Abundance and Productivity of Waterfowl at Clam Lake and Long Lake, Burnett County, Wisconsin; 2010-2011

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Abstract

Waterfowl abundance and productivity were measured at Clam Lake and Long Lake near Siren, Wisconsin during 2010-2011. Clam Lake once had large areas of wild rice (*Zizania palustris*) that have been essentially eliminated in recent years, while Long Lake continued to have extensive areas of wild rice. Comparisons between the 2 lakes revealed greater ($P \leq 0.100$) numbers of duck broods, goose broods, and adult geese in summer; ducks and geese in spring; and densities of ducks in fall at Long Lake. An increase in the population of common carp (*Cyprinus carpio*) is suspected to have had detrimental effects on the abundance of wild rice at Clam Lake, and to have indirectly reduced the abundance and production of waterfowl. Further study is recommended when wild rice is restored on Clam Lake.

Introduction

Wild rice is a valued cultural resource for Native Americans (Vennum 1999) and others in northwestern Wisconsin and an important food for waterfowl and other wildlife (Martin et al. 1951). Wild rice has historically been abundant at Clam Lake and Long Lake in Burnett County, Wisconsin. While rice has continued to thrive at Long Lake, its abundance has been severely reduced at Clam Lake in recent years (Table 1). The cause(s) of the loss of rice at Clam Lake is under investigation by the St. Croix Tribal Environmental Department (SCTED), the Wisconsin Department of Natural Resources (WDNR), and others. Additionally, the SCTED and the WDNR are attempting to restore wild rice on Clam Lake to levels similar to historic levels.

This study has 2 goals. The goals were to compare waterfowl use of Clam Lake during a period when the rice is severely diminished (2010-2011) to (1) waterfowl use on Long Lake which simultaneously has healthy and widespread wild rice beds; and (2) waterfowl use on Clam Lake at some future time when the wild rice has been restored to its historic levels. Estimates of waterfowl abundance and productivity were obtained on both lakes by aerial surveys during fall migration, spring migration, and spring breeding seasons, and from a canoe during summer.

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Study Area

Clam Lake is located in northwestern Wisconsin about 3.5 km east of the Siren Airport and 1.5 km north of Long Lake. Clam Lake is 541 ha, has a maximum depth of 3.3 m and an average depth of 1.5 m (Wisconsin Department of Natural Resources 2011). In 2010, there was approximately 23.5 hectares of sparse rice at Clam Lake (personal communications, Anthony Havranek, SCTND.) Long Lake averages 1.5 m deep, has a maximum depth of 4.0 m, and is 133 ha (Wisconsin Department of Natural Resources 2011). As its name implies, Long Lake has a narrow shape. Dense wild rice covered about 57 ha of Long Lake in 2010 (personal communications, Anthony Havranek, SCTND.)

Methods

Surveys during the summer were conducted from a canoe and during the morning. I was seated in the bow of the canoe and a second person (Anthony Havranek or Jacob Caithamer) in the stern. Both observers used binoculars as needed to identify and count waterfowl. The survey route on Long Lake was approximately 4,062 m while the route on Clam Lake was approximately 4,972 m (Figures 1 and 2). These surveys only included a portion of each lake. On Clam Lake, the survey included a large area that has historically been a wild rice bed. On Long Lake, much of the route was through or near wild rice.

I attempted to obtain complete counts of all waterfowl using the entire surface of both lakes 6 times during fall migration (2010), 3 times during spring migration (2011), and once during the nesting season (May 12, 2011). Counts were acquired through low-level aerial surveys using WDNR professional pilots (Phil Miller and Joe Springer) and aircraft (Cessna 172 or Cessna 180). Both lakes were surveyed during a continuous flight. Flights were initiated within 2 hours of sunrise. On all surveys I was seated in the right side of the aircraft while the pilot was in the left seat. During 2 surveys, a second observer was in the rear seat. The pilot flew at the slowest speed and lowest level which he considered safe, and generally about 45-75 m above the lakes. The flight pattern over Clam Lake was to first survey the portion of the lake north of Highway 70 in a counter-clockwise pattern, beginning at the Highway 70 bridge. Once the northern portion of lake was surveyed, the survey route proceeded to the southern portion of the lake, again in a counter clockwise pattern beginning at the bridge (the west shore was surveyed first, then the southern bays, and then the eastern shore). By flying in this manner, I was afforded a good view of shoreline areas, while the pilot had good views of mid-lake areas. In the southern portion of Clam Lake, the aircraft was circled around the 2 islands and various bays to insure all areas were viewed. Pilots assisted in locating, counting, and identifying birds; if they were unable to confidently do this they repositioned the aircraft so that I could see the birds in question.

Aerial surveys over Long Lake employed similar methods. Flights began at the lake's northern tip and then proceeded southward allowing me visibility of the western shore. After surveying the western shoreline, the aircraft was then flown northward so that I could then survey the eastern shore. Finally the plane was circled around a bay at the northeast end of the lake.

The aerial survey of Long Lake was usually flown after completing about ½ of the survey of Clam Lake. In other words, when the plane was at the most southeastern point of Clam Lake, the survey of Clam Lake

was suspended while the plane was flown 1.5 km to the northern tip of Long Lake. Once the survey of Long Lake was completed, the aerial survey of Clam Lake resumed.

One practice and reconnaissance flight was conducted on August 23, 2010; data from this flight were not used in any of the summaries or analyses presented herein.

I recorded data from aerial surveys on a portable tape recorder. Once the flight was concluded, data were transcribed from the tape recorder to paper notes and then electronic files.

Microsoft Excel (version 2007) was used for data summary and analyses. Paired, 2-tailed student's t-tests (Glass and Stanley 1970) were used to compare means; pairs of data were those collected on the same date at both lakes.

Results

Surveys during summer (via a canoe) averaged 86 minutes in duration (n = 3, SE = 11) on Clam Lake and 85 minutes (n=3, SE = 2) on Long Lake (Table 2). Total time to complete aerial surveys of both lakes, and to fly to and between lakes and the Siren airport, averaged 33 minutes (n = 8, SE = 3, Table 2).

A total of 8 species of waterfowl were observed during all seasons at Clam Lake while 10 species were observed at Long Lake (Table 3). In addition, observations were recorded of at least 6 other species on the 2 lakes. One interesting sighting was a flock of 18 white pelicans (*Pelecanus erythrorhynchos*) at Clam Lake on April 22, 2010. Other interesting observations were of a family of common loons (*Gavia immer*), which included 2 adults and 2 young, at Long Lake on June 22 and July 13, 2010.

Across all seasons and at both lakes, 3,416 ducks were observed (Table 4). My ability to identify the species of ducks varied seasonally. All ducks were identified to species in Summer and Spring Breeding seasons, while 45% were identified in Fall, and 87% during Spring Migration. The most commonly observed species of ducks (of those identified) was ringneck duck (*Aythya collaris*); the second most common species was blue-winged teal *(Anas discors*). The maximum count of ducks on Clam Lake was 168 on November 5, 2010. The highest count on Long Lake was 749 on April 14, 2011.

Summer

Numbers of duck broods and goose broods were greater at Long Lake than at Clam Lake ($P \leq 0.074$, Table 5, Figures 3 and 4.) At Long Lake 11 broods of Canada geese, 7 broods of wood ducks, and 1 brood of mallards were observed. At Clam Lake, no Canada goose broods were observed and only 2 ducks broods were noted. However, a family of trumpeter swans, including 5 cygnets, was observed at Clam Lake.

There were also more adult geese at Long Lake (P = 0.034) compared to Clam Lake during summer. However, no difference (P = 0.268) was detected in the number of adult ducks observed at the 2 lakes.

