2014	Aug-12
Kewaunee Fish & Wildlife Area (6 miles inland) ²	Lake Michigan (west)	Aug-12	146	1850	Aug-12
Kewaunee, Private Residence (10 miles inland) ²	Lake Michigan (west)	Oct-12	132	687	Aug-12
Point Beach State Forest ³	Lake Michigan (west)	Aug-12	124	2306	Aug-12
Private Residence (3 miles inland) ³	Lake Michigan (west)	Aug-12	157	36	Sep-12
4-H Camp TaPaWingo (6 miles inland) ³	Lake Michigan (west)	Oct-12	97	370	Aug-12
Private Residence (10 miles inland) ³	Lake Michigan (west)	Oct-12	27	827	Aug-12
Sheboygan Water Utility ⁴	Lake Michigan (west)	NA	NA	NA	NA
Maywood Environmental Park ⁴	Lake Michigan (west)	NA	NA	NA	NA
Forest Beach Migratory Preserve ⁵	Lake Michigan (west)	Oct-12	750	131	Aug-12
Belgium WPA (3 miles inland) ⁵	Lake Michigan (west)	Oct-12	224	1	NA
Ozaukee High School (6 miles inland) ⁵	Lake Michigan (west)	NA	NA	NA	NA
Riveredge Nature Center (10 miles inland) ⁵	Lake Michigan (west)	Aug-12	194	726	Sep-12
Lakeshore State Park ⁶	Lake Michigan (west)	NA	NA	NA	NA
Urban Ecology Center (3 miles inland) ⁶	Lake Michigan (west)	NA	NA	NA	NA
Point Betsie Lighthouse	Lake Michigan (east)	NA	NA	NA	NA
Orchard Beach State Park	Lake Michigan (east)	NA	NA	NA	NA
Charles Mears State Park	Lake Michigan (east)	NA	NA	NA	NA
Muskegon State Park	Lake Michigan (east)	NA	NA	NA	NA
North Beach Park	Lake Michigan (east)	NA	NA	NA	NA
Holland State Park	Lake Michigan (east)	NA	NA	NA	NA
US Gypsum 1	Lake Huron	Aug-12	216	221	Aug-12
US Gypsum 2	Lake Huron	Oct-12	162	486	Sep-12
Fish Point State Wildlife Area	Lake Huron	Oct-12	233	343	Sep-12
Albert E. Sleeper State Park	Lake Huron	Oct-12	200	1946	Aug-12
Cedar Meadow National Wildlife Refuge	Lake Erie (west)	NA	NA	NA	NA
Old Women Nat'l Estuarine Research Reserve	Lake Erie (west)	NA	NA	NA	NA
Erie Bluff's State Park	Lake Erie (east)	NA	NA	NA	NA
Evangola State Park	Lake Erie (east)	NA	NA	NA	NA
Tiffit Nature Preserve	Lake Erie (east)	NA	NA	NA	NA
Robert G. Wehle State Park	Lake Ontario (east)	Sep-13	237	691	Aug-12

^{1,2...6}Indicates sites associated with transects.

Unless indicated, all sites are located near the lakeshore.