

Appendix I–Southeast Lake Michigan, Michigan and Indiana

This appendix provides information on the numbers and information used in selecting the southeast portion of Lake Michigan as a Sea Duck Joint Venture key habitat site. All aerial survey data were collected during a project led by Kevin Kenow (U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin; Kenow et al. 2021). Additional information that assisted in designating key site boundaries, especially those areas important for Long-tailed Ducks (*Clangula hyemalis*), came from descriptions of habitat use and movements of Long-tailed Ducks radio-marked on Lake Michigan provided by Fara (2018).

Brief Description of Aerial Surveys

Aerial surveys were conducted during September through May, 2009 through 2014. Survey areas were selected to evaluate avian risk to Type E botulism and to provide information on waterbird distributions to inform offshore wind energy development. Timing and selection of areas to be surveyed in a given month were focused on these issues and were highly influenced by plane availability and weather conditions. Surveys were flown along fixed-width transects. Transects generally paralleled shorelines and extended up to 32 km (20 mi) offshore. Surveys were flown at an average air speed of about 200 km/h (125 mph) and at an altitude of about 61 to 76 m (200 to 250 ft) above the water using a U.S. Fish and Wildlife Service (USFWS) fixed-wing aircraft (Partenavia P.68 Observer¹). Two observers, one on each side of the plane, identified and tallied waterbirds within 200-m-wide (1/8-mi) strip transects on either side of the plane. Distances were established using a clinometer, and the portion of the transect band beneath the plane that was not observable was estimated at 70.4 m (35.2 x 2) and 88 m (44 x 2) at 61 and 76 m above ground level (AGL), respectively.

Brief Description of Appendix Contents

This appendix contains nine tables and three figures. Tables S1, S4, and S7 provide the raw counts of sea ducks observed on (within the 200 m transect) and off (beyond the 200 m transect) transect for the surveys that were encompassed by the southeast Lake Michigan key site during fall (September–November), winter (December–February), and spring (March–May), respectively. An additional survey area (South End) is included for this key site, as the key site extends slightly into the survey area, but total number of sea ducks reported does not include counts from the South End survey. Raw counts do not account for the visibility factors that may affect bird detectability during aerial surveys; therefore, we estimated the number of sea ducks using a visibility correction factor (Hodges et al. 2008) and present those numbers in tables S2, S5, and S8 for fall, winter, and spring, respectively. The estimated counts for the South End survey area are not included in the total number of sea ducks reported. Tables S3, S6, and S9 provide the transect distance, observed area within the 200 m transect width at 61 m AGL, and the density of all sea ducks for both the raw and visibility-corrected counts for fall, winter, and spring, respectively. Results from the South End survey are not included in the totals. Figures 1, 2, and 3 illustrate the distribution of sea ducks by month for the fall, winter, and spring seasons, respectively. In addition, all figures outline the aerial survey areas encompassed by the southeast Lake Michigan, Michigan and Indiana, key site.

References

- Fara, L. J. 2018. Migration patterns, habitat use, prey items, and hunter harvest of Long-tailed Ducks (*Clangula hyemalis*) that overwinter on Lake Michigan. MS thesis, Southern Illinois University Carbondale, Carbondale, Illinois.
- Hodges, J. I., D. J. Groves, and B. P. Conant. 2008. Distribution and abundance of waterbirds near shore in Southeast Alaska. *Northwestern Naturalist* 89:85–96.
- Kenow, K. P., Fox, T. J., Houdek, S. C., Fara, L. J., and Lubinski, B. 2021. Lake Michigan Sea Duck Survey Data, 2009-2014: U.S. Geological Survey data release, <https://doi.org/10.5066/P9FGR77R> .

¹ Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. government.

Table S1. Continued.

Oceana-Ottawa Counties, MI	24 Oct 2012	On	25	0	0	0	0	0	0	0	1	0	0	26
		Off	0	0	0	0	0	0	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	27 Nov 2012	On	1702	0	0	0	0	1	65	0	9	118	0	1895
		Off	1150	0	0	0	0	0	0	0	0	0	0	1150
Oceana-Ottawa Counties, MI	26 Sep 2013	On	0	0	0	0	0	0	0	0	0	0	0	0
		Off	0	0	0	0	0	0	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	30 Oct 2013	On	155	0	0	0	183	0	0	0	0	0	2	340
		Off	100	0	0	0	0	0	0	0	0	0	0	100
Oceana-Ottawa Counties, MI	20 Nov 2013	On	6818	0	0	0	5	2	0	0	73	0	0	6898
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	15 Nov 2011	On	10	0	0	0	0	5	97	0	47	0	0	159
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	25–26 Sep 2012	On	0	0	0	0	0	0	0	0	0	0	0	0
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	24 Oct 2012	On	3	0	0	0	0	0	0	0	0	0	0	3
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	28 Nov 2012	On	75	0	0	0	0	42	1545	0	183	0	0	1845
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	25 Sep 2013	On	0	0	0	0	0	0	0	0	0	0	0	0
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	30 Oct 1 Nov 2013	On	1	0	0	0	0	0	15	0	0	0	0	16
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	19 Nov 2013	On	68	4	0	0	0	22	213	0	954	30	0	1291
		Off	0	0	0	0	0	0	0	0	0	0	0	0
Total Southeast Lake Michigan key site		On	14,454	97	0	0	219	75	178	0	241	153	12	15,439
		Off	1250	0	0	0	0	0	0	0	0	0	0	1250

¹ LTDU = Long tailed Duck (*Clangula hyemalis*), WWSC = White-winged Scoter (*Melanitta deglandi*), BLSC = Black Scoter (*Melanitta americana*), SUSC = Surf Scoter (*Melanitta perspicillata*), SCOT = unidentified scoter species, COME = Common Merganser (*Mergus merganser*), RBME = Red-breasted Merganser (*Mergus serrator*), HOME = Hooded Merganser (*Lophodytes cucullatus*), MERG = unidentified merganser species, COGO = Common Goldeneye (*Bucephala clangula*), and BUFF = Bufflehead (*Bucephala albeola*).