Fall

The average population sizes of ducks, geese, and swans were similar ($P \geq 0.107$) at Clam Lake and Long Lake during Fall, 2010 (Table 5, Figure 5). No differences ($P \geq 0.146$) were detected in densities of Canada geese and swans at the 2 lakes (Table 5, Figure 6). However, the density of ducks was higher ($P = 0.086$) at Long Lake in fall when there averaged 1.2 ducks/ha compared to only 0.07 ducks/ha at Clam Lake (Table 5, Figure 6). At both lakes, the population size generally was larger in October and November compared to September (Figure 7).

Spring Migration

Numbers of ducks and Canada geese were greater ($P \leq 0.079$) at Long Lake than at Clam Lake during Spring Migration, 2011 (Table 5, Figure 8). Average numbers of ducks and geese were approximately 20 times and 18 times higher than those of Clam Lake, respectively. Densities of ducks and Canada geese were also greater ($P \leq 0.081$) at Long Lake (Table 5, Figure 9).

Spring Breeding

Only 1 duck, 11 geese, and 2 swans were observed during aerial surveys of both lakes on May 12, 2011. I interpreted the large drop in numbers of waterfowl from 602 on May 3 to 14 on May 12 as an indication that migrants destined for more northerly areas, such as ringneck ducks, had left the area. I considered any birds remaining as those that would attempt to nest in the area.

Discussion

Several measures of waterfowl abundance and productivity were significantly greater at Long Lake than at Clam Lake. I suspect that an important factor leading to the differences was the greater abundance of wild rice at Long Lake. A. Havranek (SCTND, personal communications) noted that rice beds were denser and occupied more than twice as much area at Long Lake compared to Clam Lake. In the fall of 2010, like the several preceding years, wild rice harvest was prohibited on Clam Lake due to its poor status. Rice harvest was allowed on Long Lake as usual, although the harvest totaled only about 127 pounds (Table 1), which was the 3rd lowest harvest during 19 years.

Resource managers (personal communications, Anthony Havranek, SCTND, and Larry Damman, retired, WDNR) have documented a large population of common carp (*Cyprinus carpio*) in Clam Lake and suspect that foraging behavior by the carp has reduced densities of many aquatic plants there. This population of carp appears to have undergone a very rapid increase during the past few years. On Long Lake, I observed no evidence of carp. Managers soon will be completing studies of the fish community at Long Lake to assess the status of carp (personal communications, Anthony Havranek, SCTND). Carp have long been recognized as being detrimental to aquatic plant communities in North America (King and Hunt 1967, Kadlec and Smith 1992). Carp destroy young plants during their foraging and make the water turbid, which further interferes with the growth of aquatic plants.

I recommend that this study is repeated once wild rice is restored to Clam Lake. Future study should entail similar data collection methods. Brood surveys should again be conducted from a canoe and cover the same routes. Aerial surveys should be conducted during fall and spring over the entire surface of both lakes. Once these data are collected, analyses should focus on determining the proportional changes observed in population measures for each lake.

I also recommend that findings from this study are combined with findings from parallel studies on plant and fish communities at the 2 lakes and presented in a more comprehensive report.

This study could have been improved in at least 2 ways. First, additional data from the spring breeding season would have provided a more complete account of waterfowl use of the 2 lakes. Had another survey or 2 been conducted in late-May, I suspect that blue-winged teal would have been detected. The second improvement would have been increasing the identification rate of ducks in fall. Because about 50% of the ducks were unidentified in fall, some findings (for example a large presence of green-winged teal [*Anas crecca*]) could have been overlooked. Identification of ducks was difficult during fall, particularly at Long Lake, because some ducks do not attain their adult plumage until winter, and because of the robust wild rice on Long Lake. Possible methods to improve identification rate might include supplemental surveys from a canoe or boat, inclusion of additional aerial observers, and additional aerial circling when large flocks of unknown ducks are encountered; this latter method seems most feasible.

Aerial surveys for waterfowl are known to be biased low (Smith 1995). Some birds that are present are not observed. The bias probably becomes greater as emergent vegetation density and height increases. Because Long Lake had higher densities of wild rice than Clam Lake, the counts of waterfowl at Long were probably biased lower than those at Clam. Thus, differences in waterfowl populations and densities between Long Lake and Clam Lake may have actually been even greater than what I measured.

Only 1 group of waterfowl hunters was observed at Clam Lake. Based on my personal experience, this seems reduced compared to about 5-10 years earlier when rice was abundant and I occasionally hunted at this lake. Hunters were also observed on Long Lake but I have no information to judge how it compares to other times.

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Table 1. Estimates of wild rice harvest efforts (trips) and harvest at Clam Lake and Long Lake, 1992-2010. Estimates were not adjusted to account for non-reporting. (All data were obtained from Peter David, Great Lakes Indian Fish and Wildlife Commission, August and September 2011.)

	Clam Lake		Long Lake	
Year	Trips	Harvest[1]	Trips	Harvest[1]
1992	48	2800	25	926
1993	67	3549	23	813
1994	70	3379	20	973
1995	54	2585	30	1150
1996	114	4959	9	192
1997	142	9579	21	1962
1998	66	1542	31	1444
1999	125	3916	17	445
2000	0	0	0	0
2001	94	3050	4	97
2002	109	3430	6	167
2003	54	2182	13	350
2004	51	2233	29	1725
2005	47	1432	24	929
2006	80	2730	43	2950
2007	2	0	15	449
2008	0	0	50	2296
2009	1	0	191	9700
2010	0	0	22	127
n	19	19	19	19
min	0	0	0	0
max	142	9579	191	9700
mean	59.2	2492.9	30.2	1405.0
median	54	2585	22	926

[1]Estimates of harvested rice (pounds) after processing.

Table 2. Methods of waterfowl surveys, Clam Lake and Long Lake, 2010-2011.

Date	Location(s)	Survey Vehicle	Pilot	Additional Observer	Start Time (am)	Finish Time (am)	Survey Duration (minutes)
2-Jun-10	Long Lake	Canoe	n/a	Anthony Havranek	6:45	8:05	1:20
22-Jun-10	Long Lake	Canoe	n/a	Anthony Havranek	7:50	9:20	1:30
13-Jul-10	Long Lake	Canoe	n/a	Jacob Caithamer	6:05	7:30	1:25
2-Jun-10	Clam Lake	Canoe	n/a	Anthony Havranek	8:50	10:35	1:45
22-Jun-10	Clam Lake	Canoe	n/a	Anthony Havranek	5:45	7:15	1:30
13-Jul-10	Clam Lake	Canoe	n/a	Jacob Caithamer	8:15	9:20	1:05
23-Aug-10[1]	Both lakes	Cessna 172	Joe Springer	none	9:45	10:20	0:35
1-Sep-10	Both lakes	Cessna 172	Joe Springer	Anthony Havranek	9:40	10:30	0:50
13-Sep-10	Both lakes	Cessna 172	Phil Miller	none	8:20	8:50	0:30
27-Sep-10	Both lakes	Cessna 172	Phil Miller	none	8:20	NR[2]	
8-Oct-10	Both lakes	Cessna 172	Joe Springer	none	9:00	9:45	0:45
22-Oct-10	Both lakes	Cessna 180	Joe Springer	none	9:20	9:50	0:30
5-Nov-10	Both lakes	Cessna 172	Joe Springer	David Lorentz	9:15	9:50	0:35
14-Apr-11	Both lakes	Cessna 180	Phil Miller	none	8:00	8:30	0:30
22-Apr-11	Both lakes	Cessna 172	Phil Miller	none	8:50	9:15	0:25
3-May-11	Both lakes	Cessna 172	Phil Miller	none	8:05	8:30	0:25
12-May-11	Both lakes	Cessna 172	Phil Miller	none	8:00	NR[2]	

[1]Reconnaisance and practice flight; data from this flight were not used in any analyses.
[2]Time that the aerial survey ended was inadvertently not recorded on September 27 and May 12.

