

COMMON  
LOON

# MONITORING SUMMARY REPORT



Lee Attix

2022

Kezar Lake  
Watershed

# KEZAR LAKE WATERSHED

## Common Loon Monitoring Summary Report

**SUBMITTED TO:**

Kezar Lake Watershed Association  
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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 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 response to these observations and related concerns about the local loon population, LCA and KLWA began a multi-year study in 2018. 2022 efforts continued this critical work for the fifth consecutive year.

This report is condensed and focuses on conveying key results only. Results are presented by year for the past five years to allow for easy comparison and evaluation of important trends through time. For more background and information on study design and methods you may reference the full 2018 and 2019 reports.

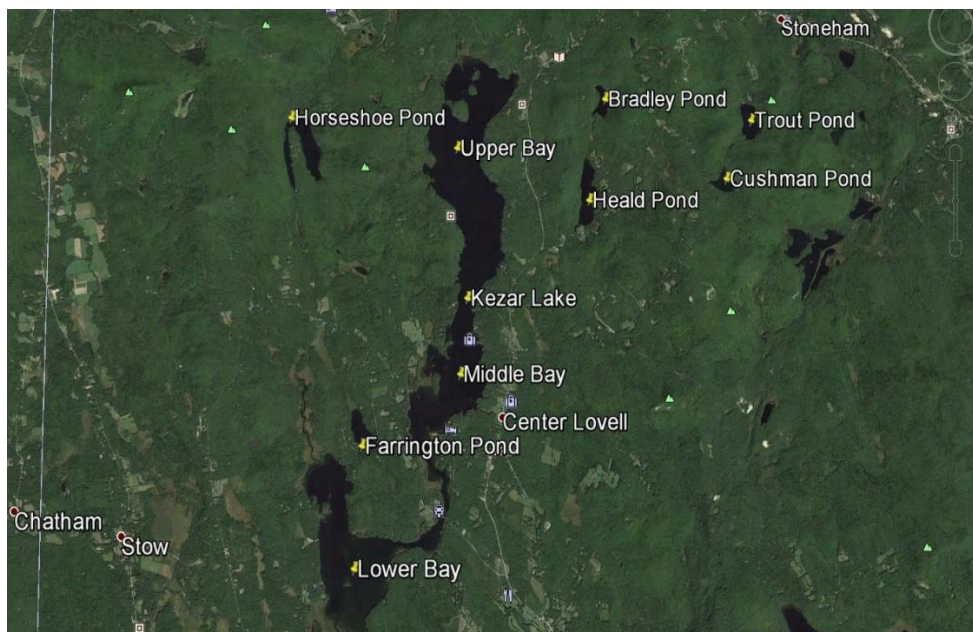
## 2.0 PRODUCTIVITY SUMMARY

In 2022, 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 (87%). From eight successful nests, 14 chicks hatched and 10 (71%) survived to > six weeks of age – an age defined as fledging for modeling purposes. Overall productivity in the Kezar Lake watershed in 2022 was 0.67 fledged young per territorial pair. This is the highest annual productivity recorded during the first five years of the study.

## 3.0 STUDY AREA

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

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



## 4.0 RESULTS

### 4.1 OVERALL PRODUCTIVITY BY YEAR (Table 1, Figure 2).

**Table 1a.** Common Loon population and productivity, Kezar Lake watershed, **2022**.

Population		Reproductive Success	
Territorial Pairs	15	Nesting Frequency	0.87
Nesting Pairs	13	Hatching Success	1.08
Chicks Hatched	14	Chick Survivorship	0.71
Chicks Surviving	10	Overall Productivity	0.67

**Table 1b.** Common Loon population and productivity, Kezar Lake watershed, **2021**.

Population		Reproductive Success	
Territorial Pairs	15	Nesting Frequency	0.80
Nesting Pairs	12	Hatching Success	1.00
Chicks Hatched	12	Chick Survivorship	0.75
Chicks Surviving	9	Overall Productivity	0.60