Table S1. Continued.

² The South End survey area is only partially within the southeast Lake Michigan key site; as such, the south end survey area counts are not included in the total counts for the southeast Lake Michigan key site.

Table S2. Estimated counts of sea ducks, by species or species groups,¹ observed on and off transect during aerial surveys conducted over Lake Michigan during fall (September–November) using a visibility correction factor (Hodges et al. 2008). Correction factor multipliers are shown in parentheses under each species or species group. Survey areas listed are only those encompassed by the southeast Lake Michigan key site.²

Survey area	Survey date	On/Off transect	LTDU (3.46)	SCOTERS (1.74)	MERGANERS (1.45)	COGO (1.60)	BUFF (3.26)	Total sea ducks
Allegan-Berrien Counties, MI	26 Sep 2012	On	0	0	0	0	0	0
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	24 Oct 2012	On	87	108	0	0	0	194
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	27 Nov 2012	On	0	57	15	6	33	111
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	25–26 Nov 2013	On	0	0	0	0	0	0
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	30 Oct 2013	On	52	44	62	0	0	158
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	19 Nov 2013	On	66	0	226	26	0	318
		Off	0	0	0	0	0	0
Ludington Bay	15 Nov 2010	On	3	5	3	0	0	12
		Off	0	0	0	0	0	0
Ludington Bay	27 Sep 2012	On	3	0	0	0	0	3
		Off	0	0	0	0	0	0
Ludington Bay	27 Nov 2012	On	4481	7	67	24	0	4578
		Off	0	0	0	0	0	0
Ludington Bay	26 Sep 2013	On	10	0	0	0	0	10
		Off	0	0	0	0	0	0
Ludington Bay	29–30 Oct 2013	On	1142	2	78	0	0	1222
		Off	0	0	0	0	0	0
Ludington Bay	20 Nov 2013	On	14,065	0	61	0	0	14,126
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	26 Sep 2012	On	0	0	0	0	0	0
		Off	0	0	0	0	0	0

Table S2. Continued.

Oceana-Ottawa Counties, MI	24 Oct 2012	On	87	0	1	0	0	88
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	27 Nov 2012	On	5889	0	109	189	0	6186
		Off	3979	0	0	0	0	3979
Oceana-Ottawa Counties, MI	26 Sep 2013	On	0	0	0	0	0	0
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	30 Oct 2013	On	536	318	0	0	7	861
		Off	346	0	0	0	0	346
Oceana-Ottawa Counties, MI	20 Nov 2013	On	23,590	9	109	0	0	23,708
		Off	0	0	0	0	0	0
South End ²	15 Nov 2011	On	35	0	216	0	0	251
		Off	0	0	0	0	0	0
South End ²	25–26 Sep 2012	On	0	0	0	0	0	0
		Off	0	0	0	0	0	0
South End ²	24 Oct 2012	On	10	0	0	0	0	10
		Off	0	0	0	0	0	0
South End ²	28 Nov 2012	On	260	0	2567	0	0	2826
		Off	0	0	0	0	0	0
South End ²	25 Sep 2013	On	0	0	0	0	0	0
		Off	0	0	0	0	0	0
South End ²	30 Oct– 1 Nov 2013	On	3	0	22	0	0	25
		Off	0	0	0	0	0	0
South End ²	19 Nov 2013	On	235	7	1724	48	0	5126
		Off	0	0	0	0	0	0
Total Southeast Lake MI key site		On	50,011	550	219	189	7	30,843
		Off	4325	0	0	0	0	4325

¹ LTDU = Long-tailed Duck (*Clangula hyemalis*), SCOTERS = Scoter species, MERGANSER = Merganser species, COGO = Common Goldeneye (*Bucephala clangula*), and BUFF = Bufflehead (*Bucephala albeola*).

² The South End survey area is only partially within the southeast Lake Michigan key site; as such, the south end survey area counts are not included in the total counts for the southeast Lake Michigan key site.

Table S3. Fall (September–November) density estimates for all sea ducks combined using both raw counts and visibility corrected (Hodges et al. 2008) count estimates for observations on transect. Survey areas listed are only those encompassed by the southeast Lake Michigan key site.¹