Table 3. Seasonal observation totals of select birds at Clam Lake and Long Lake, 2010-2011.

			Clam Lake		Long Lake	
Season	Common Name	Scientific Name	Number of adults[1]	Number of flightless young [2]	Number of adults[1]	Number of flightless young[2]
Summer[3]	Canada goose	*Branta canadensis*			24	68
	Trumpeter Swan	*Cygnus buccinator*	2	5		
	Wood duck	*Aix sponsa*	55		22	34
	Gadwall	*Anas strepera*			3	
	Mallard	*Anas platyrhynchos*	1	3	1	
	Ringneck duck	*Aythya collaris*			1	
	Common loon	*Gavia immer*	7	4		
Fall (excluding Aug 23)[4]	Canada goose	*Branta canadensis*	71		65	
	Trumpeter swan	*Cygnus buccinator*	30		32	
	Unknown swan	*Cygnus*			55	
	Wood duck	*Aix sponsa*			2	
	Mallard	*Anas platyrhynchos*	14		10	
	Blue-winged teal	*Anas discors*			324	
	Ringneck duck	*Aythya collaris*	20		2	
	Bufflehead	*Bucephala albeola*	119		45	
	Hooded merganser	*Lophodytes cucullatus*	6			
	Common merganser	*Mergus meganser*	2			
	Unknown duck		80		582	
	Great blue heron	*Aredea herodias*	2		5	
	Bald eagle	*Haliaeetus leucocephalus*	4		3	
	Unknown gull	*Larus*	63		33	

Table 3. Concluded.

			Clam Lake		Long Lake	
Season	Common Name	Scientific Name	Number of adults[1]	Number of flightless young [2]	Number of adults[1]	Number of flightless young[2]
Spring Migration[5]	Canada goose	*Branta canadensis*	2		37	
	Trumpeter swan	*Cygnus buccinator*	6		2	
	Wood duck	*Aix sponsa*	2		9	
	Mallard	*Anas platyrhynchos*	11		32	
	Ringneck duck	*Aythya collaris*			1490	
	Scaup (lesser or greater)	*Aythya*			182	
	Bufflehead	*Bucephala albeola*	15		55	
	Hooded merganser	*Lophodytes cucullatus*	2		2	
	Common merganser	*Mergus meganser*	38			
	Unknown duck		34		254	
	Common loon	*Gavia immer*	5			
	Double-crested cormorant	*Phalacrocorax auritus*	2		4	
	American white pelican	*Pelecanus erythrorhynchos*	18			
	Great blue heron	*Aredea herodias*	3		1	
	Bald eagle	*Haliaeetus leucocephalus*	5		1	
Spring Breeding Season[6]	Canada goose	*Branta canadensis*	2		9	
	Trumpeter swan	*Cygnus buccinator*	2			
	Hooded merganser	*Lophodytes cucullatus*	1			
	Double-crested cormorant	*Phalacrocorax auritus*	6			
	Great blue heron	*Aredea herodias*	2			
	Bald eagle	*Haliaeetus leucocephalus*	1			

[1]"Adults" refers to any bird capable of flight.

[2] Recorded only during summer.

[3]*n*=3.

[4]*n*=6.

[5]*n*=3.

[6]*n*=1.

Table. 4. Numbers and percentages of ducks observed and identified at Clam Lake and Long Lake (combined), 2010-2011.

	Ducks Identified		Ducks Unidentified		All Ducks	
Season	N	%	N	%	N	%
Summer	83	100.0	0	0.0	83	100.0
Fall	544	45.1	662	54.9	1206	100.0
Spring Migration	1838	86.4	288	13.5	2126	100.0
Spring Breeding	1	100.0	0	0.0	1	100.0
All Seasons	2466	72.2	950	27.8	3416	100.0

Table 5. Measures of waterfowl populations at Clam Lake and Long Lake, 2010-2011. Paired Student T-tests were used to assess null hypotheses that means were no different between the 2 lakes (comparisons within each row).

Season and Population Measure		Clam Lake $\bar{\chi}$	Clam Lake min	Clam Lake max	Clam Lake SE	Long Lake $\bar{\chi}$	Long Lake min	Long Lake max	Long Lake SE	Student T-test
Summer Population Size Index[1]	Duck Broods	0.7	0	1	0.3	2.7	2	3	0.3	0.074
	Ducklings	1.3	0	3	0.9	13.0	7	22	4.6	0.162
	Adult Ducks	18.7	8	27	5.6	9.0	6	11	1.5	0.268
	Canada Goose Broods	0.0	0	0	0.0	3.7	2	5	0.9	0.053
	Goslings	0.0	0	0	0.0	22.7	21	24	0.9	0.002
	Adult Geese	0.0	0	0	0.0	7.7	5	10	1.5	0.034
Fall Population Size[2]	Ducks	40.2	1	169	27.0	160.8	10	399	74.8	0.107
	Canada Geese	11.8	0	71	11.8	10.8	0	65	10.8	0.363
	Swans	5.0	0	16	2.5	14.5	0	45	7.8	0.276
Fall Population Density[2]	Ducks	0.074	0.002	0.312	0.050	1.209	0.075	3.000	0.562	0.086
	Canada Geese	0.022	0.000	0.131	0.022	0.081	0.000	0.489	0.081	0.363
	Swans	0.009	0.000	0.030	0.005	0.109	0.000	0.338	0.059	0.146
Spring Migration Population Size[3]	Ducks	34.0	25	45	5.9	674.7	548	749	63.7	0.009
	Canada Geese	0.7	0	1	0.3	12.3	6	19	3.8	0.079
	Swans	2.0	2	2	0.0	0.7	0	2	0.7	0.184
Spring Migration Population Density[3]	Ducks	0.063	0.046	0.083	0.011	5.073	4.120	5.632	0.479	0.009
	Canada Geese	0.001	0.000	0.002	0.001	0.093	0.045	0.143	0.028	0.081
	Swans	0.004	0.004	0.004	0.000	0.005	0.000	0.015	0.005	0.818

[1] n=3 for each category during summer.

[2] n=6 for each category during fall.

[3] n=3 for each category during spring migration.

