Sea Duck Joint Venture – Project # 144
Annual Project Summary
FY 2018 – (October 1, 2017 to Sept 30, 2018)

Project Title: Migration patterns, habitat use, and harvest characteristics of long-tailed ducks wintering on Lake Michigan.

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Partners: USFWS, SDJV; Long Point Waterfowl; Environment Canada; Wisconsin Waterfowl Association; Delta Waterfowl; Wisconsin Waterfowl Hunters' Conference; Bill Cook Chapter and Wisconsin State Division of the IWLA; Illinois Federation for Outdoor Resources.

Project Description:
This project is expected to address information needs concerning population delineation, migration, and ecology of long-tailed ducks (LTDU) wintering in the Great Lakes. Long-tailed ducks marked on the Atlantic Coast and eastern Great Lakes regions have shown very little use of western Great Lakes, however there is a sizable LTDU population that winters on Lake Michigan. We proposed to capture and radio-mark 20 adult female LTDUs during November 2015 through April 2018, in anticipation of obtaining data from ≥12 adult females for one entire year. Over-water mist netting and night-lighting techniques were employed to obtain the sample of birds for this project.

Objective:
The goal of the project is to determine temporal and spatial patterns of migration, breeding ground affiliations, and fidelity to wintering areas of long-tailed ducks wintering on Lake Michigan. Specific objectives are to:

1. Radio-mark an adequate number (estimated at 20) of adult female LTDUs wintering on Lake Michigan with Platform Transmitter Terminals (PTTs) to ensure that an effective sample of ≥12 survive and provide location data for at least one full year. Deploy additional transmitters, if necessary, to obtain a minimum of 12 PTTs that collect data for a minimum of one year.
2. Characterize movements and habitat use of radio-marked LTDUs.
3. Additional components of the study include evaluations of food habits and harvest characteristics of LTDUs wintering on Lake Michigan.

Preliminary Results (FY 2018):
Capture
In FY 2018, we conducted capture during 25 Oct-08 Nov 2017 (9 night-lighting attempts), and 14-18 March 2018 (3 night-lighting attempts). Twenty-nine LTDUs were captured during these

efforts, consisting of 15 after second year (ASY) males, one hatch year (HY) male, five ASY females, six second year (SY) females, and two HY females. Several opportunities to capture HY and male LTDUs were passed on, as they were not the target sex or age class and/or ASY females were being targeted in the flock but not captured. Of the captured birds, four ASY females, five SY females, and six ASY males were implanted with satellite transmitters.

Capture success during FY 2018 (average capture rate of 2.42 LTDUs per night over 12 nights) was the highest we have experienced and well above capture rates during our FY 2016 and FY 2017 efforts (average capture rate of 0.36 LTDUs per night over 19 nights and average capture rate of 1.61 LTDUs per night over 28 capture nights, respectively), but only slightly higher than our previous high, which was observed during our spring 2015 pilot work (average capture rate of 2.00 LTDUs per night over 7 capture nights). Increased knowledge about LTDU habitat use and diel movements, gathered from aerial infrared thermal flights conducted during fall 2016 and males (n=5) radio-marked during fall 2016, allowed us to increase our capture efficiency in FY 2018. Males radio-marked during fall 2016 (n=5) were referred to as "Judas" males, as implanted transmitters were programmed to transmit at noon and midnight, providing insight into diel habitat use and movements that led to additional LTDU concentrations and captures.

Migration and movements of LTDUs radio marked on Lake Michigan

Satellite transmitters were implanted into 25 LTDUs that were captured on Lake Michigan during March, April, October, November 2016 (n=9), March, October, November 2017 (n=12), and March 2018 (n=4; Table 1). Of the 25 deployed transmitters, 20 were programmed to provide migration information (duty cycle=3 hrs on:72 hrs off), while the other five were programmed as "Judas" birds (duty cycle=2 hrs on:10 hrs off). As of 29 October 2018, two transmitters deployed in FY 2018 were transmitting regularly after surviving for >60 days post transmitter implantation (PTT IDs 164905 and 164916). Of the other 23 deployed transmitters (13 of which were deployed in FY 2018), 10 were associated with known LTDU mortalities that occurred within 15 days of transmitter implantation (PTT IDs 158806-1, 146129, 163780-1, 163770-1, 164903-1, 164911, 163770, 163780, 164908, and 164903), transmissions ceased within 60 days of transmitter implantation of two transmitters (PTT IDs 146127 and 158807), and 11 provided location information for >60 days after implantation (PTT IDs 146126, 146128, 146131, 146132, 158804, 158806, 163773, 158810, 158809, 163778, and 164342).

Of the 13 radio-marked LTDUs that survived for >60 days past transmitter implantation (Table 2), three were "Judas" males (PTT IDs 146128, 146131, and 146132) that provided little or no migration data before battery life was depleted (Figure 1), while the other 10 radio-marked individuals (PTT IDs 146126, 158804, 158806, 163773, 158810, 158809, 163778, 164342, 164905, and 164916) should have provided data on migratory patterns and movements. But, due to either undetected mortality (i.e., no mortality signal) or transmitter malfunction, only three radio-marked LTDUs have provided data describing an annual migration (PTT ID 146126, 164905, and 164916; Figure 2). Of the remaining seven, three have provided spring migration data to presumed breeding grounds (PTT IDs 158804, 158806, and 158809; Figure 3) and four have provided only data regarding Lake Michigan habitat use with limited spring migration data (PTT IDs 163773, 158810, 163778, and 164342; Figure 4).

Data from radio-marked LTDUs, particularly "Judas" males, have provided insight into the daily movements and seasonal patterns of LTDUs on Lake Michigan. Long-tailed ducks appear to move farther offshore to deeper waters at night (Table 3; Figure 5). Nighttime capture locations support this notion (Figure 6). Additionally, LTDUs tended to move from the northern end to the southern end of Lake Michigan as winter progressed, and then back to the northern end and Green Bay in spring before departing for the breeding grounds. This pattern is consistent with findings from aerial surveys conducted on Lake Michigan.