Survey area	Survey date	Transect distance (km)	Transect area (km ²) at 61 m AGL	Raw count density (sea ducks/km ²)	Corrected count density (sea ducks/km ²)
Allegan-Berrien Counties, MI	26 Sep 2012	388.8	128.1	0	0
Allegan-Berrien Counties, MI	24 Oct 2012	391.6	129.1	0.7	1.5
Allegan-Berrien Counties, MI	27 Nov 2012	385.5	127.2	0.4	0.9
Allegan-Berrien Counties, MI	25–26 Sep 2013	376.4	124.1	0	0
Allegan-Berrien Counties, MI	30 Oct 2013	377.5	124.4	0.7	1.3
Allegan-Berrien Counties, MI	19 Nov 2013	378.1	124.6	1.5	2.5
Ludington Bay	15 Nov 2010	555.2	183.0	<0.1	0.1
Ludington Bay	27 Sep 2012	210.6	69.4	0	0
Ludington Bay	27 Nov 2012	154.9	51.1	26.6	89.7
Ludington Bay	26 Sep 2013	147.2	48.5	0.1	0.2
Ludington Bay	29–30 Oct 2013	146.8	48.4	8.0	25.3
Ludington Bay	20 Nov 2013	148.1	48.8	84.1	284.9
Oceana-Ottawa Counties, MI	26 Sep 2012	456.7	150.5	0	0
Oceana-Ottawa Counties, MI	24 Oct 2012	352.5	116.2	0.2	0.8
Oceana-Ottawa Counties, MI	27 Nov 2012	456.2	150.4	12.6	41.1
Oceana-Ottawa Counties, MI	26 Sep 2013	347.0	114.4	0	0
Oceana-Ottawa Counties, MI	30 Oct 2013	342.3	112.8	3.0	7.6
Oceana-Ottawa Counties, MI	20 Nov 2013	345.9	114.0	60.5	207.9
South End ¹	15 Nov 2011	335.3	110.5	1.4	2.3
South End ¹	25–26 Sep 2012	572.6	188.7	0	0
South End ¹	24 Oct 2012	322.4	106.3	<0.1	0.1
South End ¹	28 Nov 2012	581.4	191.6	9.6	14.7
South End ¹	25 Sep 2013	583.9	192.5	0	0
South End ¹	30 Oct–1–Nov 2013	578.2	190.6	0.1	0.1
South End ¹	19 Nov 2013	583.0	192.2	6.7	10.5
Total Southeast Lake Michigan key site		3556.8	1172.4	2.8	4.4

¹ The South End survey area is only partially within the southeast Lake Michigan key site; as such, the total fall density estimate for the southeast Lake Michigan key site does not include data from the south end survey area.

Table S4. Continued.

Oceana-Ottawa Counties, MI	20 Jan 2012	On	9468	0	0	0	0	692	0	0	50	112	0	10,322
		Off	700	0	0	0	0	0	0	0	0	80	0	0
Oceana-Ottawa Counties, MI	4–6 Feb 2013	On	2703	7	0	0	0	64	1	0	0	13	0	2788
		Off	0	0	0	0	0	0	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	25 Feb 2013	On	3651	5	0	0	0	41	2	0	341	169	0	4209
		Off	0	0	0	0	0	0	0	0	100	100	0	200
Oceana-Ottawa Counties, MI	19 Dec 2013	On	12,637	0	0	0	0	22	0	0	3	624	0	13,286
		Off	8650	0	0	0	0	0	0	0	0	2700	0	11,350
Oceana-Ottawa Counties, MI	9 Jan 2014	On	5377	0	0	0	2	2	0	0	149	60	0	5590
		Off	2850	0	0	0	0	0	0	0	0	0	0	2850
Oceana-Ottawa Counties, MI	3 Feb 2014	On	10	60	0	0	0	0	0	0	0	0	0	70
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	9 Dec 2010	On	93	110	1	0	0	1057	0	0	0	0	3	1264
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	7 Dec 2011	On	6	0	0	0	0	4	0	0	320	41	0	371
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	15 Feb 2012	On	263	38	0	0	0	40	302	0	99	15	0	757
		Off	150	0	0	0	0	0	0	0	0	0	0	150
South End ²	24 Feb 2013	On	1180	27	0	0	0	132	286	0	502	36	0	2163
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	12–13 Dec 2013	On	115	0	0	0	0	413	231	0	119	213	1	1092
		Off	0	0	0	0	0	0	0	0	0	0	0	0
South End ²	8 Jan 2014	On	539	25	0	0	20	279	0	0	72	35	0	970
		Off	300	0	0	0	5	0	0	0	300	0	0	605
South End ²	2 Feb 2014	On	4725	36	0	0	47	14	672	0	8	177	0	5679
		Off	0	0	0	0	0	0	0	0	0	0	0	0
Total Southeast Lake Michigan key site		On	51,674	476	0	0	861	4006	387	0	1078	7379	32	65,893
		Off	17,162	6	0	0	200	179	0	0	193	2800	0	20,630

¹ LTDU = Long-tailed Duck (*Clangula hyemalis*), WWSC = White-winged Scoter (*Melanitta deglandi*), BLSC = Black Scoter (*Melanitta americana*), SUSC = Surf Scoter (*Melanitta perspicillata*), SCOT = unidentified scoter species, COME = Common Merganser (*Mergus merganser*), RBME = Red-breasted

Table S4. Continued.

Merganser (*Mergus serrator*), HOME = Hooded Merganser (*Lophodytes cucullatus*), MERG = unidentified merganser species, COGO = Common Goldeneye (*Bucephala clangula*), and BUFF = Bufflehead (*Bucephala albeola*).

² The South End survey area is only partially within the southeast Lake Michigan key site; as such, the south end survey area counts are not included in the total counts for the southeast Lake Michigan key site.

