COMMON LOON MONITORING SUMMARY REPORT

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2018

Kezar Lake Watershed

KEZAR LAKE WATERSHED

Common Loon Monitoring Summary Report

SUBMITTED TO:
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Loon Conservation Associates (LCA) is dedicated to the protection and welfare of loons through collaboration, education, and the implementation of successful conservation actions.

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1.0 EXECUTIVE SUMMARY

Supported by a grant from the Stephen & Tabitha King (STK) Foundation, Loon Conservation Associates (LCA) spearheaded a collaborative study with the Kezar Lake Watershed Association (KLWA), conducting comprehensive common loon (*Gavia immer*) monitoring surveys in the Kezar Lake watershed. Loons are a key indicator of aquatic integrity for lakes. This initiative provides an opportunity to confirm the current population status, identify major threats and create long-term, sustainable conservation solutions that strengthen the current population.

Engaging and training local volunteers to conduct surveys with professional guidance from LCA was a key component of the project. More than 15 dedicated and passionate volunteers helped conduct over 500 independent surveys between May 15 and August 30, 2018. Results published in this report are taken from data gathered by LCA and KLWA members and volunteers.

In 2018, seven lakes were surveyed in the watershed. Based on well-defined criteria for an established loon territory, a total of 15 territorial pairs were documented, and 13 of these pairs nested. From seven successful nests, 10 chicks hatched and five survived to > six weeks of age – an age defined as fledging for modeling purposes. Overall productivity in the Kezar Lake watershed in 2018 was 0.33 fledged young per territorial pair.

Historically, nesting loons across their breeding range have benefited from the use of rafts, with a measurably higher success rate on rafts when compared to natural nests. In 2018, using knowledge and expertise from LCA, some rafts were moved to new locations. This resulted in three nesting pairs using rafts – a first for the watershed. All three pairs on rafts were successful hatching one or two chicks (100%), compared to 12 natural nests, with four successes (33%).

Using traditional night-lighting techniques, a total of eight adult loons were captured and banded in 2018. Six of the adults were captured and banded on Kezar Lake; two were captured and banded on Horseshoe Pond.

To enhance research of nesting loons, a battery powered trail camera was deployed on two nesting pairs on Kezar Lake (Outlet River Marsh & Rock Island). The camera successfully captured day and night images of incubation behaviors, disturbance, predatory threats and chick hatching in both territories.

2.0 INTRODUCTION

Anecdotal evidence from casual surveys performed by KLWA members and volunteers over the past decade indicate the productivity of loons in the Kezar Lake watershed may be well below the 0.48 threshold needed to sustain a healthy loon population. Poor reproductive success is likely attributed to one or more causes, including; predation, human disturbance, water level fluctuation impacts, as well as contaminants, including lead (Pb) and mercury (Hg), and wintering hazards such as commercial fishing nets and oil spills.

In the Kezar Lake watershed, occasional, successful breeding pairs have been confirmed in recent years on a small amount of the suitable habitat on Kezar Lake, and on Horseshoe Pond and Heald Pond. For unknown reasons, loons are not occupying and breeding, successfully, on much of Kezar Lake, and other small lakes remain unoccupied, or unproductive.

Because the loon breeding population in the Kezar Lake Watershed is small and vulnerable to multiple anthropogenic stressors, coupled with the potential impacts of climate change, more information is needed on the individual performance (i.e., reproductive success) and specific movements of individuals to ensure long-term sustainability.

3.0 OBJECTIVES

Collaborate with KLWA to:

1. Conduct weekly, comprehensive productivity surveys to identify territorial pairs, nesting pairs, nest success/failure, number of chicks hatched, and number of chicks fledged;
2. Develop a color-banded population to determine demographic parameters of interest (individual reproductive performance, rate of return by adults to their breeding territory and mate fidelity) in breeding common loons in KLWA watershed;
3. Consult on deployment and placement of artificial nesting rafts, where appropriate, to increase nest success rates, and minimize nest loss due to flooding and predation;
4. Introduce the use of nest monitoring cameras to better assess nest disturbance, nesting behaviors, and potential causes of nest failure, and
5. Collect Hg and Pb levels in breeding loons to evaluate contaminant risk.