Food Habits

Two methods, ocular (traditional) and molecular examination of alimentary canal contents, were used to determine the diets of LTDUs on Lake Michigan. A total of 16 LTDU carcasses were donated by hunters for diet determination. An esophageal, small intestine, and cloacal swab were collected from each carcass for molecular determination of prey species through qPCR analysis. The esophagus of each carcass was then removed, and prey items determined to lowest taxonomic level using a dissection microscope (10X ocular). Molecular methods detected more prey species (4) than ocular methods (1) and show promise as a non-lethal means to determine LTDU diets. Quagga mussel (*Dreissena rostriformis bugensis*) was the primary prey item with 100% occurrence among LTDUs examined. *Diporeia* spp., yellow perch (*Perca flavescens*), and alewife (*Alosa pseudoharengus*) were also detected, suggesting that LTDUs are opportunistic feeders.

Hunter Harvest

A systematic, in person, hunter survey was conducted at Seagull Marina, in Two Rivers, WI from 01 November to 04 December 2016. The survey was conducted from 0800 to 1400 hrs CST during 21 days of the 60-day hunting season. Hunters were present on 15 (71%) survey days, and a 100% response rate was received on the 119 attempted surveys. Twelve groups were not surveyed due to high traffic or not falling within the survey time frame. A total of 361 hunters included in the survey harvested 1,422 waterfowl. Of that total, 1,383 (97%) were LTDUs and 31 (2%) were scoter species (24 white-winged scoters and seven black scoters). Hunters reported that 173 total ducks were not recovered, accounting for a wounding loss [ducks wounded and unable to retrieve / (ducks wounded and unable to retrieve + ducks killed and retrieved)] of 10.8%. Sex composition of harvested LTDUs was 848 (61%) males and 535 (39%) females. However, hunters admitted difficulty in identifying differences among juvenile males, juvenile females, and adult females; and grouped them together in the female category, inflating the number of harvested females. We found that hunters spent approximately four hours per day hunting and averaged 3.83 LTDUs per hunter per day, which was much higher than the reported harvest rate (0.95 ducks/hunter/day [interpolated as Total Duck Hunter Days Afield/Total Duck Harvest]) for all ducks combined throughout the state of Wisconsin during 2016, as estimated through the U.S. Fish and Wildlife Service Harvest Information Program.

Project Status:

Information collected from radio marked individuals, with transmitters lasting for ≥60 days, has provided information on the movements and habitat use of LTDUs on Lake Michigan and information regarding breeding ground affiliations, as well as migration timing and corridors. Capture and implantation of satellite transmitters for this project is now complete, but two transmitters were still sending signals on a regular basis when this report was finalized.

Migration and movement data from LTDUs radio-marked prior to the fall 2017 capture effort, along with the diet comparison work and hunter harvest survey from fall 2016, were included in Luke Fara's thesis titled '**Migration patterns, habitat use, prey items, and hunter harvest of long-tailed ducks (*Clangula hyemalis*) that overwinter on Lake Michigan**'. Luke successful defended his thesis on 14 May 2018 and his thesis is available online through Southern Illinois University -Carbondale (**https://opensiuc.lib.siu.edu/cgi/viewcontent.cgi? article=3428&context=theses**).

Project Funding Sources (US$).

USGS	Other U.S. federal contributions	SIU	Grants or Scholarships – Received From	In kind field assistance (volunteer #'s and total hours)
$2,400	12 PTTs	$15,000		24 Volunteers totaling 180 hours

Table 1. Radio-transmitter identification (PTT-ID), sex, age, capture location, capture date, duty cycle, transmission duration, and outcome of 25 long-tailed ducks radio-marked from March 2016 through March 2018 on Lake Michigan.

PTT-ID	Sex	Age[1]	Capture location	Capture date	Duty cycle	Transmission duration (days)	Comments
158806-1	Female	ASY	Two Rivers, WI	11-Mar-16	3 hrs on: 72 hrs off	4	Mortality signal 15-Mar-16; PTT recovered 17-Mar-16
146126	Female	SY	Seul Choix Point, MI	28-Apr-16	3 hrs on: 72 hrs off	188	Last transmission 02-Nov-16; possible PTT failure
146127	Male	ASY	Two Rivers, WI	29-Oct-16	2 hrs on: 10 hrs off	17	Last transmission 15-Nov-16; possible PTT failure
146128	Male	ASY	Two Rivers, WI	29-Oct-16	2 hrs on: 10 hrs off	184	Last transmission 01-May-17; battery likely depleted
146129	Male	HY	Two Rivers, WI	29-Oct-16	2 hrs on: 10 hrs off	13	Mortality signal 11-Nov-16; remains found; PTT not recovered
146131	Male	SY	Two Rivers, WI	29-Oct-16	2 hrs on: 10 hrs off	213	Last transmission 30-May-17; battery likely depleted
146132	Male	ASY	Two Rivers, WI	04-Nov-16	2 hrs on: 10 hrs off	219	Last transmission 11-June-17; battery likely depleted
158804	Female	ASY	Two Rivers, WI	04-Nov-16	3 hrs on: 72 hrs off	270	Last transmission 01-Aug-17; possible PTT failure
158806	Female	ASY	Two Rivers, WI	21-Nov-16	3 hrs on: 72 hrs off	225	Last transmission 04-Jul-17; possible PTT failure
158807	Male	ASY	Two Rivers, WI	16-Mar-17	3 hrs on: 72 hrs off	1	Last transmission 17-Mar-17; possible transmitter failure
163780-1	Female	SY	Two Rivers, WI	31-Oct-17	3 hrs on: 72 hrs off	9	Mortality signal 09-Nov-17; PTT recovered 15-Nov-17
163773	Female	ASY	Two Rivers, WI	02-Nov-17	3 hrs on: 72 hrs off	160	Last transmission 11-Apr-18; possible PTT failure