Table S5. Estimated counts of sea ducks, by species or species groups.¹ observed on and off transect during aerial surveys conducted over Lake Michigan during winter (December–February) using a visibility correction factor (Hodges et al. 2008). Correction factor multipliers are shown in parentheses under each species or species group. Survey areas listed are only those encompassed by the southeast Lake Michigan key site.²

Survey area	Survey date	On/Off transect	LTDU (3.46)	SCOTERS (1.74)	MERGANSERS (1.45)	COGO (1.60)	BUFF (3.26)	Total sea ducks
Allegan-Berrien Counties, MI	8 Dec 2011	On	0	139	100	261	3	503
		Off	0	0	278	0	0	278
Allegan-Berrien Counties, MI	13 Feb 2012	On	332	44	252	315	49	992
		Off	7	0	0	0	0	7
Allegan-Berrien Counties, MI	6 Feb 2013	On	5879	26	2190	27	0	8121
		Off	3979	10	0	0	0	3989
Allegan-Berrien Counties, MI	24–25 Feb 2013	On	10,325	64	1,60	186	0	11,635
		Off	4498	0	0	0	0	4498
Allegan-Berrien Counties, MI	13 Dec 2013	On	284	205	1295	3936	52	5772
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	9 Jan 2014	On	9297	0	3	115	0	9415
		Off	2422	0	0	0	0	2422
Allegan-Berrien Counties, MI	3 Feb 2014	On	90	261	0	0	0	351
		Off	346	348	0	0	0	694
Ludington Bay	8 Dec 2010	On	4242	3	67	0	0	4312
		Off	2422	0	0	0	0	2422
Ludington Bay	21 Jan 2012	On	2657	108	342	5008	0	8115
		Off	0	0	0	0	0	0
Ludington Bay	4 Feb 2013	On	9861	129	608	85	0	10,682
		Off	3806	0	0	0	0	3806
Ludington Bay	25 Feb 2013	On	6031	200	9	34	0	6273
		Off	0	0	0	0	0	0
Ludington Bay	18 Dec 2013	On	9096	57	26	275	0	9455
		Off	0	0	0	0	0	0

Table S5. Continued.

Ludington Bay	3 Feb 2014	On	3591	960	0	0	0	4552
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	20 Jan 2012	On	32,759	0	1076	179	0	34,014
		Off	2422	0	116	0	0	2538
Oceana-Ottawa Counties, MI	4–6 Feb 2013	On	9352	12	94	21	0	9480
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	25 Feb 2013	On	12,632	9	557	270	0	13,468
		Off	0	0	145	160	0	305
Oceana-Ottawa Counties, MI	19 Dec 2013	On	43,724	0	36	998	0	44,759
		Off	29,929	0	0	4320	0	34,249
Oceana-Ottawa Counties, MI	9 Jan 2014	On	18,604	3	219	96	0	18,923
		Off	9861	0	0	0	0	9861
Oceana-Ottawa Counties, MI	3 Feb 2014	On	35	104	0	0	0	139
		Off	0	0	0	0	0	0
South End ²	9 Dec 2010	On	322	193	1533	0	10	2057
		Off	0	0	0	0	0	0
South End ²	7 Dec 2011	On	21	0	470	66	0	556
		Off	0	0	0	0	0	0
South End ²	15 Feb 2012	On	910	66	639	24	0	1640
		Off	519	0	0	0	0	519
South End ²	24 Feb 2013	On	4083	47	1334	58	0	5521
		Off	0	0	0	0	0	0
South End ²	12–13 Dec 2013	On	398	0	1106	341	3	1848
		Off	0	0	0	0	0	0
South End ²	8 Jan 2014	On	1865	78	509	56	0	2508
		Off	1038	9	435	0	0	1482
South End ²	2 Feb 2014	On	16,349	144	1006	283	0	17,782
		Off	0	0	0	0	0	0

Table S5. Continued.

Total Southeast Lake Michigan key site	On	178,791	2324	7934	11,806	104	200,961
	Off	59,692	358	539	4480	0	65,069

¹ LTDU = Long-tailed Duck, SCOTERS = Scoter species, MERGANSER = Merganser species, COGO = Common Goldeneye (*Bucephala clangula*), and BUFF = Bufflehead (*Bucephala albeola*).

² The South End survey area is only partially within the southeast Lake Michigan key site; as such, the south end survey area counts are not included in the total counts for the southeast Lake Michigan key site.

Table S6. Winter (December–February) density estimates for all sea ducks combined using both raw counts and visibility corrected (Hodges et al. 2008) count estimates for observations on transect. Survey areas listed are only those encompassed by the southeast Lake Michigan key site.¹

Survey area	Survey date	Transect distance (km)	Transect area (km ²) at 61 m AGL	Raw count density (sea ducks/km ²)	Corrected count density (sea ducks/km ²)
Allegan-Berrien Counties, MI	8 Dec 2011	292.9	96.5	3.2	5.2
Allegan-Berrien Counties, MI	13 Feb 2012	484.0	159.5	3.2	6.2
Allegan-Berrien Counties, MI	6 Feb 2013	360.4	118.8	27.3	68.4
Allegan-Berrien Counties, MI	24–25 Feb 2013	387.3	127.7	30.3	91.1
Allegan-Berrien Counties, MI	13 Dec 2013	378.2	124.7	28.6	46.3
Allegan-Berrien Counties, MI	9 Jan 2014	364.7	120.2	23.0	78.3
Allegan-Berrien Counties, MI	3 Feb 2014	92.9	30.6	5.7	11.5
Ludington Bay	8 Dec 2010	547.5	180.5	7.1	23.9
Ludington Bay	21 Jan 2012	208.8	68.8	61.0	117.9
Ludington Bay	4 Feb 2013	205.6	67.8	50.1	157.6
Ludington Bay	25 Feb 2013	203.2	67.0	28.1	93.7
Ludington Bay	18 Dec 2013	148.2	48.8	58.4	193.6
Ludington Bay	3 Feb 2014	24.4	8.0	198.8	566.0
Oceana-Ottawa Counties, MI	20 Jan 2012	465.6	153.5	67.3	221.6
Oceana-Ottawa Counties, MI	4–6 Feb 2013	355.9	117.3	23.8	80.8
Oceana-Ottawa Counties, MI	25 Feb 2013	357.0	117.7	35.8	114.5
Oceana-Ottawa Counties, MI	19 Dec 2013	340.9	112.4	118.2	398.3
Oceana-Ottawa Counties, MI	9 Jan 2014	340.0	112.1	49.9	168.9
Oceana-Ottawa Counties, MI	3 Feb 2014	129.1	42.6	1.6	3.3
South End ¹	9 Dec 2010	851.6	280.7	4.5	7.3
South End ¹	7 Dec 2011	319.0	105.1	3.5	5.3
South End ¹	15 Feb 2012	588.4	193.9	3.9	8.5
South End ¹	24 Feb 2013	509.8	168.0	12.9	32.9
South End ¹	12–13 Dec 2013	583.6	192.4	5.7	9.6
South End ¹	8 Jan 2014	257.3	84.8	11.4	29.6
South End ¹	2 Feb 2014	367.2	121.0	46.9	146.9
Total Southeast Lake Michigan key site		5686.6	1874.5	35.2	107.2