**Table 1c.** Common Loon population and productivity, Kezar Lake watershed, **2020**.

Population		Reproductive Success	
Territorial Pairs	16	Nesting Frequency	0.63
Nesting Pairs	10	Hatching Success	0.70
Chicks Hatched	7	Chick Survivorship	0.57
Chicks Surviving	4	Overall Productivity	0.25

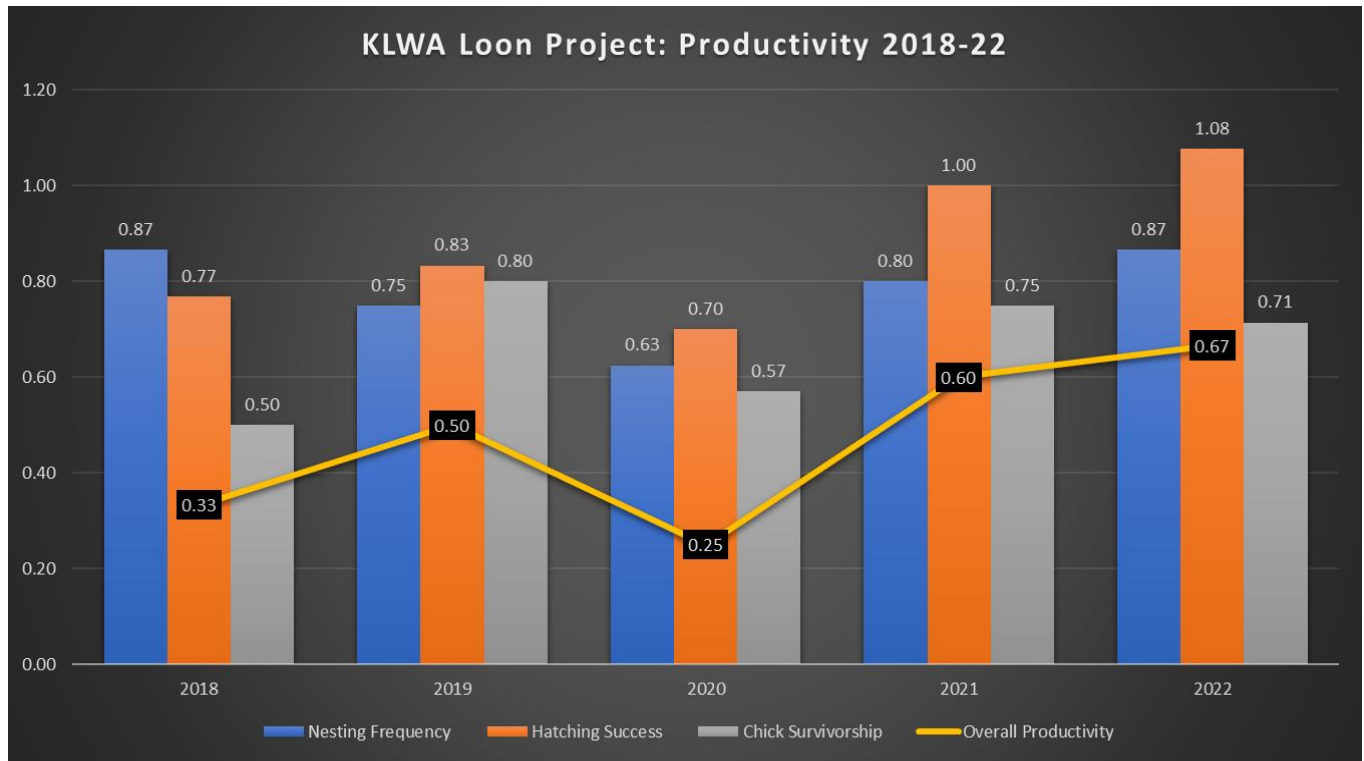
**Table 1d.** Common Loon population and productivity, Kezar Lake watershed, **2019**.