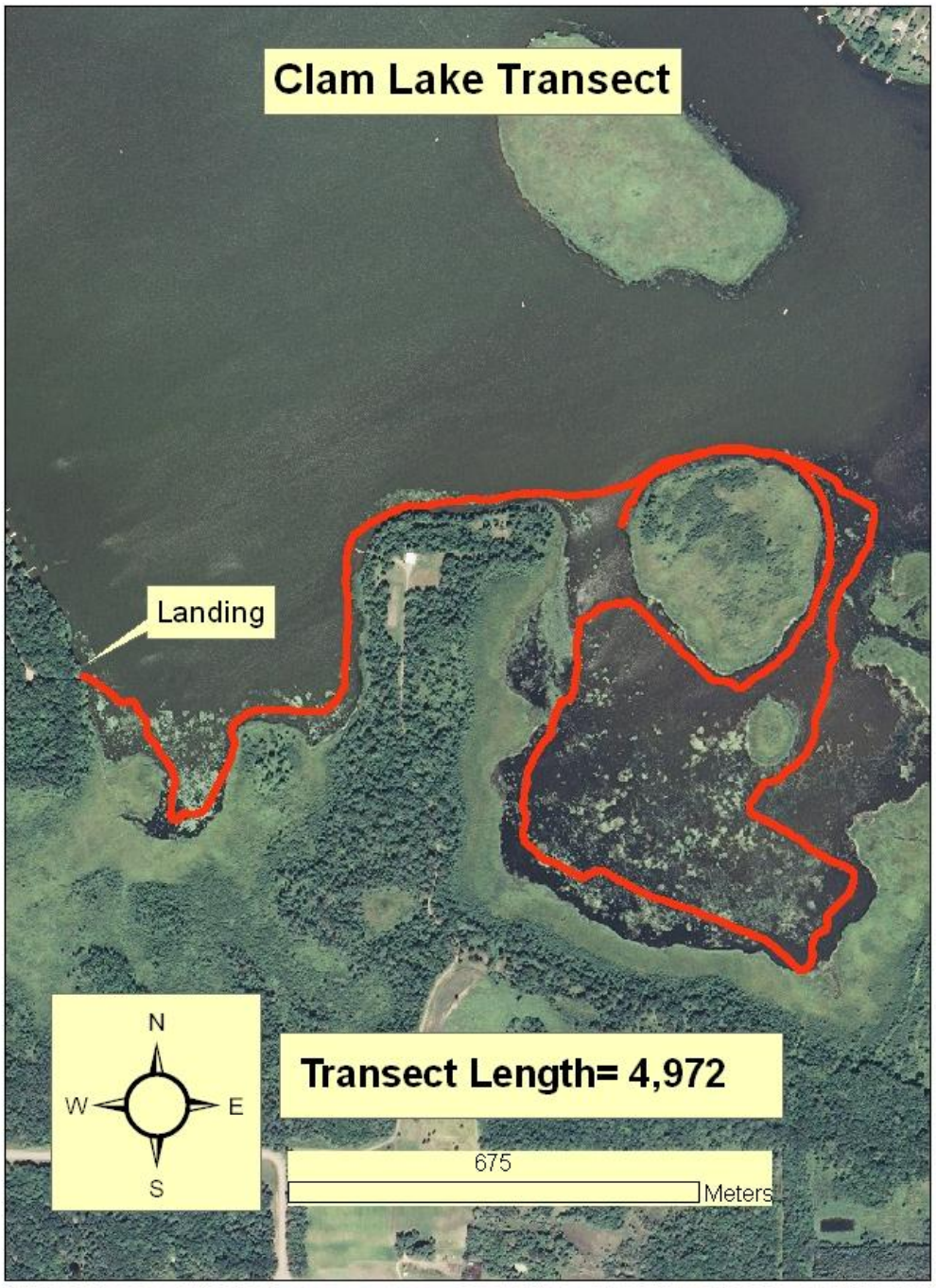

Figure 1. Canoe-survey route used during surveys of Clam Lake, summer, 2010.

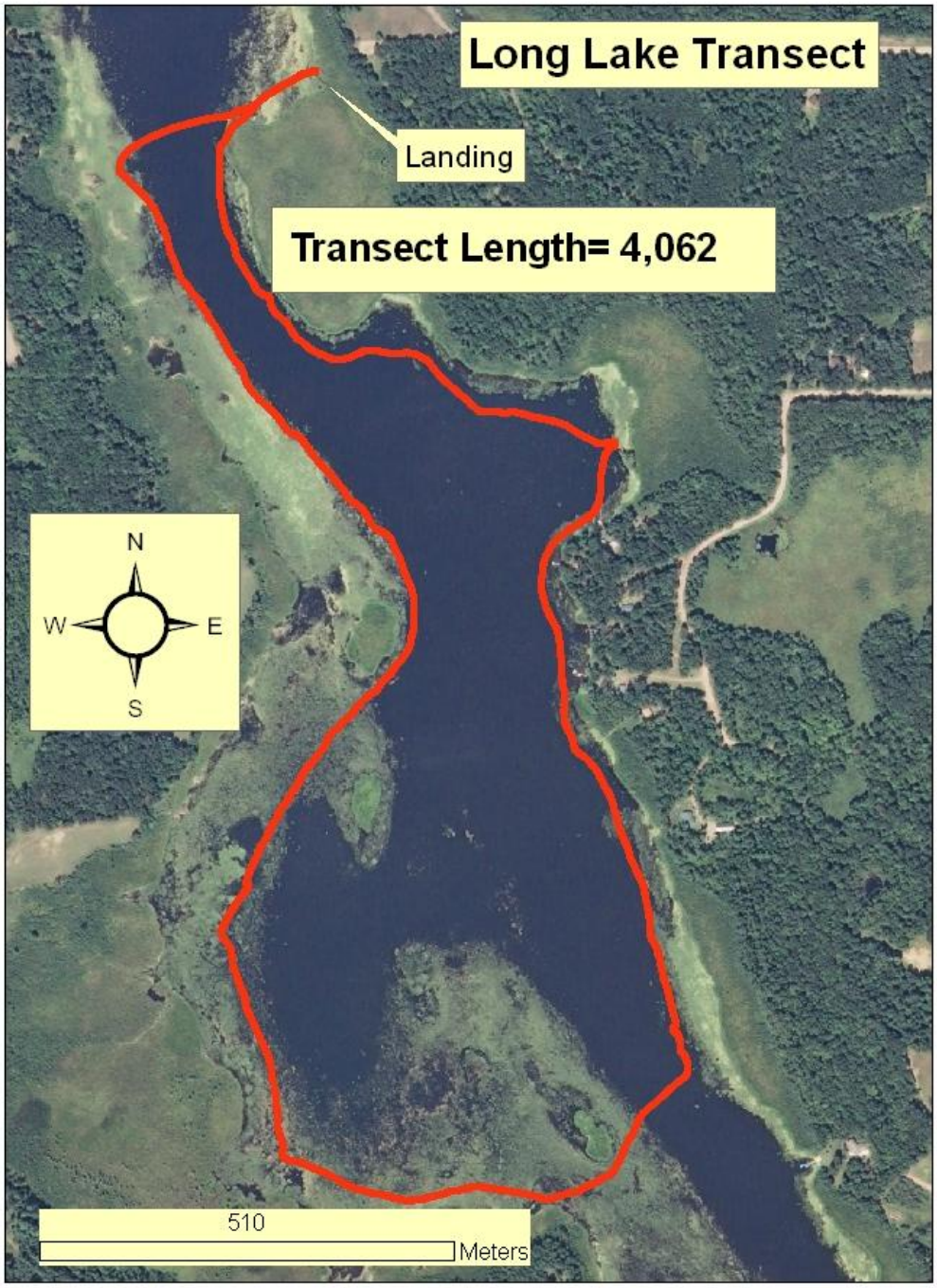

Figure 2. Canoe-survey route used during surveys of Long Lake, summer, 2010.

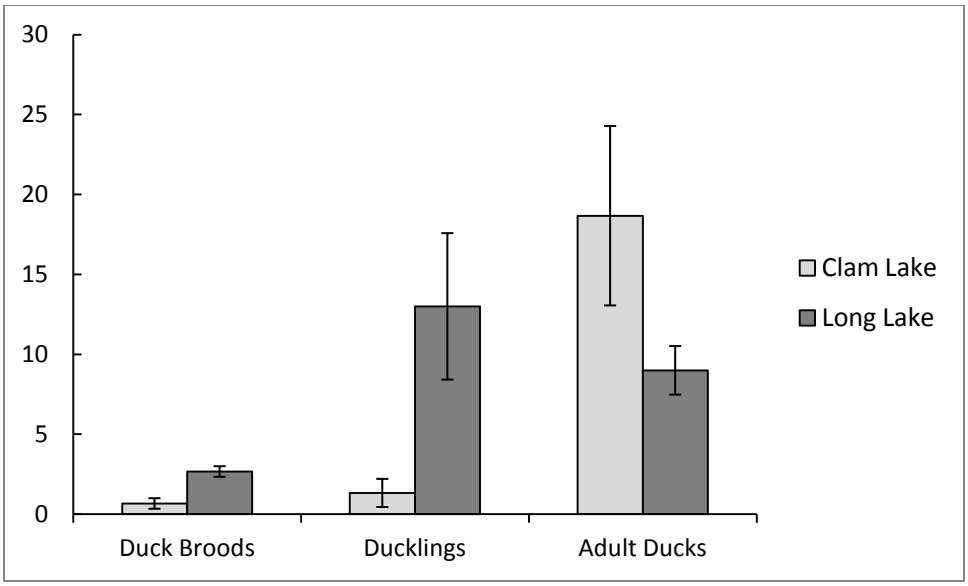

Figure 3. Average numbers (and the standard errors) of duck broods, ducklings, and adult ducks observed at Clam Lake and Long Lake, summer, 2010.