163770-1	Female	ASY	Two Rivers, WI	03-Nov-17	3 hrs on: 72 hrs off	15	Mortality signal 18-Nov-17; PTT recovered 15-Nov-17
158810	Male	ASY	Two Rivers, WI	05-Nov-17	3 hrs on: 72 hrs off	207	Last transmission 31-May-18; possible PTT failure
158809	Male	ASY	Two Rivers, WI	05-Nov-17	3 hrs on: 72 hrs off	254	Last transmission 17-Jul-18; possible PTT failure
163778	Female	ASY	Two Rivers, WI	05-Nov-17	3 hrs on: 72 hrs off	138	Last transmission 23-Mar-18; possible PTT failure
164903-1	Male	ASY	Two Rivers, WI	07-Nov-17	3 hrs on: 72 hrs off	8	Mortality signal 15-Nov-17; PTT recovered 17-Nov-17
164905	Male	ASY	Two Rivers, WI	07-Nov-17	3 hrs on: 72 hrs off	326+	Still transmitting as of 28-Oct-18
164342	Female	SY	Two Rivers, WI	08-Nov-17	3 hrs on: 72 hrs off	151	Last transmission 08-Apr-18; possible PTT failure
164911	Male	ASY	Two Rivers, WI	08-Nov-17	3 hrs on: 72 hrs off	4	Mortality signal 12-Nov-17; PTT not recovered
164916	Male	ASY	Two Rivers, WI	08-Nov-17	3 hrs on: 72 hrs off	326+	Still transmitting as of 28-Oct-18
163770	Female	SY	Two Rivers, WI	14-Mar-18	3 hrs on: 72 hrs off	6	Mortality signal 20-Mar-18; PTT recovered 23-Mar-18
163780	Female	ASY	Two Rivers, WI	14-Mar-18	3 hrs on: 72 hrs off	0	Mortality signal 15-Mar-18; PTT recovered 15-Mar-18
164908	Female	SY	Two Rivers, WI	18-Mar-18	3 hrs on: 72 hrs off	8	Mortality signal 26-Mar-18; PTT not recovered
164903	Female	SY	Two Rivers, WI	18-Mar-18	3 hrs on: 72 hrs off	5	Mortality signal 23-Mar-18; PTT recovered 15-Jun-18

[1] HY Hatch Year, SY Second Year, and ASY After Second Year; determined by bursal measurement (females), presence of sheathed penis (males), and/or plumage characteristics.

Table 2. Sequential dates and locations of 13 long-tailed ducks (6 Female; 7 Male) radio-marked on Lake Michigan that survived for >60 days after transmitter implantation.

PTT-ID	Wintering	Spring staging areas	Breeding	Fall staging areas	Following year wintering areas
146126	29 Apr - 15 May 16 (Lake Michigan [29 Apr-15 May 16]; SY-♀)	18 May - 09 Jun 16 (James Bay [18-21 May 16]; Hudson Bay [24 May-09 Jun 16])	12 Jun - 01 Sep 16 (~60 km south southwest of Karrak Lake, Nunavut, Canada)	04 Sep - 18 Oct 16 (Queen Maud Gulf [04-07 Sep 16]; Storis Passage [10-14 Sep 16]; Victoria Strait [17 Sept 16]; James Ross Strait [20-29 Sep 16]; Hudson Bay [02-05 Oct 16]; James Bay [08-18 Oct 16])	27 Oct - 02 Nov 16 (Lake Michigan [27 Oct-02 Nov 16]; *transmission lost*)
146128	30 Oct 16 – 01 May 17 (Lake Michigan [30 Oct 16-01 May 17]; *battery depleted*; ASY-♂)				
146131	30 Oct 16 – 15 May 17 (Lake Michigan [30-31 Oct 16]; Green Bay [02 Nov-01 Dec 16]; Lake Michigan [02 Dec 16-02 Apr 17]; Green Bay [03 Apr-11 May 17]; SY-♂)	15 – 30 May 17 (James Bay [14-15 May 17]; Hudson Bay [16-30 May 17]; *battery depleted*)			

146132	05 Nov 16 – 02 May 17 (Lake Michigan [05 Nov 16-01 Apr 17]; Green Bay [02-13 Apr 17]; Lake Michigan [13 Apr-02 May 17]; ASY-♂)	10 – 23 May 17 (Ontario, Canada [10 May 17; *in flight*]; James Bay [10 May 17]; Hudson Bay [11-23 May 17]; *battery depleted*)		
158804	05 Nov 16 - 18 May 17 (Lake Michigan [05 Nov 16-18 May 17]; ASY-♀)	21 - 30 May 17 (Ontario, Canada [21 May 17]; Hudson Bay [24-30 May 17])	02 Jun - 16 Jul 17 (~175 km north northwest of Baker Lake, Nunavut, Canada)	25 Jul - 01 Aug 17 (Adalaide Penisula, Nunavut, Canada [25 Jul-01 Aug 17]; *transmission lost*)
158806	22 Nov 16 - 15 May 17 (Lake Michigan [22 Nov 16]; Green Bay [23 Nov-06 Dec 16]; Lake Michigan [09 Dec 16-15 May 17]; ASY-♀)	24 May 17 (Ontario [24 May 17])	27 Jun - 04 Jul 17 (~35 km south of Yathkyed Lake, Nunavut, Canada; *transmission lost*)	
163773	03 Nov 17 – 11 Apr 18 (Lake Michigan [03 Nov 17-23 Mar 18]; Green Bay [26 Mar-11 Apr 18]; *transmission lost*; ASY-♀)			
158810	06 Nov 17 – 15 May 18 (Lake Michigan [06	15 – 31 May 18 (James Bay [18 May		