¹ The South End survey area is only partially within the southeast Lake Michigan key site; as such, the total fall density estimate for the southeast Lake Michigan key site does not include data from the south end survey area.

Table S7. Continued.

Total Southeast Lake Michigan key site	On	13,524	266	0	0	238	1029	394	0	129	306	0	15,866
	Off	1824	0	0	0	0	0	2	0	4	0	0	1830

¹ LTDU = Long-tailed Duck (*Clangula hyemalis*), WWSC = White-winged Scoter (*Melanitta deglandi*), BLSC = Black Scoter (*Melanitta americana*), SUSC = Surf Scoter (*Melanitta perspicillata*), SCOT = unidentified scoter species, COME = Common Merganser (*Mergus merganser*), RBME = Red-breasted Merganser (*Mergus serrator*), HOME = Hooded Merganser (*Lophodytes cucullatus*), MERG = unidentified merganser species, COGO = Common Goldeneye (*Bucephala clangula*), and BUFF = Bufflehead (*Bucephala albeola*).

² The South End survey area is only partially within the southeast Lake Michigan key site; as such, the south end survey area counts are not included in the total counts for the southeast Lake Michigan key site.

Table S8. Estimated counts of sea ducks, by species or species groups,¹ observed on and off transect during aerial surveys conducted over Lake Michigan during spring (March–May) using a visibility correction factor (Hodges et al. 2008). Correction factor multipliers are shown in parentheses under each species or species group. Survey areas listed are only those encompassed by the southeast Lake Michigan key site.²

Survey area	Survey date	On/Off transect	LTDU (3.46)	SCOTERS (1.74)	MERGANERS (1.45)	COGO (1.60)	BUFF (3.26)	Total sea ducks
Allegan-Berrien Counties, MI	14 Mar 2012	On	685	0	19	149	0	853
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	4 Apr 2012	On	125	0	67	38	0	230
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	21–22 Mar 2013	On	2650	456	1148	176	0	4431
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	3–4 Apr 2013	On	16,788	113	187	32	0	17,120
		Off	3391	0	9	0	0	3400
Allegan-Berrien Counties, MI	25 Apr 2013	On	1955	0	120	22	0	2098
		Off	0	0	0	0	0	0
Allegan-Berrien Counties, MI	6 May 2014	On	495	0	77	3	0	575
		Off	0	0	0	0	0	0
Ludington Bay	17 Mar 2010	On	4467	78	78	19	0	4643
		Off	0	0	0	0	0	0
Ludington Bay	15 Mar 2011	On	2232	172	30	5	0	2439
		Off	104	0	0	0	0	104
Ludington Bay	4 Apr 2012	On	215	0	35	0	0	249
		Off	0	0	0	0	0	0
Ludington Bay	22 Mar 2013	On	910	3	212	6	0	1132
		Off	0	0	0	0	0	0
Ludington Bay	4 Apr 2013	On	457	0	6	0	0	463
		Off	0	0	0	0	0	0
Ludington Bay	26 Apr 2013	On	35	2	41	0	0	77
		Off	0	0	0	0	0	0
Ludington Bay	6 May 2014	On	204	0	20	0	0	224
		Off	0	0	0	0	0	0

Table S8. Continued.

Oceana-Ottawa Counties, MI	14 Mar 2012	On	2955	0	9	0	0	2964
		Off	394	0	0	0	0	394
Oceana-Ottawa Counties, MI	4 Apr 2012	On	363	0	30	8	0	402
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	21–22 Mar 2013	On	9276	52	62	2	0	9392
		Off	2422	0	0	0	0	2422
Oceana-Ottawa Counties, MI	4 Apr 2013	On	2038	0	41	29	0	2107
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	25 Apr 2013	On	543	0	68	0	0	611
		Off	0	0	0	0	0	0
Oceana-Ottawa Counties, MI	6 May 2014	On	401	0	0	0	0	401
		Off	0	0	0	0	0	0
South End ²	15 Mar 2011	On	1298	28	740	162	0	2226
		Off	0	0	480	0	0	480
South End ²	6–7 Apr 2011	On	7173	7	703	2	0	7884
		Off	0	0	0	0	0	0
South End ²	13 Mar 2012	On	879	0	738	141	0	1758
		Off	0	0	0	0	0	0
South End ²	3–4 Apr 2012	On	1654	0	339	30	0	2024
		Off	0	0	0	0	0	0
South End ²	21 Mar 2013	On	2574	0	571	35	3	3184
		Off	0	0	0	0	0	0
South End ²	3 Apr 2013	On	6996	50	407	43	0	7497
		Off	2076	0	0	0	0	2076
South End ²	24 Apr 2013	On	713	0	442	37	0	1192
		Off	0	0	0	0	0	0
South End ²	24 Mar 2014	On	14,383	78	1388	59	0	15,908
		Off	15,743	0	0	0	0	15,743
South End ²	5–6 May 2014	On	142	0	239	61	10	452
		Off	0	0	0	0	0	0

Table S8. Continued.