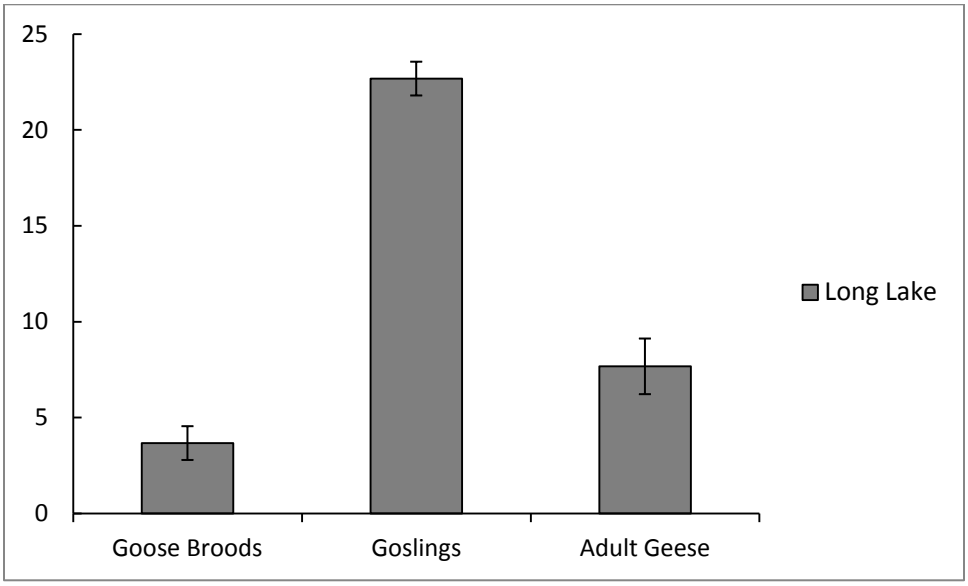

Figure 4. Average numbers (and the standard errors) of Canada goose broods, goslings, and adults observed at Long Lake, summer, 2010; no Canada geese were observed at Clam Lake during this time.

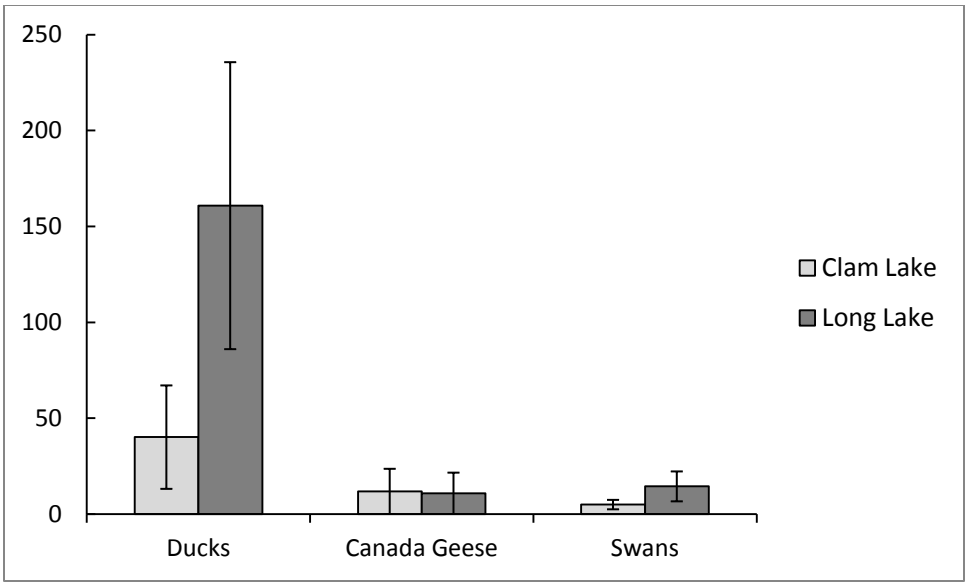

Figure 5. Averages of population estimates (and the standard errors) of ducks, Canada geese, and swans at Clam Lake and Long Lake during Fall, 2010.

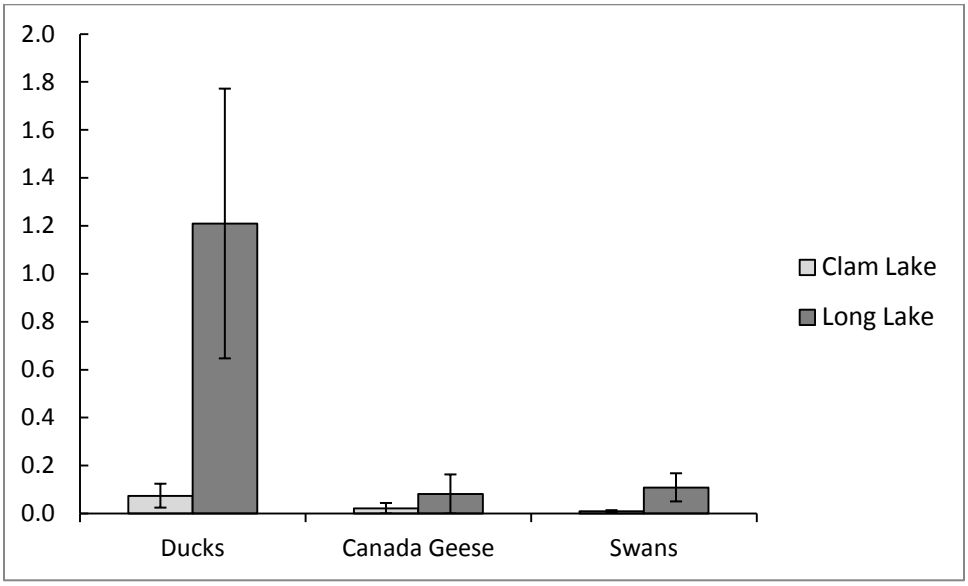

Figure 6. Averages of population density estimates (birds/ha and the standard errors) of ducks, Canada geese, and swans at Clam Lake and Long Lake during Fall, 2010.