Population		Reproductive Success	
Territorial Pairs	16	Nesting Frequency	0.75
Nesting Pairs	12	Hatching Success	0.83
Chicks Hatched	10	Chick Survivorship	0.80
Chicks Surviving	8	Overall Productivity	0.50

**Table 1e.** 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.



**4.2 PRODUCTIVITY AND NEST FAILURE BY LAKE/TERRITORY BY YEAR (Table 2).**

**Table 2a.** Productivity and nest failure by lake/territory, **2022**.

Lake Name	Territory	TP*	NP*	CH*	CF*	NF*	Cause of Nest Failure
Kezar Lake	LB - NW Cove	Y	Y	0	0	1	Unknown
Kezar Lake	LB - Rock Island	Y	Y	2	0	0	
Kezar Lake	LB - Outlet River Marsh	Y	N	0	0	0	
Kezar Lake	LB - SE Island	Y	Y	0	0	1	Abandoned - black flies
Kezar Lake	MB - Narrows	Y	Y	1	1	1	Unknown
Kezar Lake	MB - Blueberry Island**	N	N	0	0	0	
Kezar Lake	MB - Mud Cove	Y	N	0	0	0	
Kezar Lake	MB - Fox Cove	Y	Y	2	2	0	
Kezar Lake	MB - Severance West	Y	Y	0	0	2	Mammalian Predation
Kezar Lake	MB - Vinton's Cove	Y	Y	0	0	2	Mammalian Predation
Kezar Lake	UB - Alaska Bay	Y	Y	0	0	1	Abandonment
Kezar Lake	UB - Great Brook	Y	Y	2	2	0	
Farrington Pond	Farrington	N	N	0	0	0	
Horseshoe Pond	Horseshoe	Y	Y	2	2	0	
Cushman Pond	Cushman	Y	Y	2	1	0	
Bradley Pond	Bradley	N	N	0	0	0	
Heald Pond	Heald	Y	Y	1	0	0	
Trout Pond	Trout	Y	Y	2	2	0	

\* TP = territorial pair, NP = nesting pair, CH = chick(s) hatched, CF = chicks fledged, NF = nest failure

\*\* Pair who nested on Blueberry Island considered MB Narrows pair.



**Table 2b.** Productivity and nest failure by lake/territory, **2021.**

Lake Name	Territory	TP*	NP*	CH*	CF*	NF*	Cause of Nest Failure
Kezar Lake	LB - NW Cove	Y	N	0	0	0	
Kezar Lake	LB - Rock Island	Y	Y	2	1	0	
Kezar Lake	LB - Outlet River Marsh	Y	Y	0	0	1	Unknown
Kezar Lake	LB - SE Island	Y	Y	0	0	1	Abandonment/Lost Egg
Kezar Lake	MB - Narrows	Y	Y	1	0	0	
Kezar Lake	MB - Blueberry Island**	N	N	0	0	0	
Kezar Lake	MB - Mud Cove	Y	N	0	0	0	
Kezar Lake	MB - Fox Cove	Y	Y	2	2	0	
Kezar Lake	MB - Severance West	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	MB - Vinton's Cove	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	UB - Alaska Bay	Y	N	0	0	0	
Kezar Lake	UB - Great Brook	Y	Y	2	1	0	
Farrington Pond	Farrington	N	N	0	0	0	
Horseshoe Pond	Horseshoe	Y	Y	2	2	0	
Cushman Pond	Cushman	Y	Y	1	1	0	
Bradley Pond	Bradley	N	N	0	0	0	
Heald Pond	Heald	Y	Y	2	2	0	
Trout Pond	Trout	Y	Y	0	0	1	Mammalian Predation

\* TP = territorial pair, NP = nesting pair, CH = chick(s) hatched, CF = chicks fledged, NF = nest failure

\*\* Pair who nested on Blueberry Island considered MB Narrows pair.