	Nov 17-15 May 18]; ASY-♂)	18]; Hudson Bay [21-31 May 18]; *transmission lost*)		
158809	06 Nov 17 – 18 May 18 (Lake Michigan [06 Nov 17-18 May 18]; ASY-♂)		03 Jun – 01 Jul 18 (~230 km east of Nueltin Lake, Nunavut, Canada)	04 – 17 Jul 18 (Hudson Bay [04-07 Jul 18]; Gulf of Boothia, Nunavut, Canada [10 Jul 18]; McClintock Channel, Nunavut, Canada [14 Jul 18]; Victoria Island, Nunavut, Canada [17 Jul 18]; *transmission lost*)
163778	06 Nov 17 – 23 Mar 18 (Lake Michigan [06 Nov 17-23 Mar 18]; *transmission lost*; ASY-♀)			
164905	12 Nov 17 – 15 May 18 (Lake Michigan [12 Nov 17-20 Apr 18]; Green Bay [23 Apr-15 May 18]; ASY-♂)	18 – 27 May 18 (Lake Superior [18 May 18]; Hudson Bay [21-27 May 18])	31 May – 26 Aug 18 (Multiple areas throughout Nunavut and Northwest Territories, Canada)	29 Aug – 29 Sep 18 (Erebus Bay, King William Island, Nunavut, Canada [29 Aug-01 Sep 18]; Victoria Strait, Nunavut, Canada [04 Sep 18]; East of Collinson Peninsula, Victoria Island,

				Nunavut, Canada [08-14 Sep 18]; Pasley Bay, Boothia Peninsula, Nunavut, Canada [17 Sep 18]; Northwest of Dixon Island, Nunavut, Canada [20 Sep 18]; North of Tasmania Islands, Boothia Peninsula, Nunavut, Canada [23-26 Sep 18]; Wager Bay, Nunavut, Canada [29 Sep-06 Oct 18], Hudson Bay [09-24 Oct 18], Lake Michigan [28 Oct 18]; *still receiving transmissions*)
164916	09 Nov 17 – 12 May 18 (Lake Michigan [09 Nov 17-12 May 18]; ASY-♂)	15 May – 09 Jun 18 (Hudson Bay [15 May-09 Jun 18])	13 Jun – 14 Aug 18 (~160 km east of Karrak Lake, Nunavut, Canada)	17 Aug – 30 Sep 18 (Schwatka Bay, King William Island, Nunavut, Canada [17-27 Aug 18]; LaTrobe Bay, King William Island, Nunavut, Canada [30 Aug – 08 Sep 18]; Pelly Bay, Kugaaruk, Nunavut, Canada [11 Sep-03 Oct 18], Ross

		Welcome Sound, Nunavut, Canada [06-09 Oct 18], James Bay [12-28 Oct 18]; *still receiving transmissions*)
164342	09 Nov 17 – 08 Apr 18 (Lake Michigan [09 Nov 17-08 Apr 18]; *transmission lost*; SY-♀)	

Table 3. Daytime and nighttime habitat use information of 13 long-tailed ducks radio-marked on Lake Michigan from March 2016 to November 2018, for the open waters of Lake Michigan, excluding Green Bay. Daytime was defined as the time between two hours post-sunrise to two hours pre-sunset and nighttime as two hours post-sunset to two hours pre-sunrise. All locations used had an Argos precision index location class greater than or equal to one (LC≥1).

PTT-ID	No. of transmissions used for day and night analysis on Lake Michigan	No. of daytime transmissions on Lake Michigan	No. of nighttime transmissions on Lake Michigan	Avg. distance to nearest shore during daytime hours (km ± SD)	Avg. distance to nearest shore during nighttime hours (km ± SD)	Avg. water depth during daytime hours (m ± SD)	Avg. water depth during daytime hours (m ± SD)
146126	3	0 (0%)	3 (100%)	n/a	8.4 ± 4.9	n/a	64.9 ± 47.2
146128	138	118 (86%)	20 (14%)	4.0 ± 4.9	14.3 ± 5.3	18.3 ± 7.7	74.8 ± 46.6
146131	11	11 (100%)	0 (0%)	3.4 ± 1.7	n/a	23.2 ± 9.6	n/a
146132	140	120 (86%)	20 (14%)	7.8 ± 4.4	16.4 ± 8.4	27.6 ± 10.9	71.5 ± 30.7
158804	20	11 (55%)	9 (45%)	4.9 ± 3.4	16.2 ± 5.2	22.6 ± 7.1	66.9 ± 21.2
158806	16	7 (44%)	9 (56%)	1.4 ± 1.1	7.3 ± 2.2	16.8 ± 12.8	59.4 ± 39.3
163773	21	7 (33%)	14 (67%)	2.9 ± 1.1	8.6 ± 4.7	20.2 ± 7.2	60.2 ± 28.4
158810	22	14 (64%)	8 (36%)	5.4 ± 6.6	12.5 ± 8.6	21.5 ± 8.4	48.2 ± 20.2
158809	25	14 (56%)	11 (44%)	5.6 ± 2.6	15.6 ± 8.0	21.9 ± 5.2	59.5 ± 27.0
163778	19	8 (42%)	11 (58%)	3.5 ± 2.1	12.2 ± 9.1	22.9 ± 4.3	66.8 ±41.1
164342	23	12 (52%)	11 (48%)	0.8 ± 0.6	6.2 ± 3.9	8.9 ± 4.3	40.7 ± 21.5
164905[1]	15	4 (27%)	11 (73%)	2.3 ± 0.5	8.8 ± 5.6	15.9 ± 2.1	45.9 ± 27.8
164916[1]	29	15 (52%)	14 (48%)	7.7 ± 6.0	9.4 ± 3.9	27.5 ± 9.2	54.9 ± 19.8
Combined[1]	**482**	**341 (71%)**	**141 (29%)**	**5.4 ± 4.8**	**11.9 ± 7.0**	**22.3 ± 10.1**	**61.0 ± 32.8**

[1] Not finalized as PTT-IDs 164905 and 164916 were still transmitting as of 29 October 2018.