4.0 STUDY AREA

This study is limited to lakes of appropriate size, and with suitable habitat in the Kezar Lake watershed in Oxford County, Maine (Figure 1). The specific lakes are: Kezar Lake, Horseshoe Pond, Farrington Pond, Cushman Pond, Heald Pond, Bradley Pond, and Trout Pond.

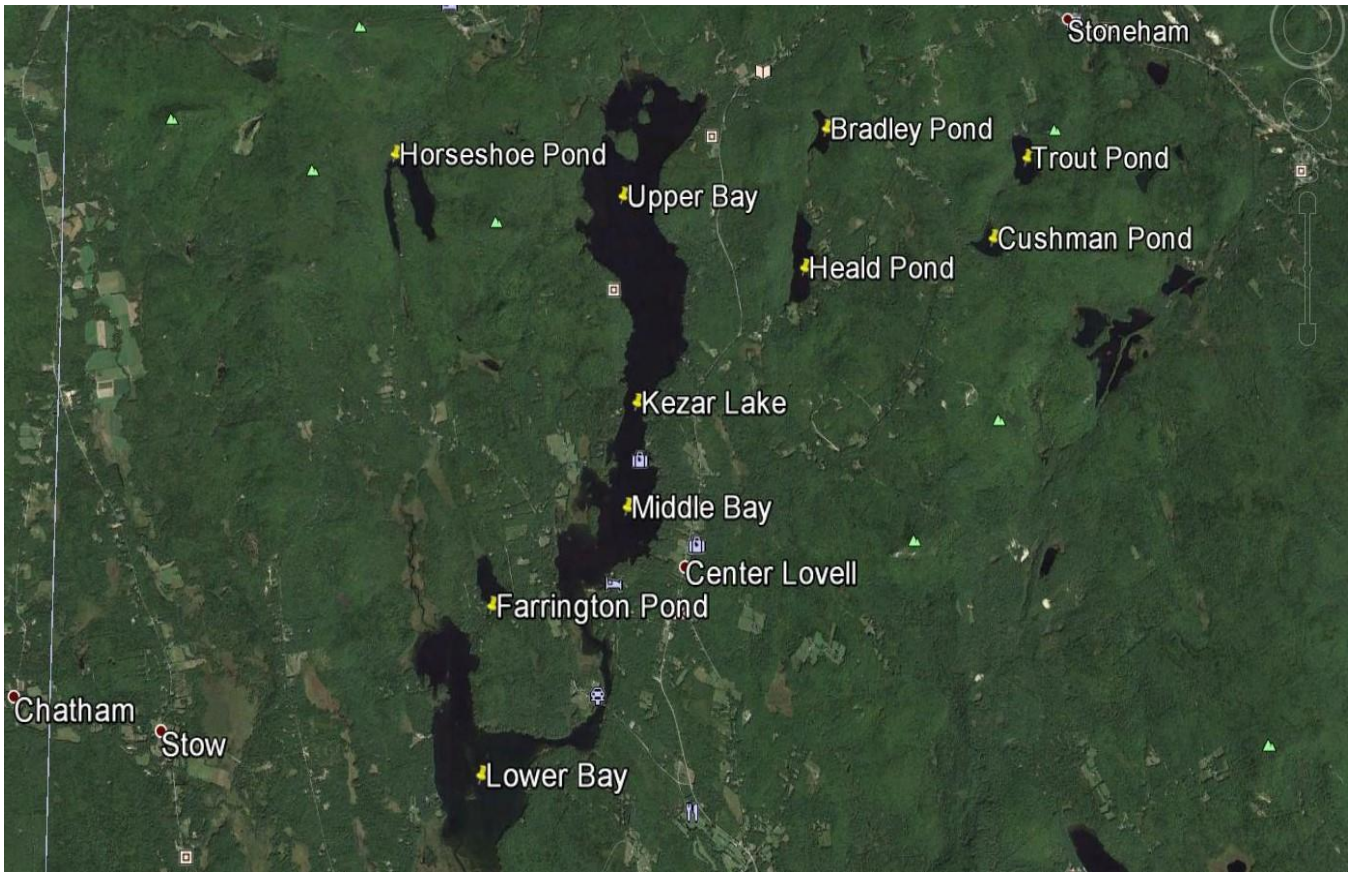

Figure 1. The Kezar Lake watershed study area. Courtesy of Google Earth Pro.