**Table 2c.** Productivity and nest failure by lake/territory, **2020.**

Lake Name	Territory	TP*	NP*	CH*	CF*	NF*	Cause of Nest Failure
Kezar Lake	LB - NW Cove	Y	N	0	0	0	
Kezar Lake	LB - Rock Island	Y	Y	2	1	0	
Kezar Lake	LB - Outlet River Marsh	Y	N	0	0	0	
Kezar Lake	LB - SE Island	Y	N	0	0	0	
Kezar Lake	MB - Narrows	Y	Y	0	0	2	Unknown & Flooding (inviable)?
Kezar Lake	MB - Blueberry Island	N	N	0	0	0	
Kezar Lake	MB - Mud Cove	Y	N	0	0	0	
Kezar Lake	MB - Fox Cove	Y	Y	0	0	2	Mammalian Predation/Abandonment
Kezar Lake	MB - Severance West	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	MB - Vinton's Cove	Y	Y	0	0	2	Unknown & Abandonment (inviable)?
Kezar Lake	UB - Alaska Bay	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	UB - Great Brook	Y	Y	2	1	1	Abandoned - Black Flies/Wakes? **
Farrington Pond	Farrington	Y	N	0	0	1	
Horseshoe Pond	Horseshoe	Y	Y	1	1	0	
Cushman Pond	Cushman	Y	Y	0	0	1	Unknown - egg found in water
Bradley Pond	Bradley	N	N	0	0	0	
Heald Pond	Heald	Y	Y	2	1	0	
Trout Pond	Trout	Y	N	0	0	0	

\* TP = territorial pair, NP = nesting pair, CH = chick(s) hatched, CF = chicks fledged, NF = nest failure

\*\*One intact egg was found in the water, underneath the raft at UB, Great Brook. A nest monitoring camera captured images of huge wakes from boats washing over the raft during incubation, illustrating the possibility that the wakes could have caused the nest failure.

**Table 2d.** Productivity and nest failure by lake/territory, **2019**.

Lake Name	Territory	TP*	NP*	CH*	CF*	NF*	Cause of Nest Failure
Kezar Lake	LB - NW Cove	Y	Y	2	2	0	
Kezar Lake	LB - Rock Island	Y	Y	1	1	1	Abandoned - Black Flies
Kezar Lake	LB - Outlet River Marsh	Y	Y	0	0	1	Abandoned
Kezar Lake	LB - SE Island	Y	N	0	0	0	
Kezar Lake	MB - Narrows	Y	N	0	0	0	
Kezar Lake	MB - Blueberry Island	N	N	0	0	0	
Kezar Lake	MB - Mud Cove	Y	N	0	0	0	
Kezar Lake	MB - Fox Cove	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	MB - Severance West	Y	Y	0	0	1	Mammalian Predation - Raccoon
Kezar Lake	MB - Vinton's Cove	Y	Y	0	0	1	Unknown Predation
Kezar Lake	UB - Alaska Bay	Y	Y	2	2	0	
Kezar Lake	UB - Great Brook	Y	Y	1	0	1	Abandoned - Black Flies
Farrington Pond	Farrington	Y	Y	0	0	1	Unknown
Horseshoe Pond	Horseshoe	Y	Y	1	1	0	
Cushman Pond	Cushman	Y	N	0	0	0	
Bradley Pond	Bradley	N	N	0	0	0	
Heald Pond	Heald	Y	Y	1	0	0	
Trout Pond	Trout	Y	Y	2	2	0	

\*TP = territorial pair, NP = nesting pair, CH = chick(s) hatched, CF = chicks fledged, NF = nest failure