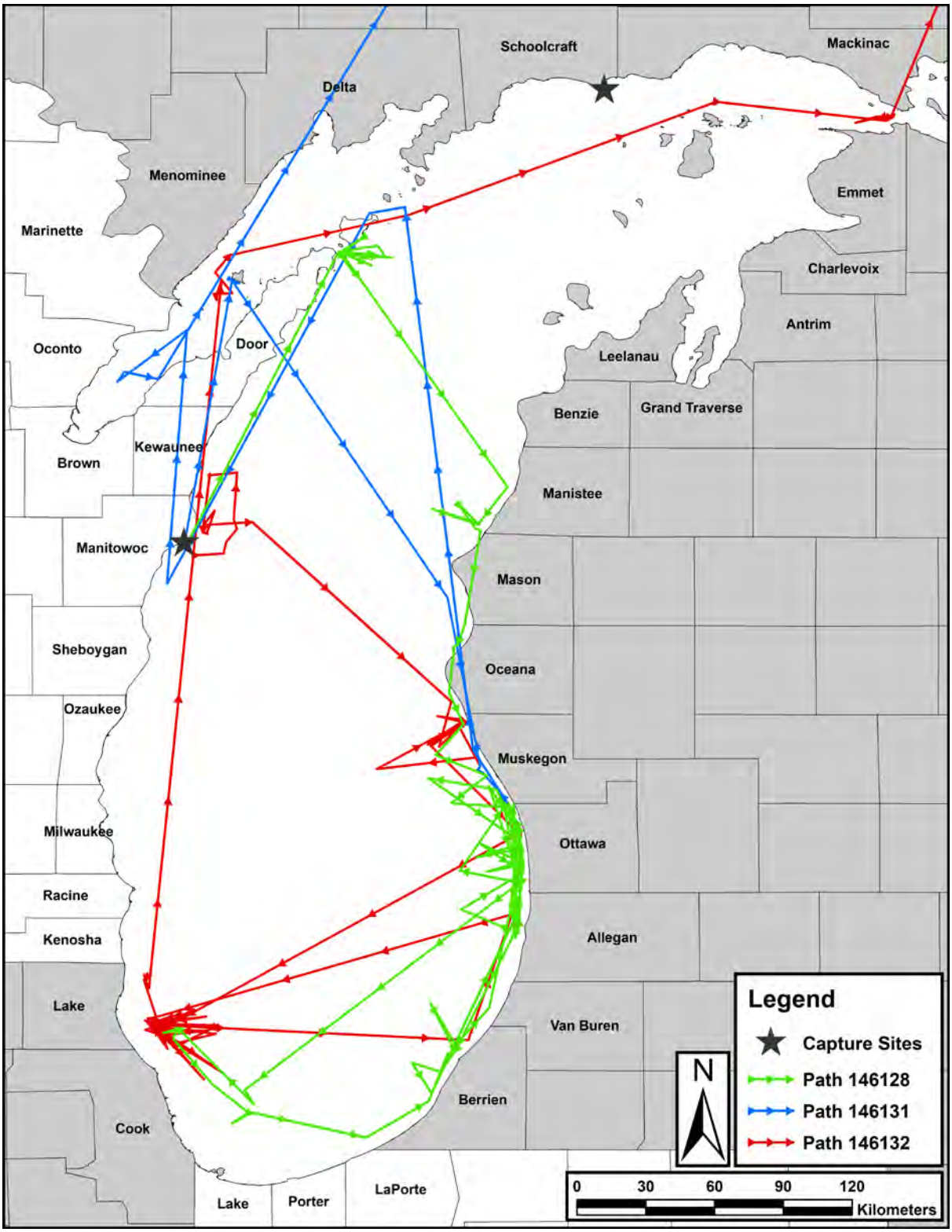

Figure 1. Map depicting movements of three "Judas" long-tailed ducks (all after second year males) from 29 October 2016 through 11 May 2017. All locations have an Argos precision index location class greater than or equal to one (LC≥1).