5.0 METHODS

5.1 GROUND SURVEYS

All known or potential loon territories and surrounding areas were surveyed by LCA and KLWA members, and volunteers, using binoculars and/or a spotting scope. Surveys were conducted by boat, or alternatively from shore. Surveys began in May and concluded in August. Lakes occupied by territorial pairs were prioritized and surveyed weekly at a minimum. To minimize impacts on the loons, surveys were conducted from the greatest distance possible. If nesting evidence was obscured by vegetation, it necessitated searching for nest evidence by foot. All known nesting sites were checked regularly for nesting evidence.

Loon territories were delineated according to observed territorial behavior by a loon pair such as close physical association, defensive posturing, and calling along borders. Territories are used by pairs for feeding, resting, breeding, nesting and chick rearing. They are also protected by resident pairs against incursion by other loons (and sometimes waterfowl) for a minimum of four weeks. Territories are used as a unit of reference in describing loon breeding activity and are recognized as being either established or transitional. Established territories have consistent occupancy for at least three seasons; transitional territories exhibit inconsistent occupation.

Nesting pairs were defined as those laying at least one egg; a nesting attempt was evidenced by a constructed nest dish or scrape with at least one egg present or fresh eggshell fragments. Successful nesting pairs hatched at least one chick. Causes of nest failure were attributed according to evidence observed.

Chicks hatched were recorded as those that hatched completely out of their eggs, not necessarily departing from the nest. For this report, we define the terms chick and fledgling as follows: chicks refer to loon young ≤ six weeks of age post-hatching and fledglings or "fledged young" refer to loon young > six weeks of age. Sub-adult loons in alternate plumage are recorded as immatures (ages 1-2). The number of loon chicks to survive past six weeks of age, were assumed to have fledged.

5.2 ARTIFICIAL NESTING ISLANDS

Rafts were floated in territories that met specific criteria for flotation; including knowledge of 1) wind and wave action patterns relative to each territory, 2) loon territorial boundaries and proximity to neighboring territories, 3) previous traditional and non-traditional nest site locations, 4) boat traffic patterns relative to the specific territory, and 5) shoreline activities.

5.3 LOON CAPTURE AND SAMPLE COLLECTION

Loons were captured using well-established night lighting and playback techniques. Adult and juvenile birds were leg banded with U.S. Geological Survey (USGS) aluminum bands, and a unique combination of plastic colored bands, enabling identification of individual birds to be made from a distance in future observations. Chicks were not banded if their legs were too small to hold adult-size bands.

Captured loons were weighed, two second secondary feathers were collected by clipping at the base of the quill, and blood samples were taken from the metatarsal vein for contaminant analysis. All sampling was accomplished using non-lethal methods.

5.4 USE OF NEST CAMERAS

A battery powered trail camera (Browning Dark Ops HD Pro, Model # BTC-6HDP) was deployed by LCA and KLWA staff. The camera was first set up in the Rock Island territory of Kezar Lake, and later moved to the Outlet River Marsh territory after the nest at Rock Island had a successful hatch.

The camera was installed after nest building and incubation was confirmed. It was mounted on a metal pole driven into the bottom of the lake, approximately 10-20 feet from the nest. The camera was programmed in motion detection mode, with a three-picture trigger and a two-minute delay between triggers. This setting was chosen to preserve battery life and memory.

5.5 DEFINING REPRODUCTIVE SUCCESS

Reproductive success was evaluated according to four parameters; 1) nesting frequency, 2) hatching success, 3) chick survivorship, and 4) overall productivity. Nesting frequency was defined as the number of nesting pairs per total territorial pairs. This measure indicates the percent of the total potential breeding population that attempts to reproduce each season. The rate of success by these pairs, or hatching success, was measured through the number of chicks hatched by these pairs. Chick survivorship was defined as the number of chicks surviving divided by the number of chicks hatched. Overall productivity is a combination of the prior three parameters and measured through fledged young per territorial pair (CS/TP).

6.0 RESULTS

6.1 PRODUCTIVITY

During the 2018 field season, seven lakes were surveyed in the Kezar Lake watershed. Fifteen territorial pairs were recorded occupying six of the seven surveyed lakes. Of the 15 pairs, 13 nested, and seven successful nests hatched 10 chicks; five survived to fledge. This yielded a nesting frequency of 0.87, a hatching success of 0.77, and chick survival of 0.50. Overall productivity was 0.33 fledged young per territorial pair (Table 1, Figure 2). A total of seven nest failures were recorded with one case of abandonment (Kezar Lake, SE Island), and six cases of confirmed or suspected mammalian predation (Figure 3). The nesting pairs at Kezar Lake, MB Narrows, and Cushman Pond each failed twice.