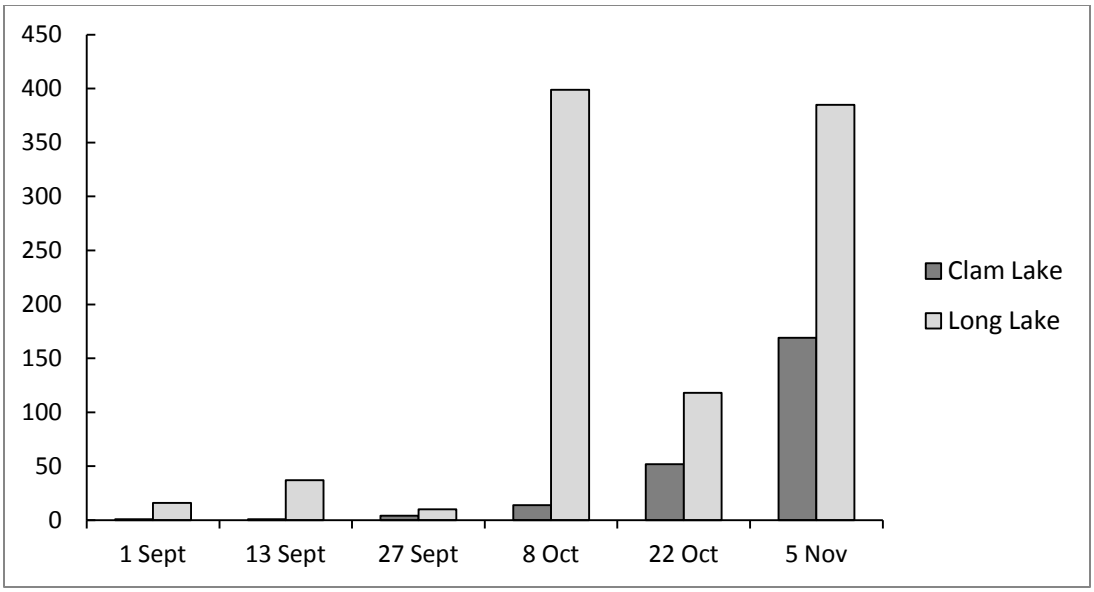

Figure 7. Duck populations observed at Clam Lake and Long Lake during fall, 2010.

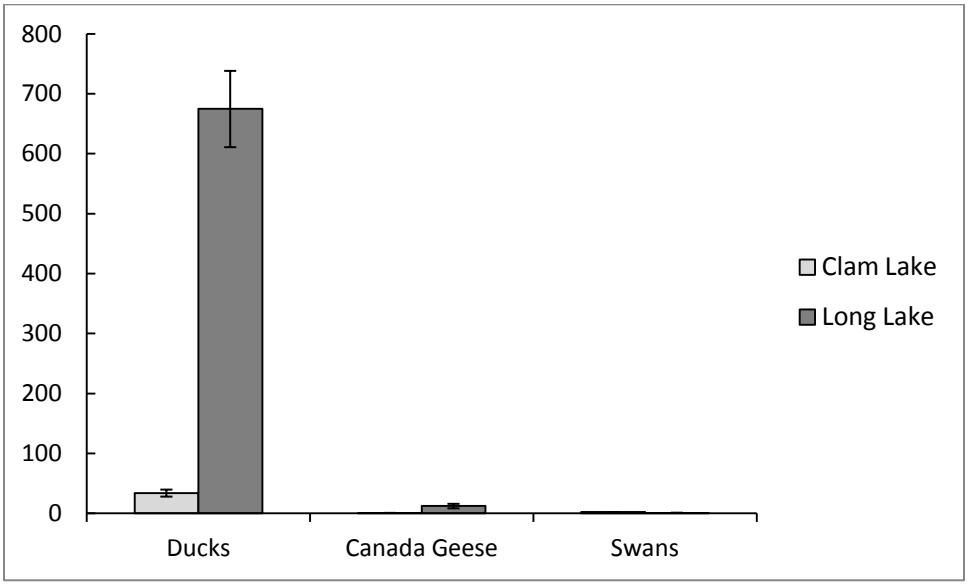

Figure 8. Averages of population estimates (and the standard errors) of ducks, Canada geese, and swans at Clam Lake and Long Lake during Spring Migration, 2011.

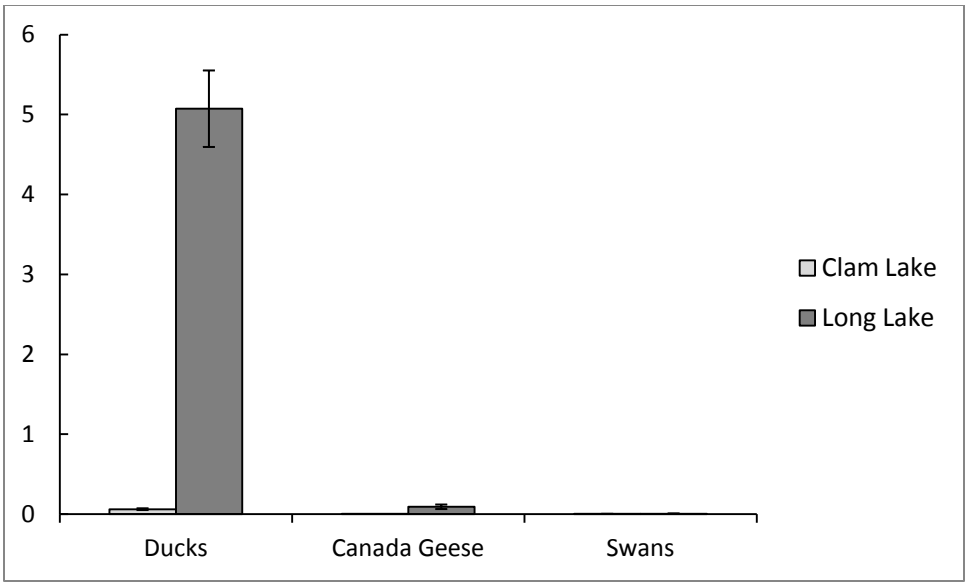

Figure 9. Averages of population density estimates (birds/ha and the standard errors) of ducks, Canada geese, and swans at Clam Lake and Long Lake during Spring Migration, 2011.

Appendix 1. Observations collected during surveys of Clam Lake, 2010-2011.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comment
2-Jun-10	Wood	LM	1			
2-Jun-10	Wood	FM	3			
2-Jun-10	Wood	FM	10			
2-Jun-10	Wood	FM	3			
2-Jun-10	Wood	PA	1			
2-Jun-10	Wood	LF	1			
2-Jun-10	Wood	LF	1			
2-Jun-10	Wood	LF	1			
22-Jun-10	Mallard	FB	1	3	2	
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	PA	1			
22-Jun-10	Wood	PA	1			
22-Jun-10	Wood	PA	1			
22-Jun-10	Wood	FM	3			
22-Jun-10	Wood	FM	4			
22-Jun-10	Wood	LF	1			
22-Jun-10	Wood	UA	1			
22-Jun-10	Wood	UA	4			
13-Jul-10	Trumpeter S	PB	1	5	1C	
13-Jul-10	Wood	PA	1			
13-Jul-10	Wood	BO	1	1	2	
13-Jul-10	Wood	UA	3			
13-Jul-10	Wood	LF	1			
13-Jul-10	Wood	LF	1			
13-Jul-10	Wood	LF	1			
23-Aug-10	GBHeron	MF	1			
23-Aug-10	GBHeron	MF	1			
23-Aug-10	GBHeron	MF	1			
23-Aug-10	gulls	MF	5			
23-Aug-10	Mallard	MF	1			
23-Aug-10	Mallard	MF	1			
23-Aug-10	Mallard	MF	2			