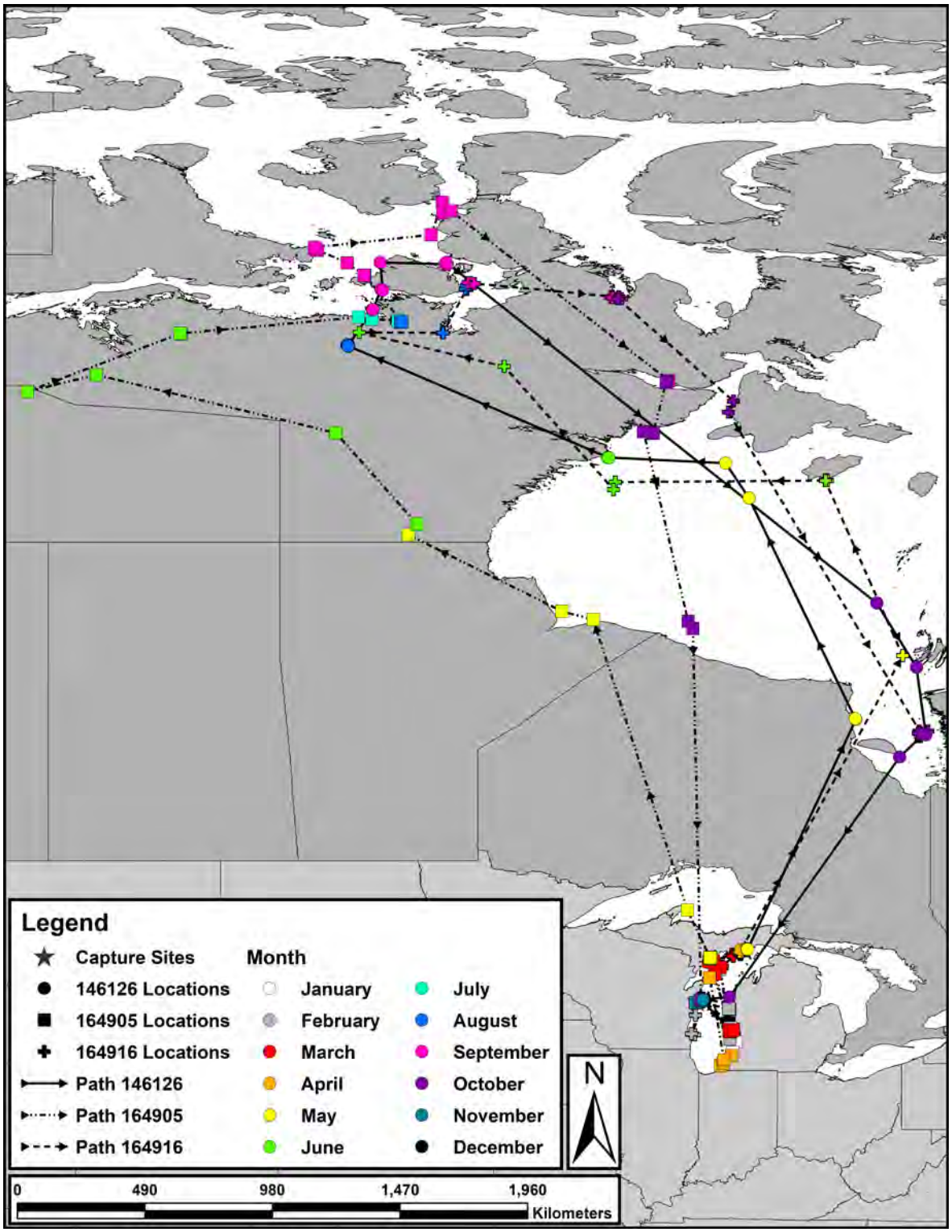

Figure 2. Map depicting annual migratory paths of a second year female long-tailed duck (146126) captured 28 April 2016, an after second year male long-tailed duck (164905) captured 07 November 2017, and an after second year male long-tailed duck (164916) captured 08 November 2017. All locations have an Argos precision index location class greater than or equal to one (LC≥1).

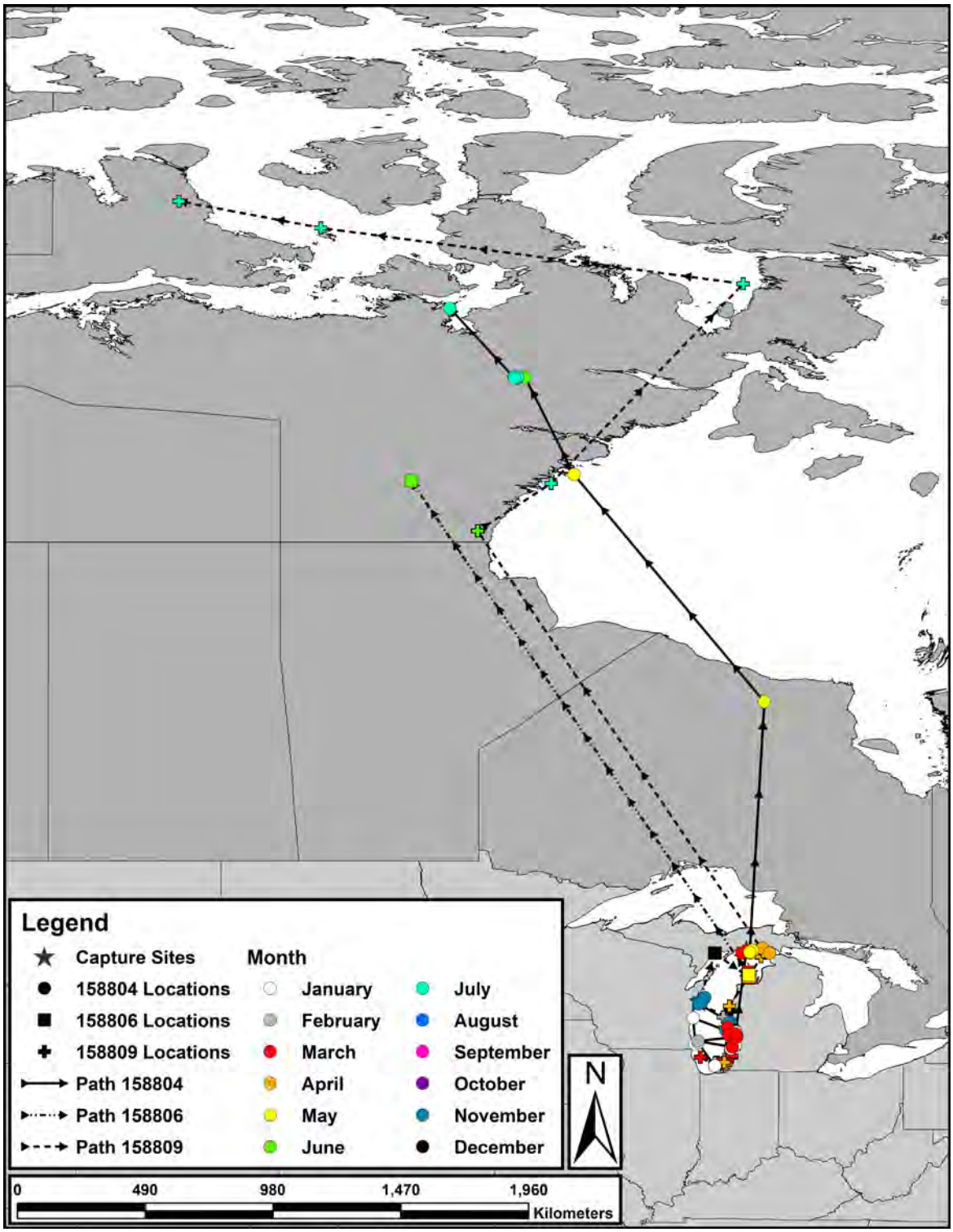

Figure 3. Map depicting spring migratory paths of an after second year female long-tailed duck (158804) captured 04 November 2016, an after second year female long-tailed duck (158806) captured 21 November 2016, and an after second year male long-tailed duck (158809) captured 05 November 2017. All locations have an Argos precision index location class greater than or equal to one (LC≥1).