Table 1. Common Loon population and productivity, Kezar Lake watershed, 2018.

Population		Reproductive Success	
Territorial Pairs	15	Nesting Frequency	0.87
Nesting Pairs	13	Hatching Success	0.77
Chicks Hatched	10	Chick Survivorship	0.50
Chicks Surviving	5	Overall Productivity	0.33

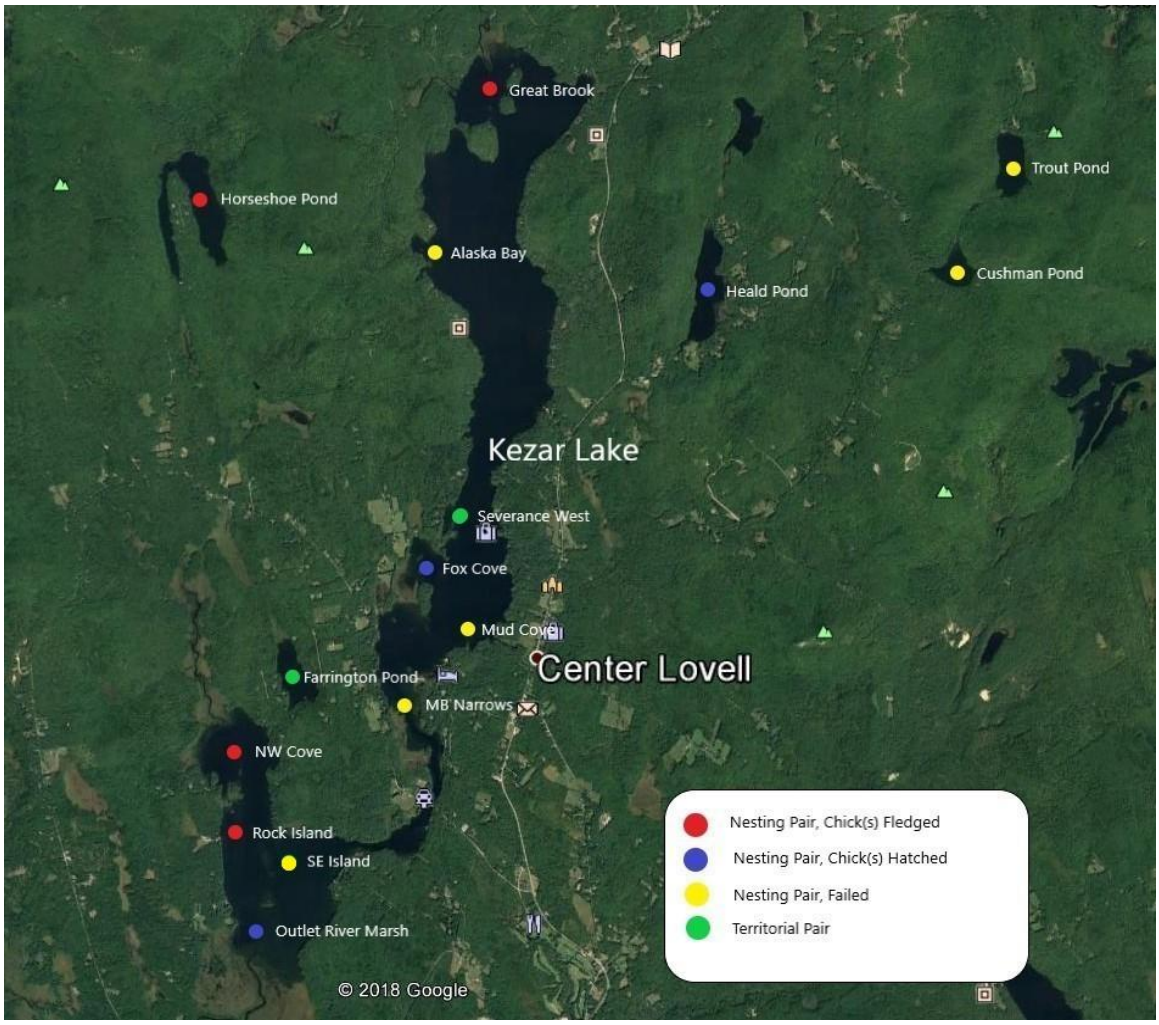

Figure 2. Common Loon population and productivity, Kezar Lake watershed, 2018. Courtesy of Google Earth Pro.