Total Southeast Lake Michigan key site	On	46,794	876	2250	489	0	50,411
	Off	6311	0	9	0	0	6320

¹ LTDU = Long-tailed Duck (*Clangula hyemalis*), SCOTERS = Scoter species, MERGANSER = Merganser species, COGO = Common Goldeneye (*Bucephala clangula*), and BUFF = Bufflehead (*Bucephala albeola*).

² The South End survey area is only partially within the southeast Lake Michigan key site; as such, the south end survey area counts are not included in the total counts for the southeast Lake Michigan key site.

Table S9. Spring (March–May) density estimates for all sea ducks combined using both raw counts and visibility corrected (Hodges et al. 2008) count estimates for observations on transect. Survey areas listed are only those encompassed by the southeast Lake Michigan key site.¹

Survey area	Survey date	Transect distance (km)	Transect area (km ²) at 61 m AGL	Raw count density (sea ducks/km ²)	Corrected count density (sea ducks/km ²)
Allegan-Berrien Counties, MI	14 Mar 2012	385.9	127.2	2.4	6.7
Allegan-Berrien Counties, MI	4 Apr 2012	388.6	128.1	0.8	1.8
Allegan-Berrien Counties, MI	21–22 Mar 2013	389.3	128.3	15	34.5
Allegan-Berrien Counties, MI	3–4 Apr 2013	382.0	125.9	40.2	136.0
Allegan-Berrien Counties, MI	25 Apr 2013	387.5	127.7	5.2	16.4
Allegan-Berrien Counties, MI	6 May 2014	288.3	95.0	2.1	6.0
Ludington Bay	17 Mar 2010	260.0	85.7	16.4	54.2
Ludington Bay	15 Mar 2011	255.1	84.1	9.1	29.0
Ludington Bay	4 Apr 2012	203.6	67.1	1.3	3.7
Ludington Bay	22 Mar 2013	158.3	52.2	8.0	21.7
Ludington Bay	4 Apr 2013	206.8	68.2	2.0	6.8
Ludington Bay	26 Apr 2013	157.1	51.8	0.8	1.5
Ludington Bay	6 May 2014	149.5	49.3	1.5	4.6
Oceana-Ottawa Counties, MI	14 Mar 2012	462.8	152.5	5.6	19.4
Oceana-Ottawa Counties, MI	4 Apr 2012	462.2	152.3	0.9	2.6
Oceana-Ottawa Counties, MI	21–22 Mar 2013	353.8	116.6	23.6	80.5
Oceana-Ottawa Counties, MI	4 Apr 2013	354.9	117.0	5.4	18.0
Oceana-Ottawa Counties, MI	25 Apr 2013	354.8	116.9	1.7	5.2
Oceana-Ottawa Counties, MI	6 May 2014	241.1	79.5	1.5	5.1
South End ¹	15 Mar 2011	508.0	167.4	6.0	13.3
South End ¹	6–7 Apr 2011	623.0	205.3	12.5	38.4
South End ¹	13 Mar 2012	586.2	193.2	4.4	9.1
South End ¹	3–4 Apr 2012	579.6	191.0	3.8	10.6
South End ¹	21 Mar 2013	584.9	192.8	6.0	16.5
South End ¹	3 Apr 2013	584.8	192.8	12.2	38.9
South End ¹	24 Apr 2013	583.9	192.5	2.8	6.2
South End ¹	24 Mar 2014	584.9	192.8	27.0	82.5
South End ¹	5–6 May 2014	584.5	192.7	1.3	2.3
Total Southeast Lake Michigan key site		5841.6	1925.4	8.3	26.2

¹ The South End survey area is only partially within the southeast Lake Michigan key site; as such, the total fall density estimate for the southeast Lake Michigan key site does not include data from the south end survey area.