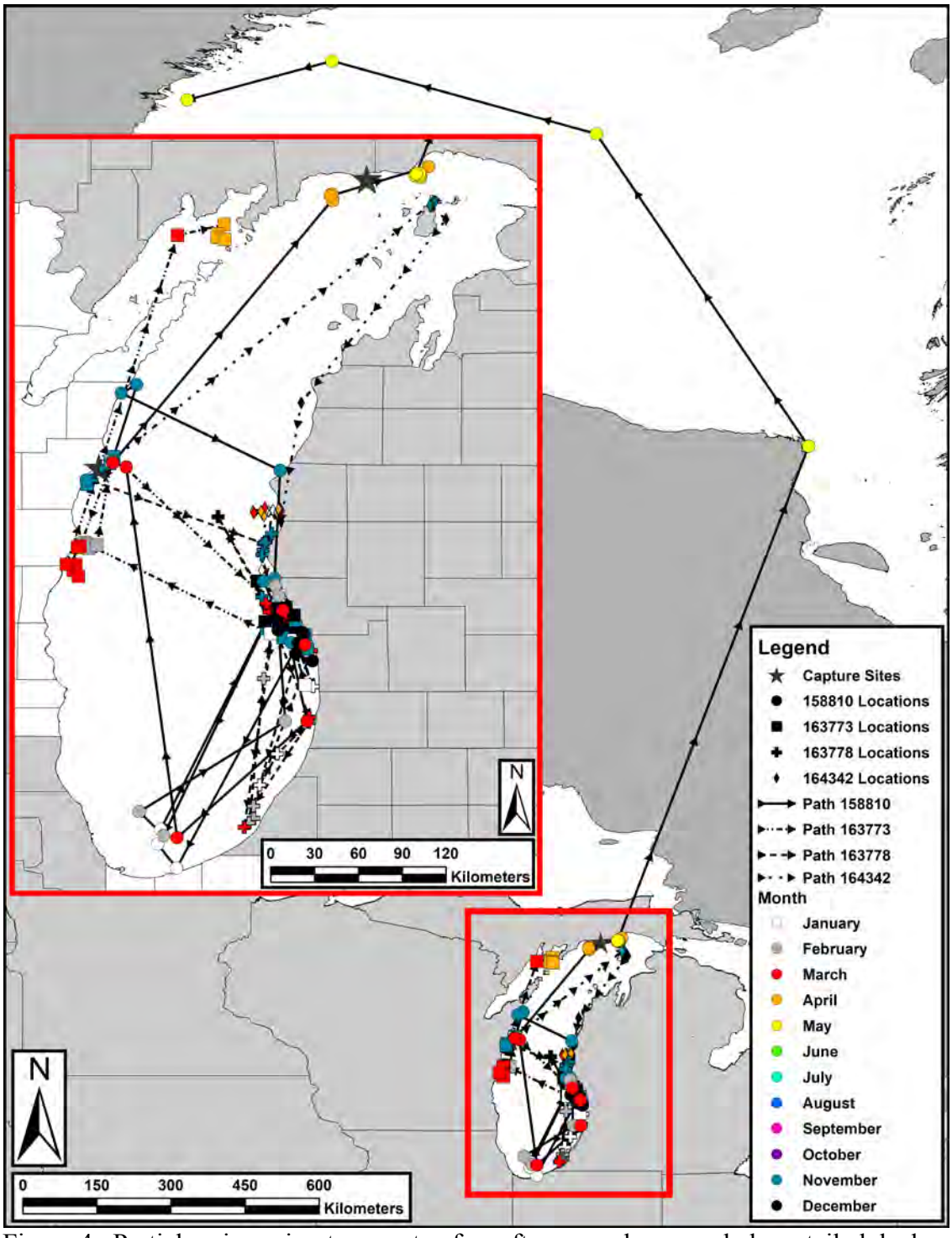

Figure 4. Partial spring migratory route of an after second year male long-tailed duck (158810) captured 05 November 2017 and movements on Lake Michigan for an after second year female long-tailed duck (163773) captured on 02 November 17, an after second year female long-tailed duck (163778) captured on 05 November 17, and a second year female long-tailed duck (164342) captured on 08 November 17. All locations have an Argos precision index location class greater than or equal to one (LC≥1).