Figure 3. Mammalian predation, Kezar Lake, Alaska Bay, 2018.

6.2 USE OF ARTIFICIAL NESTING ISLANDS (RAFTS)

A total of 10 rafts were floated in the watershed – Kezar Lake (8), Horseshoe Pond (1), Cushman Pond (1). On Kezar Lake, two of the eight rafts were used for nesting (25%), as was the raft on Horseshoe Pond. The raft on Cushman Pond was moved there after two nest failures (predation), with the hope of getting the loons acclimated to it for use in 2019. A total of five chicks were hatched from rafts (50% of total hatches) on these two water bodies. Four of the five chicks which fledged (80% of total chicks fledged) were hatched on rafts (Table 2).

Table 2. Comparative loon nesting summary: raft vs. natural nests, 2018.

Raft Nests	**2018**	**Natural Nests**	**2018**
Number of Nest Attempts	3	Number of Nest Attempts	12
Number of Successful Nest Attempts	3	Number of Successful Nest Attempts	3
Success Rate	**100%**	**Success Rate**	**25%**
Chicks Hatched from Rafts	5	Chicks Hatched from Natural Sites	5
Total Chicks Fledged	4	Total Chicks Fledged	1
Contribution to Productivity*	**80%**	**Contribution to Productivity***	**20%**

** Percentage of total chicks fledged.*

6.3 CAPTURE AND BANDING

In 2018, a total of eight adult loons were captured and banded; six on Kezar Lake and two on Horseshoe Pond (Table 3).

Table 3. Common loons captured and banded, Kezar Lake watershed, 2018.

Lake Name	Territory	Band #	Year	Sex	Age	Left Leg Top	Left Leg Bottom	Right Leg Top	Right Leg Bottom
Kezar	NW Cove	0938-78850	2018	F	ATY	Yellow Stripe	Green	Green Dot	Silver
Kezar	NW Cove	0649-08855	2018	M	ATY	Red Stripe	White	Green Dot	Silver
Kezar	Fox Cove	0649-08853	2018	F	ATY	Green	Red	Silver	Green Dot
Kezar	Fox Cove	0938-78831	2018	M	ATY	Yellow Stripe	White	Green Dot	Silver
Kezar	Rock Island	1118-15849	2018	F	ATY	Yellow Dot	Red	Green Dot	Silver
Kezar	Rock Island	1118-15844	2018	M	ATY	Red Stripe	White	Red	Silver
Horseshoe	Horseshoe	1118-15842	2018	M	ATY	Orange Stripe	Green	Red	Silver
Horseshoe	Horseshoe	0938-78836	2018	F	ATY	Yellow Stripe	Green	Silver	Red

6.4 CONTAMINANT ANALYSIS

Results reported here include samples obtained from an adult male (Kezar – Great Brook) and a chick (Kezar – Alaska Bay) in 2017, along with the eight loons which were sampled in 2018 (Table 5). All blood and feather samples, and whole eggs collected were processed and analyzed at Biodiversity Research Institute's (BRI) laboratory in Portland, Maine.

To assess the potential impacts of mercury (Hg) and lead (Pb) on loons, known baseline effects levels can be separated into risk categories based on studies from BRI and their collaborators.

Low risk indicates background Hg concentrations that have no known impact on wildlife. Loons that fall within the moderate risk category have elevated Hg concentrations but their impact levels on individuals remain undetermined. Loons that are in the high-risk category are exposed to toxic levels of environmental Hg that statistically show physiological, behavioral, and reproductive impacts. The extremely high Hg category is based on in-field observable impacts on loons and other birds (Evers

et al. 2008). The high and extremely high categories therefore have Hg at levels of concern (Table 4).

Table 4. Risk categories for assessing Hg and Pb impacts, reported as parts per million (ppm) in wet weight (ww) for blood and egg, and fresh weight (fw) for feathers, for the common loon.