Appendix 1. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comment
23-Aug-10	Trumpeter S	PB	1	4		The family group was bunched making it difficult to count cygnets
23-Aug-10	Wod	MF	1			
23-Aug-10	Wood	MF	1			
1-Sep-10	gulls	MF	4			
1-Sep-10	gulls	MF	12			
1-Sep-10	Trumpeter S	PB	1	4		
1-Sep-10	unk duck	MF	1			
13-Sep-10	b eagle	UA	2			
13-Sep-10	GBHeron	MF	1			
13-Sep-10	gulls	MF	1			
13-Sep-10	gulls	MF	2			
13-Sep-10	Trumpeter S	PB	1	4		
13-Sep-10	unk duck	MF	1			
27-Sep-10	GBHeron	MF	1			
27-Sep-10	gulls	MF	3			
27-Sep-10	unk duck	MF	4			
8-Oct-10	Trumpeter S	UA	2			
8-Oct-10	unk duck	MF	3			
8-Oct-10	unk duck	MF	3			
8-Oct-10	unk duck	MF	8			
22-Oct-10	Can Goose	MF	60			
22-Oct-10	Can Goose	MF	7			
22-Oct-10	Can Goose	MF	4			
22-Oct-10	gulls	MF	8			
22-Oct-10	gulls	MF	10			
22-Oct-10	gulls	MF	1			
22-Oct-10	mallard	MF	10			
22-Oct-10	ringneck	MF	20			
22-Oct-10	Trumeter S	MF	4			
22-Oct-10	Trumpeter S	PB	1	2		2 adults and 2 cygnets
22-Oct-10	Trumpeter S	PB	1	3		
22-Oct-10	Trumpeter S	UA	1			
22-Oct-10	Trumpeter S	UA	4			
22-Oct-10	unk divers	MF	9			diving ducks of some sort
22-Oct-10	unk duck	MF	4			
22-Oct-10	unk duck	MF	2			
22-Oct-10	unk duck	MF	5			

Appendix 1. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comment
22-Oct-10	unk duck	MF	2			
5-Nov-10	b eagle	UA	2			
5-Nov-10	bufflehead	MF	10			
5-Nov-10	bufflehead	MF	20			
5-Nov-10	bufflehead	MF	8			
5-Nov-10	bufflehead	MF	25			
5-Nov-10	bufflehead	MF	6			
5-Nov-10	bufflehead	MF	50			
5-Nov-10	c merg	MF	2			
5-Nov-10	gulls	MF	7			
5-Nov-10	gulls	MF	1			
5-Nov-10	gulls	MF	10			
5-Nov-10	gulls	MF	1			
5-Nov-10	gulls	MF	1			
5-Nov-10	gulls	MF	1			
5-Nov-10	gulls	MF	1			
5-Nov-10	h merg	MF	4			
5-Nov-10	h merg	MF	2			
5-Nov-10	Mallard	MF	4			
5-Nov-10	unk divers	MF	10			
5-Nov-10	unk divers	MF	10			
5-Nov-10	unk divers	MF	10			
5-Nov-10	unk divers	MF	8			
14-Apr-11	b eagle	UA	1			
14-Apr-11	bufflehead	MF	8			
14-Apr-11	bufflehead	MF	6			
14-Apr-11	c merg	MF	1			
14-Apr-11	c merg	MF	3			
14-Apr-11	Mallard	PA	1			
14-Apr-11	Mallard	PA	1			
14-Apr-11	Mallard	LM	2			
14-Apr-11	Trumpeter S	PA	1			
14-Apr-11	unk divers	MF	10			
14-Apr-11	unk divers	MF	5			
14-Apr-11	unk divers	MF	5			
14-Apr-11	unk duck	MF	1			
22-Apr-11	b eagle	UI	1			
22-Apr-11	C Goose	MF	1			
22-Apr-11	c merg	MF	1			

Appendix 1. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comment
22-Apr-11	c merg	PA	1			
22-Apr-11	c merg	MF	5			
22-Apr-11	c merg	MF	5			
22-Apr-11	GBHeron	MF	1			
22-Apr-11	GBHeron	MF	2			
22-Apr-11	h merg	PA	1			
22-Apr-11	loon	MF	1			
22-Apr-11	loon	MF	1			
22-Apr-11	loon	MF	1			
22-Apr-11	Mallard	LM	1			
22-Apr-11	Mallard	PA	1			
22-Apr-11	Trumpeter S	PA	1			
22-Apr-11	unk divers	MF	1			
22-Apr-11	unk duck	MF	6			
22-Apr-11	w pelican	MF	18			
3-May-11	b eagle	UA	1			
3-May-11	b eagle	UA	2			
3-May-11	bufflehead	LM	1			
3-May-11	C Goose	MF	1			
3-May-11	c merg	MF	12			
3-May-11	c merg	MF	4			
3-May-11	c merg	MF	5			
3-May-11	cormorant	MF	2			
3-May-11	loon	MF	1			
3-May-11	loon	MF	1			
3-May-11	mallard	LM	1			
3-May-11	mallard	LM	1			
3-May-11	Trumpeter S	PA	1			on nest
3-May-11	unk duck	MF	2			
3-May-11	unk duck	MF	4			
3-May-11	wood	PA	1			
12-May-11	b eagle	UA	1			
12-May-11	C Goose	PA	1			
12-May-11	cormorant	MF	6			
12-May-11	GBHeron	MF	2			
12-May-11	h merg	UA	1			
12-May-11	Trumpeter S	PA	1			on nest

Appendix 1. Concluded.

[1]BO = brood without any adults, FB= Female with brood, FM = males in flocks (any size), LF = lone female, LM = lone male, MF = mixed flock, PA = pair, PB = pair with brood, UA = unknown sex adult, UI = unknown sex immature, and UU = unknown sex, unknown age.

Apendix 2. Observations collected during surveys of Long Lake, 2010-2011.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comment
2-Jun-10	Can Goose	PB	1	5	1C	
2-Jun-10	Can Goose	PB	1	5	1C	
2-Jun-10	Can Goose	PB	1	8	1B	
2-Jun-10	Can Goose	PB	1	3	1B	
2-Jun-10	Mallard	FB	1	3	2	
2-Jun-10	Wood	LF	1			
2-Jun-10	Wood	LF	1			
2-Jun-10	Wood	LF	1			
2-Jun-10	Wood	FB	1	7	1A	
2-Jun-10	Wood	FB	1	12	1A	
22-Jun-10	Can Goose	PB	1	3	3	
22-Jun-10	Can Goose	GB	4	20	3	gang brood with 4 adults and 20 young; may have been more adults
22-Jun-10	Wood	FB	1	2	2	
22-Jun-10	Wood	FB	1	5	1C	
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LM	1			
22-Jun-10	Wood	LF	1			
22-Jun-10	Wood	FF	2			
13-Jul-10	Can Goose	GB	6	17	3	gang brood with 6 adults and 17 young; difficult to distinguish young from adults; looked maybe like 3 broods combined
13-Jul-10	Can Goose	GB	4	7	3	gang brood with 4 adults and 7 young; difficult to distinguish young from adults; looked maybe like 2 broods combined
13-Jul-10	Gadwall	UA	3			
13-Jul-10	Ringneck	LM	1			
13-Jul-10	Wood	LM	1			
13-Jul-10	Wood	PA	1			
13-Jul-10	Wood	BO	1	1	3	
13-Jul-10	Wood	BO	1	6	1A	
13-Jul-10	Wood	FB	1	1	3	
13-Jul-10	Wood	LF	1			
13-Jul-10	Wood	UA	1			
13-Jul-10	Wood	UA	1			
23-Aug-10	GB Heron	MF	1			