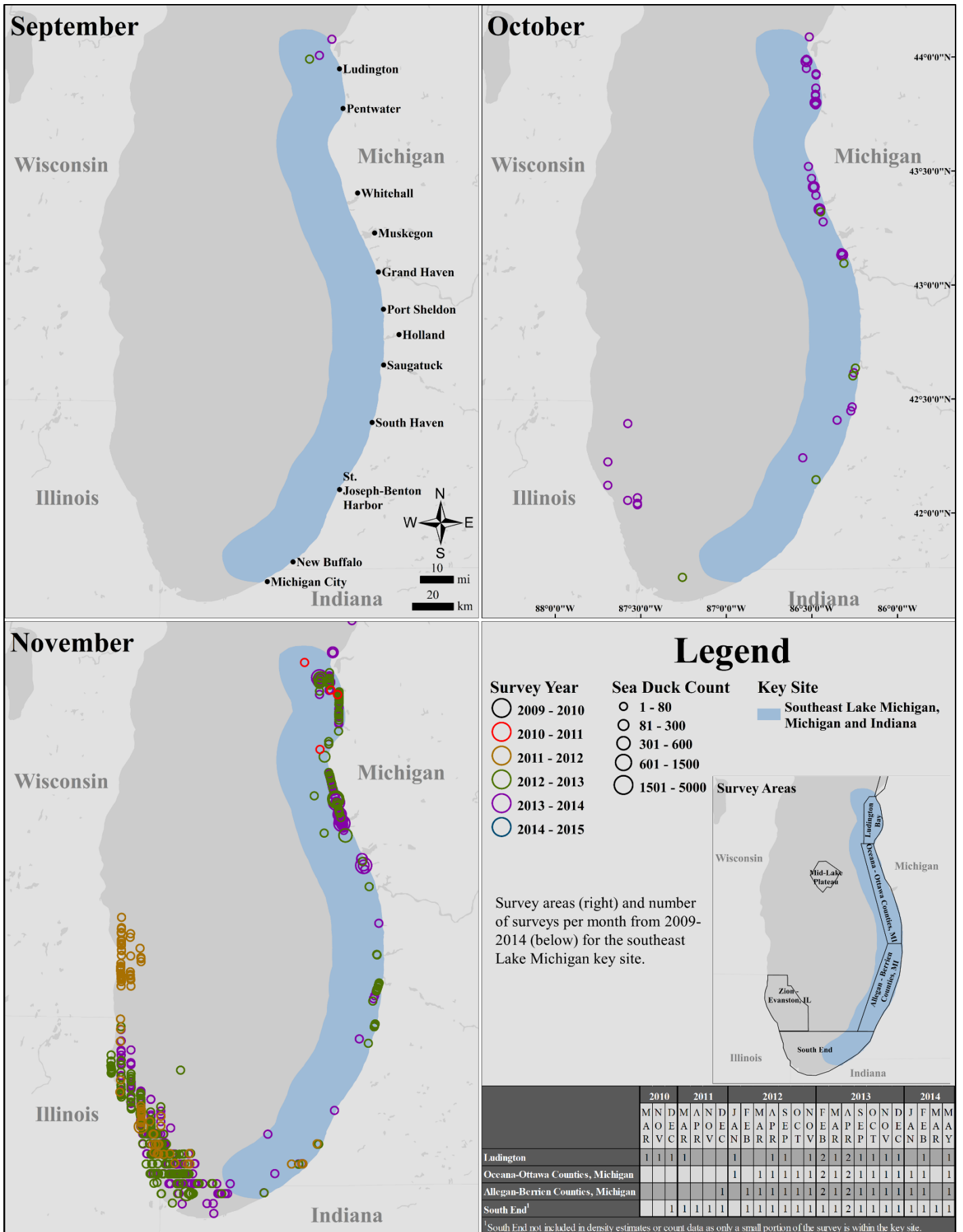


Figure S1. Maps depict sea duck counts from aerial surveys conducted over Lake Michigan from 2009–2014 during fall (September–November) for the Southeast Lake Michigan, Michigan and Indiana key site, by month.