**Table 2e.** Productivity and nest failure by lake/territory, **2018**.

Lake Name	Territory	TP*	NP*	CH*	CF*	NF*	Cause of Nest Failure
Kezar Lake	LB - NW Cove	Y	Y	1	1	0	
Kezar Lake	LB - Rock Island	Y	Y	1	1	0	
Kezar Lake	LB - Outlet River Marsh	Y	Y	2	0	0	
Kezar Lake	LB - SE Island	Y	N	0	0	1	Abandoned
Kezar Lake	MB - Narrows	Y	N	0	0	2	Mammalian Predation
Kezar Lake	MB - Blueberry Island	N	N	0	0	0	
Kezar Lake	MB - Mud Cove	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	MB - Fox Cove	Y	Y	1	0	0	
Kezar Lake	MB - Severance West	Y	N	0	0	0	
Kezar Lake	UB - Alaska Bay	Y	Y	0	0	1	Mammalian Predation
Kezar Lake	UB - Great Brook	Y	Y	2	1	0	
Farrington Pond	Farrington	Y	N	0	0	0	
Horseshoe Pond	Horseshoe	Y	Y	2	2	0	
Cushman Pond	Cushman	Y	N	0	0	2	Unknown
Bradley Pond	Bradley	N	N	0	0	0	
Heald Pond	Heald	Y	Y	1	0	0	
Trout Pond	Trout	Y	Y	0	0	1	Mammalian Predation

\*TP = territorial pair, NP = nesting pair, CH = chick(s) hatched, CF = chicks fledged, NF = nest failure

### 4.3 USE OF ARTIFICIAL NESTING ISLANDS (RAFTS) BY YEAR (Table 3).

**Table 3a.** Comparative loon nesting summary: raft vs. natural nests, **2022**.

<b>Raft Nests</b>	<b>2022</b>	<b>Natural Nests</b>	<b>2022</b>
Number of Nest Attempts	7	Number of Nest Attempts	8
Number of Successful Nest Attempts	4	Number of Successful Nest Attempts	4
<b>Success Rate</b>	<b>57%</b>	<b>Success Rate</b>	<b>50%</b>
Chicks Hatched from Rafts	8	Chicks Hatched from Natural Sites	6
Total Chicks Fledged	5	Total Chicks Fledged	5
<b>Contribution to Productivity*</b>	<b>50%</b>	<b>Contribution to Productivity*</b>	<b>50%</b>

\* Percentage of total chicks fledged

**Table 3b.** Comparative loon nesting summary: raft vs. natural nests, **2021**.

<b>Raft Nests</b>	<b>2021</b>	<b>Natural Nests</b>	<b>2021</b>
Number of Nest Attempts	5	Number of Nest Attempts	7
Number of Successful Nest Attempts	4	Number of Successful Nest Attempts	3
<b>Success Rate</b>	<b>80%</b>	<b>Success Rate</b>	<b>43%</b>
Chicks Hatched from Rafts	7	Chicks Hatched from Natural Sites	5
Total Chicks Fledged	5	Total Chicks Fledged	4
<b>Contribution to Productivity*</b>	<b>56%</b>	<b>Contribution to Productivity*</b>	<b>44%</b>

\* Percentage of total chicks fledged.

**Table 3c.** Comparative loon nesting summary: raft vs. natural nests, **2020**.

<b>Raft Nests</b>	<b>2020</b>	<b>Natural Nests</b>	<b>2020</b>
Number of Nest Attempts	6	Number of Nest Attempts	7
Number of Successful Nest Attempts	2	Number of Successful Nest Attempts	1
<b>Success Rate</b>	<b>33%</b>	<b>Success Rate</b>	<b>14%</b>
Chicks Hatched from Rafts	3	Chicks Hatched from Natural Sites	2
Total Chicks Fledged	3	Total Chicks Fledged	1
<b>Contribution to Productivity*</b>	<b>75%</b>	<b>Contribution to Productivity*</b>	<b>25%</b>

\* Percentage of total chicks fledged.