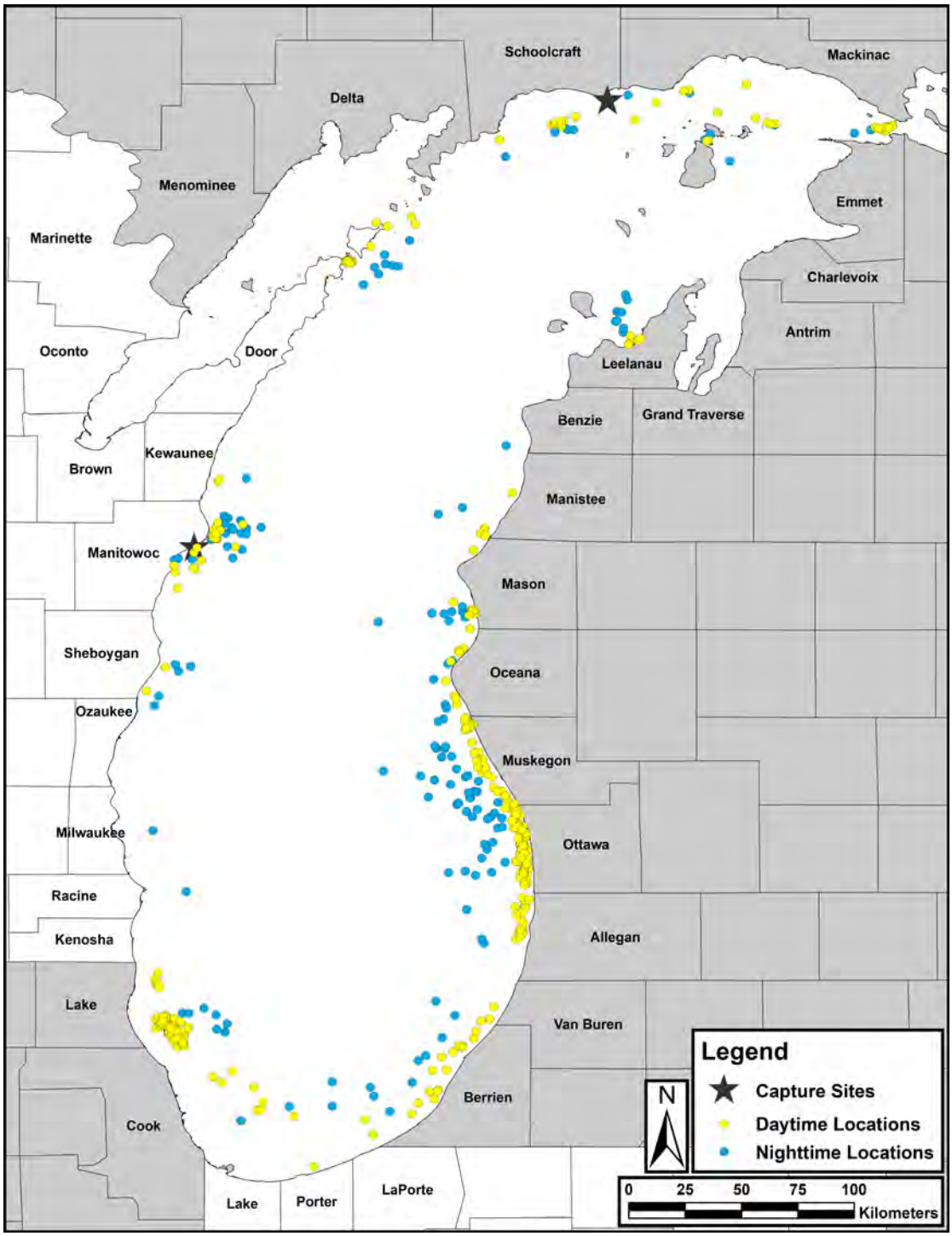

Figure 5. Daytime and nighttime locations of 13 long-tailed ducks radio-marked on Lake Michigan from April 2016 through November 2017, for the open waters of Lake Michigan, excluding Green Bay. Daytime was defined as the time between two hours post-sunrise to two hours pre-sunset and nighttime as two hours post-sunset to two hours pre-sunrise. All locations used had an Argos precision index location class greater than or equal to one (LC≥1).

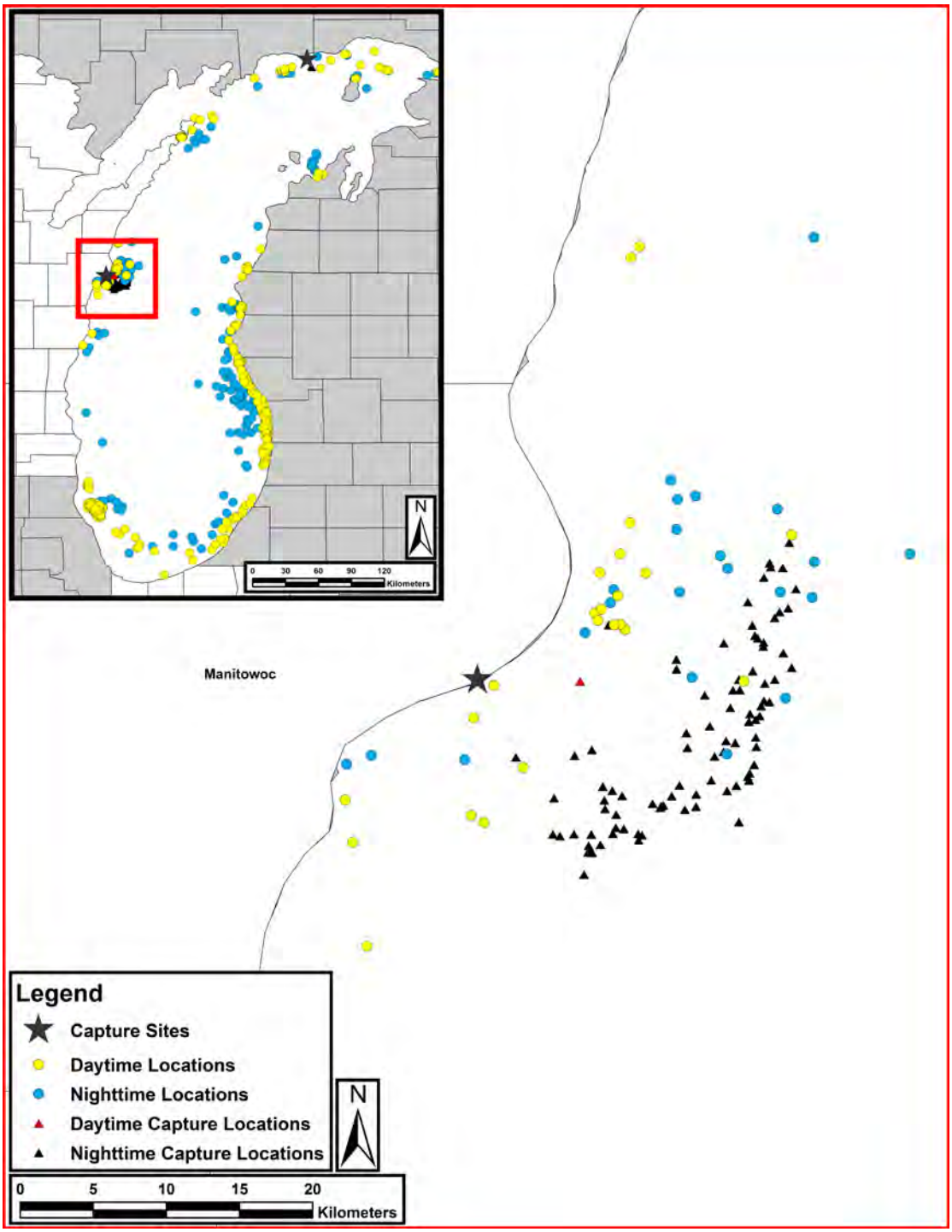

Figure 6. Daytime (red triangle) and nighttime (black triangle) locations of long-tailed ducks captured near Two Rivers, Wisconsin from March 2015 through March 2018, with daytime (yellow dots) and nighttime (blue dots) locations of radio-marked long-tailed ducks. For radio-marked individuals, daytime was defined as the time between two hours post-sunrise to two hours pre-sunset and nighttime as two hours post-sunset to two hours pre-sunrise. All locations used had an Argos precision index location class greater than or equal to one (LC≥1).