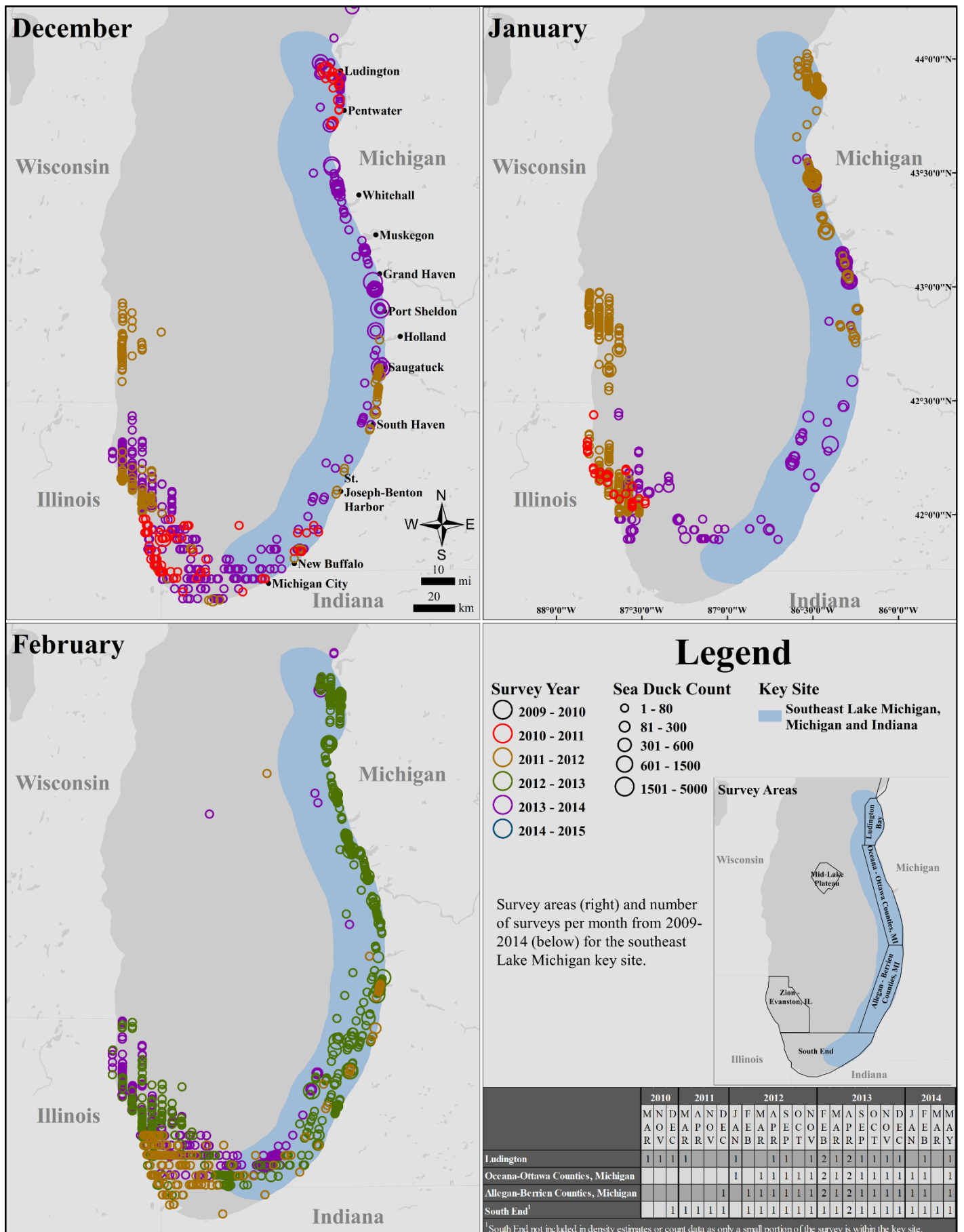


Figure S2. Maps depict sea duck counts from aerial surveys conducted over Lake Michigan from 2009–2014 during winter (December–February) for the Southeast Lake Michigan, Michigan and Indiana key site, by month.

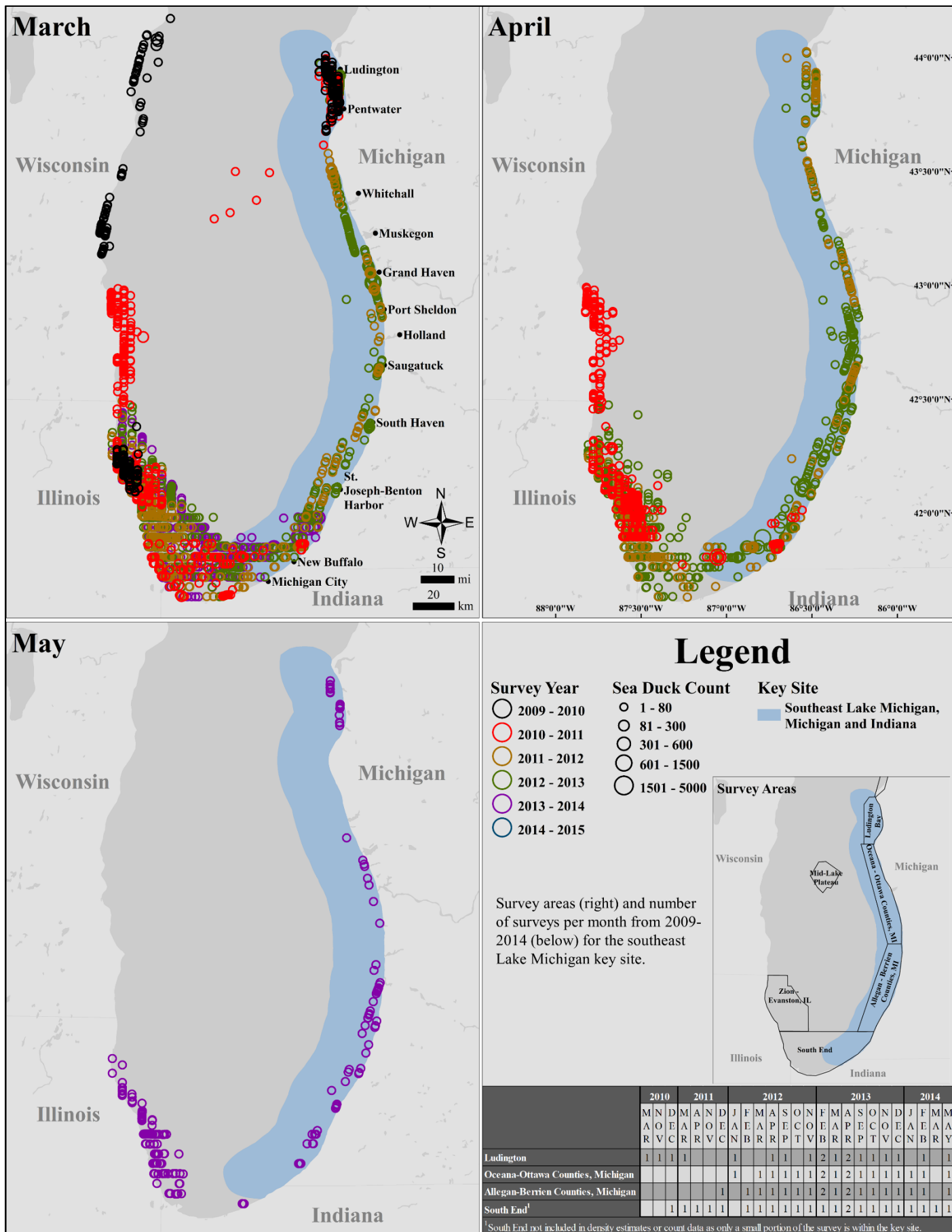


Figure S3. Maps depict sea duck counts from aerial surveys conducted over Lake Michigan from 2009–2014 during spring (March–May) for the Southeast Lake Michigan, Michigan and Indiana key site, by month.