Contaminant and Matrix	Low	Moderate	High	Endpoint	Reference
Mercury (Hg)					
Adult (blood)	0 to 1.0	1.0 to 3.0	> 3.0	40% fewer fledged young	Burgess and Meyer 2008; Evers et al. 2008
Adult (feather)	0 to 9.0	9.0 to 40.0	> 40.0	Significant asymmetry	Evers et al. 2008
Juvenile (blood)	0 to 0.1	0.1 to 0.3	> 0.3	Lower survival	Evers et al. 2010; unpubl. data
Egg	0 to 0.7	0.7 to 1.3	> 1.3	Significantly smaller egg and reduced hatchability	Evers et al. 2003
Lead (Pb)					
Blood	0 to 0.12	0.12 to 0.24	> 0.24	Probable death	Franson et al. 2003; BRI unpubl. data

6.4.1 BLOOD

Blood Hg results are reported in parts per million (ppm) wet weight (ww). Mercury levels in the blood of the nine adult loons sampled ranged from 0.822 to 2.962 ppm (ww), and the mercury level in the blood of the chick was 0.169 (Table 5). All of the samples fell within the low or moderate risk ranges for reduced nesting success, although two samples (Great Brook male & Fox Cove male) were on the high end of the moderate risk range.

Lead levels in all the adults fell below the minimum detection limit of 3.3ug/dl. The chick blood was not tested for lead (Table 5).

Table 5. Results of Hg in blood (ppm, ww), 2017 & 2018.

Date Collected	Lake	Territory	Sex	Age	Blood Hg (ppm, ww)	Blood Pb
7/19/2017	Kezar	Great Brook	M	ATY	2.962	<3.3 ug/dl
9/12/2017	Kezar	Alaska Bay	UNK	HY	0.169	NA
7/8/2018	Kezar	NW Cove	M	ATY	2.283	<3.3 ug/dl
7/8/2018	Kezar	NW Cove	F	ATY	0.822	<3.3 ug/dl
7/8/2018	Kezar	Fox Cove	M	ATY	2.584	<3.3 ug/dl
7/8/2018	Kezar	Fox Cove	F	ATY	1.620	<3.3 ug/dl
7/24/2018	Kezar	Rock Island	M	ATY	1.379	<3.3 ug/dl
7/24/2018	Kezar	Rock Island	F	ATY	0.846	<3.3 ug/dl
7/24/2018	Horseshoe	Horseshoe	M	ATY	1.385	<3.3 ug/dl
7/24/2018	Horseshoe	Horseshoe	F	ATY	1.178	<3.3 ug/dl

6.4.2 FEATHER

Feather Hg results are reported in parts per million (ppm), fresh weight (fw). Mercury levels in the feathers of the nine adults ranged from 9.382 to 19.110 ppm (fw) (Table 6). The levels all fall within the moderate risk range for reduced nesting success.

Table 6. Results of Hg in feathers (ppm, fw), 2017 & 2018.

Date Collected	Lake	Territory	Sex	Age	Feather Hg (ppm, fw)
7/19/2017	Kezar	Great Brook	M	ATY	19.110
7/8/2018	Kezar	NW Cove	M	ATY	15.171
7/8/2018	Kezar	NW Cove	F	ATY	11.040
7/8/2018	Kezar	Fox Cove	M	ATY	17.176
7/8/2018	Kezar	Fox Cove	F	ATY	11.354
7/24/2018	Kezar	Rock Island	M	ATY	15.772
7/24/2018	Kezar	Rock Island	F	ATY	9.382
7/24/2018	Horseshoe	Horseshoe	M	ATY	9.626
7/24/2018	Horseshoe	Horseshoe	F	ATY	9.452

6.4.3 EGG

In 2018, two abandoned eggs were collected from Kezar Lake. Mercury concentrations in the two loons' eggs collected from Kezar Lake were 0.304 and 0.613 ppm (ww), respectively (Table 7). These levels fall within the low risk category for threat to successful hatching.

Table 7. Results of Hg in eggs (ppm, ww), 2018.

Date Collected	Lake	Territory	Hg (ppm, ww)
6/18/18	Kezar	Alaska Bay	0.613
7/7/18	Kezar	SW Island	0.304

6.5 BANDED LOON REOBSERVATIONS AND RECOVERIES

Loon banding efforts began in 2017 in the Kezar Lake watershed. One adult male was captured and banded on Kezar Lake in the Great Brook territory, and one chick was banded in the Alaska Bay territory. The banded male in Great Brook was observed in territory on April 27 and he nested successfully in June/July. No juvenile loons were observed on Kezar Lake in 2018.