Appendix 2. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comments
23-Aug-10	GB Heron	MF	1			
23-Aug-10	gulls	MF	1			
23-Aug-10	shore bird	MF	1			
23-Aug-10	unk ducks	MF	7			
1-Sep-10	BWT	MF	1			
1-Sep-10	GB Heron	MF	3			
1-Sep-10	GB Heron	MF	2			
1-Sep-10	gulls	MF	7			
1-Sep-10	gulls	MF	15			
1-Sep-10	Mallard	MF	1			
1-Sep-10	Trumpeter S	MF	3			
1-Sep-10	unk ducks	MF	4			
1-Sep-10	unk ducks	MF	4			
1-Sep-10	unk ducks	MF	2			
1-Sep-10	unk ducks	MF	1			
1-Sep-10	unk ducks	MF	2			
1-Sep-10	Wood	MF	1			
13-Sep-10	b eagle	UA	1			
13-Sep-10	BWT	MF	25			
13-Sep-10	BWT	MF	8			
13-Sep-10	gulls	MF	5			
13-Sep-10	unk ducks	MF	2			
13-Sep-10	unk ducks	MF	2			
27-Sep-10	gulls	MF	1			
27-Sep-10	gulls	MF	4			
27-Sep-10	Trumpeter S	MF	5			flock of 5 adult swans
27-Sep-10	unk ducks	MF	1			
27-Sep-10	unk ducks	MF	3			
27-Sep-10	unk ducks	MF	6			
8-Oct-10	b eagle	UI	1			
8-Oct-10	BWT	MF	6			
8-Oct-10	BWT	MF	14			
8-Oct-10	BWT	MF	270			
8-Oct-10	Mallard	LM	1			
8-Oct-10	Ringneck	MF	2			
8-Oct-10	Trumpeter S	UA	2			
8-Oct-10	unk ducks	MF	20			
8-Oct-10	unk ducks	MF	10			

Appendix 2. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comments
8-Oct-10	unk ducks	MF	7			
8-Oct-10	unk ducks	MF	5			
8-Oct-10	unk ducks	MF	30			
8-Oct-10	unk ducks	MF	6			
8-Oct-10	unk ducks	MF	2			
8-Oct-10	unk ducks	MF	25			
8-Oct-10	Wood	LM	1			
22-Oct-10	b eagle	UA	1			
22-Oct-10	Can Goose	MF	65			
22-Oct-10	mallard	MF	8			
22-Oct-10	unk ducks	MF	15			
22-Oct-10	unk ducks	MF	15			
22-Oct-10	unk ducks	MF	20			
22-Oct-10	unk ducks	MF	40			
22-Oct-10	unk ducks	MF	20			
22-Oct-10	unk swans	MF	10			possibly tundra swans
22-Oct-10	unk swans	MF	22			possibly tundra swans
5-Nov-10	bufflehead	MF	45			
5-Nov-10	Trumpeter S	MF	22			had family of 2 parents and 4 cygnets, and family of 2 cygnets and 2 adults
5-Nov-10	unk ducks	MF	300			
5-Nov-10	unk ducks	MF	10			
5-Nov-10	unk ducks	MF	30			
5-Nov-10	unk swans	MF	10			
5-Nov-10	unk swans	MF	13			
14-Apr-11	b eagle	UA	1			
14-Apr-11	bufflehead	MF	25			
14-Apr-11	bufflehead	MF	3			
14-Apr-11	bufflehead	MF	3			
14-Apr-11	Can Goose	PA	2			
14-Apr-11	Can Goose	PA	1			
14-Apr-11	H merg	PA	1			
14-Apr-11	Mallard	PA	1			
14-Apr-11	Mallard	LM	1			
14-Apr-11	Ringneck	MF	200			
14-Apr-11	Ringneck	PA	1			
14-Apr-11	Ringneck	PA	1			
14-Apr-11	Ringneck	MF	7			

Appendix 2. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comments
14-Apr-11	Ringneck	MF	100			
14-Apr-11	Ringneck	MF	200			
14-Apr-11	scaup	MF	4			
14-Apr-11	scaup	MF	20			
14-Apr-11	unk divers	MF	25			
14-Apr-11	unk divers	MF	7			
14-Apr-11	unk divers	MF	30			
14-Apr-11	unk divers	MF	30			
14-Apr-11	unk divers	MF	25			
14-Apr-11	unk divers	MF	4			
14-Apr-11	unk divers	MF	7			
14-Apr-11	unk divers	MF	40			
14-Apr-11	unk ducks	PA	1			
14-Apr-11	Wood	PA	1			
14-Apr-11	Wood	MF	6			
22-Apr-11	bufflehead	MF	2			
22-Apr-11	Can Goose	MF	1			
22-Apr-11	Can Goose	MF	2			
22-Apr-11	Can Goose	MF	6			
22-Apr-11	Can Goose	MF	1			
22-Apr-11	Can Goose	PA	1			
22-Apr-11	Cormorant	MF	4			
22-Apr-11	Mallard	PA	1			
22-Apr-11	Ringneck	MF	4			
22-Apr-11	Ringneck	MF	25			
22-Apr-11	Ringneck	MF	6			
22-Apr-11	Ringneck	MF	220			
22-Apr-11	Ringneck	MF	40			
22-Apr-11	Ringneck	MF	3			
22-Apr-11	Ringneck	MF	2			
22-Apr-11	Ringneck	MF	2			
22-Apr-11	Ringneck	MF	2			
22-Apr-11	Ringneck	MF	3			
22-Apr-11	Ringneck	MF	2			
22-Apr-11	Ringneck	MF	50			
22-Apr-11	Ringneck	MF	85			
22-Apr-11	Ringneck	MF	60			
22-Apr-11	Ringneck	MF	30			

Appendix 2. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comments
22-Apr-11	Ringneck	MF	100			
22-Apr-11	Ringneck	MF	10			
22-Apr-11	Ringneck	MF	40			
22-Apr-11	scaup	LM	1			
22-Apr-11	scaup	MF	12			
22-Apr-11	scaup	LM	1			
22-Apr-11	scaup	MF	25			
22-Apr-11	Trumpeter S	PA	1			
3-May-11	bufflehead	MF	20			
3-May-11	bufflehead	MF	2			
3-May-11	C Goose	MF	2			
3-May-11	C Goose	MF	1			
3-May-11	C Goose	MF	3			
3-May-11	C Goose	UA	1			
3-May-11	C Goose	MF	2			
3-May-11	C Goose	MF	6			
3-May-11	C Goose	MF	2			
3-May-11	C Goose	MF	2			
3-May-11	GB Heron	MF	1			
3-May-11	mallard	MF	2			
3-May-11	mallard	MF	2			
3-May-11	mallard	MF	7			
3-May-11	mallard	MF	2			
3-May-11	mallard	MF	6			
3-May-11	mallard	MF	2			
3-May-11	mallard	MF	2			
3-May-11	Mallard	MF	4			
3-May-11	Ringneck	MF	80			
3-May-11	Ringneck	MF	20			
3-May-11	Ringneck	MF	100			
3-May-11	Ringneck	MF	75			
3-May-11	Ringneck	MF	8			
3-May-11	Ringneck	MF	8			
3-May-11	Ringneck	MF	4			
3-May-11	scaup	MF	10			
3-May-11	scaup	MF	50			
3-May-11	scaup	MF	12			
3-May-11	scaup	MF	10			

Appendix 2. Continued.

Date	Species	Obs Type[1]	Count	Brood Size	Brood Age Class	Comments
3-May-11	scaup	MF	25			
3-May-11	scaup	MF	12			
3-May-11	unk ducks	MF	7			
3-May-11	unk ducks	MF	10			
3-May-11	unk ducks	MF	2			
3-May-11	unk ducks	MF	45			
3-May-11	unk ducks	MF	10			
3-May-11	unk ducks	MF	10			
3-May-11	wood	LM	1			
12-May-11	C Goose	UA	1			
12-May-11	C Goose	MF	2			
12-May-11	C Goose	UA	1			
12-May-11	C Goose	UA	1			
12-May-11	C Goose	PA	1			
12-May-11	C Goose	MF	2			

[1]BO = brood without any adults, FB= Female with brood, FM = males in flocks (any size), LF = lone female, LM = lone male, MF = mixed flock, PA = pair, PB = pair with brood, UA = unknown sex adult, UI = unknown sex immature, and UU = unknown sex, unknown age.