6.6 RESULTS OF NEST CAMERAS

The camera at Kezar Lake, Rock Island captured over 7500 images between 6/18/18 and 7/10/18. This was a raft nest, and significant movement of the raft caused it to be completely or mostly out of camera view in many of the photos. All the images were still valuable in documenting important data like possible human disturbance and predator threats. On one occasion, the camera filmed a beaver swimming by the raft at night (Figure 4).

With virtually no significant disturbance issues, this pair hatched a chick from their lone egg on 7/9/2018 (Figure 5). The Rock Island camera was moved to a nest in the Outlet River Marsh territory on 7/12/18, and it captured approximately 6500 pictures between 7/12/18 and 7/24. During their incubation the loons encountered threats from several predators (Figures 6&7). No human disturbance was observed, and both eggs hatched, successfully (Figure 8).

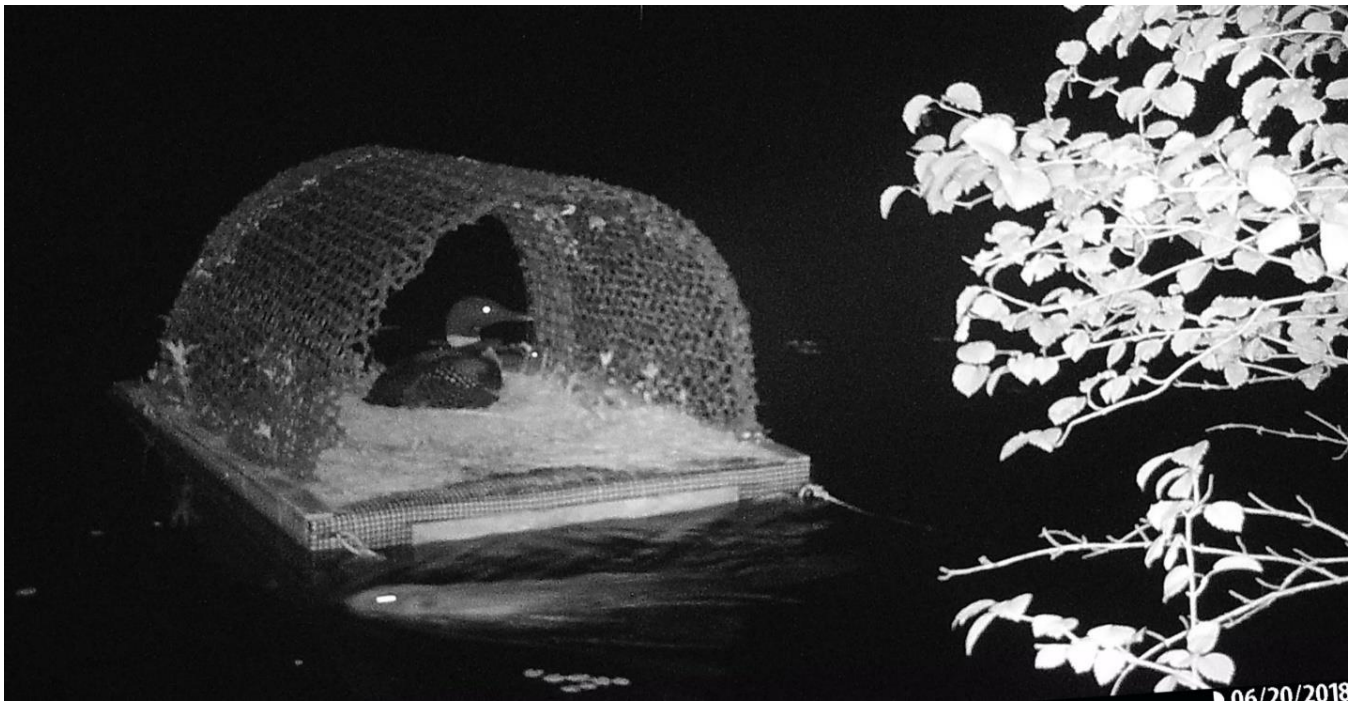

Figure 4. Beaver near raft, Kezar Lake, Rock Island, 2018.

Figure 5. Adult and one chick, Kezar Lake, Rock Island, 2018.

Figure 6. Night threat, muskrat, Kezar Lake, Outlet River Marsh, 2018.

Figure 7. Threat, snapping turtle, Kezar Lake, Outlet River Marsh, 2018.

Figure 8. Adult with two chicks, Kezar Lake, Outlet River Marsh, 2018.

7.0 DISCUSSION

In 2018, six of seven lakes (86%) with suitable nesting habitat in the Kezar Lake watershed were occupied by loon pairs. This high occupancy rate demonstrates a strong breeding base in numbers, with potential to sustain a healthy breeding population. Bradley Pond in Lovell was the only lake unoccupied by a pair of loons, although it has an adequate fish population and good nesting habitat. A single loon was observed on Bradley Pond in May. Future occupancy by a pair, and breeding, is possible.

Nesting conditions were ideal in 2018. It was a dry season, void of significant rain, which can often flood natural nests. Thirteen of the 15 pairs (87%) in the watershed nested, however six of those 13 pairs (46%) failed. Two pairs failed twice, which increases the failure rate to 53% (8 of 15). Predation was the cause of failure in almost all cases, with one case of abandonment. These findings indicate there is a robust population of natural predators, and close monitoring of nest productivity in future years is called for.

The 2018 productivity of .033 CH/TP is well below the established sustainable population threshold of 0.48 CH/TP. However, loon productivity is subject to significant year-to-year fluctuations, and one year is not indicative of longer-term trends. Multi-year studies, typically no less than five years in duration are required to adequately begin to assess the population status.

Ten artificial nest platforms (rafts) were initially introduced in the watershed in 2014, with the hope of increasing nest productivity. In 2014 – 2017, none of the rafts were used. In 2018, three of the ten rafts were used, and all three pairs were successful. Rafts eliminate the threat of nest failure due to fluctuating water levels and reduce the threat from mainland predators. These results clearly demonstrate the value of rafts in boosting the productivity of nesting loons.

Contaminants analyzed for Hg and Pb levels from the samples obtained did not show any immediate threats to health. All fell within low to medium risk categories for potential negative impacts.

Inexpensive trail cameras have proven to be a valuable tool to document the events and behaviors during the incubation period of nesting loons. Depending on individual circumstances, they are usually installed after incubation has begun, and they are tolerated without any negative impacts or recorded cases of abandonment. In 2018, both nests that were monitored by a camera were successful. A few threats were captured, and valuable information was obtained. If more cameras are utilized in the future, causes of nest failure can be monitored more closely, possibly leading to future conservation actions designed to reduce the number of nest failures.

In its first year, this project demonstrated the effectiveness of collaboration between trained professional researchers and volunteer citizen scientists. With training and guidance of dedicated volunteers, following successful models in other regions, this unique partnership allows for the development of sustainable conservation efforts, which in turn provides valuable information to local communities and scientists concerned about the health of loon populations.

8.0 RECOMMENDATIONS

Common loons have responded well to dedicated human conservation measures designed to either stabilize a population, or help a population rebound. However, these actions were implemented after years of research needed to accurately verify the status of the population, and identify past and present stressors, which may have led to population declines.

LCA recommends the following actions for 2019:

- Continue to use standardized survey methods to collect data on the number of territorial pairs, nesting pairs, location of nests, chicks hatched, and those surviving >six weeks of age.
- Focus on band return identification to verify color-marked individuals have returned, the status of territory fidelity, and individual productivity.
- Expand the use of nest monitoring cameras, as circumstances allow.
- Further develop the engagement and skills of citizen science volunteers and seek to expand the volunteer base.
- Continue to capture and band loons through traditional night capture of pairs with chicks.
- Maintain ongoing monitoring of contaminants (Hg & Pb) and look for avenues to include cyanobacteria testing as part of routine health evaluations.
- Continue to engage and inform the local community about loons in the watershed through all available media.
- Continue strategic use and monitoring of artificial nesting platforms (rafts). Focus on locations where territorial pairs have been confirmed for multiple years, where a raft has a likelihood of enticing successful nesting. Review nesting platform locations, annually, and make strategic relocations as circumstances dictate.

9.0 ACKNOWLEDGMENTS

LCA wishes to acknowledge the Kezar Lake Watershed Association and its members, and especially Heinrich Wurm, and all the dedicated volunteers who passionately gave hundreds of hours of volunteer time to help make this project a huge success in its first year.

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