**Table 3d.** Comparative loon nesting summary: raft vs. natural nests, **2019**.

<b>Raft Nests</b>	<b>2019</b>	<b>Natural Nests</b>	<b>2019</b>
Number of Nest Attempts	4	Number of Nest Attempts	10
Number of Successful Nest Attempts	3	Number of Successful Nest Attempts	6
<b>Success Rate</b>	<b>75%</b>	<b>Success Rate</b>	<b>60%</b>
Chicks Hatched from Rafts	3	Chicks Hatched from Natural Sites	7
Total Chicks Fledged	2	Total Chicks Fledged	6
<b>Contribution to Productivity*</b>	<b>25%</b>	<b>Contribution to Productivity*</b>	<b>75%</b>

\* Percentage of total chicks fledged.



**Table 3e.** Comparative loon nesting summary: raft vs. natural nests, **2018**.

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

\* Percentage of total chicks fledged.

#### 4.4 CAPTURE AND BANDING BY YEAR (Table 4).

**Table 4a.** Common loons captured and banded, Kezar Lake watershed, **2022**.

<b>Lake Name</b>	<b>Territory</b>	<b>Band #</b>	<b>Year</b>	<b>Sex</b>	<b>Age*</b>	<b>Left Leg Top</b>	<b>Left Leg Bottom</b>	<b>Right Leg Top</b>	<b>Right Leg Bottom</b>
Kezar	MB Narrows	0689-15904	2022	M	ATY	Orange Dot	White	Blue Stripe	Silver
Kezar	MB Narrows	0689-15903	2022	F	ATY	Blue Stripe	Orange	Red Dot	Silver
Horseshoe	Horseshoe	1238-25628	2022	U	HY	Yellow Dot	Silver	Yellow Stripe	Red

\* HY = hatch year, ATY = adult

**Table 4b.** Common loons captured and banded, Kezar Lake watershed, **2021**.

<b>Lake Name</b>	<b>Territory</b>	<b>Band #</b>	<b>Year</b>	<b>Sex</b>	<b>Age*</b>	<b>Left Leg Top</b>	<b>Left Leg Bottom</b>	<b>Right Leg Top</b>	<b>Right Leg Bottom</b>
Kezar	G. Brook	0689-15625	2021	F	ATY	Orange	G Stripe	Yellow	Silver
Kezar	G Brook	0689-15646	2021	UNK	HY	Yellow	Silver	Orange	Blue
Kezar	Fox Cove	0689-15636	2021	UNK	HY	Silver	R Dot	Yellow	O Dot
Kezar	Fox Cove	0689-15627	2021	UNK	HY	Silver	R Dot	Orange	Green
Cushman	Cushman	0689-15628	2021	F	ATY	Orange	B Stripe	Yellow	Silver
Cushman	Cushman	0689-15637	2021	M	ATY	O Stripe	Green	Silver	R Dot

\* HY = hatch year, ATY = adult

**Table 4c.** Common loons captured and banded, Kezar Lake watershed, **2020**.

<b>Lake Name</b>	<b>Territory</b>	<b>Band #</b>	<b>Year</b>	<b>Sex</b>	<b>Age*</b>	<b>Left Leg Top</b>	<b>Left Leg Bottom</b>	<b>Right Leg Top</b>	<b>Right Leg Bottom</b>
Kezar	G. Brook	0689-09499	2020	F	HY	Silver	Orange	Yellow	Green
Kezar	Rock Isl.	0649-09454	2020	F	HY	Orange	Silver	Green	Orange

\* HY = hatch year, ATY = adult

**Table 4d.** Common loons captured and banded, Kezar Lake watershed, **2019**.

Lake Name	Territory	Band #	Year	Sex	Age*	Left Leg Top	Left Leg Bottom	Right Leg Top	Right Leg Bottom
Kezar	NW Cove	1118-16202	2019	UNK	HY	Silver	Green	Red	Green
Kezar	NW Cove	0689-09415	2019	UNK	HY	Green	Silver	Red Dot	Yellow
Kezar	Alaska Bay	0689-09401	2019	UNK	HY	Silver	Green	Yellow	Blue
Kezar	Alaska Bay	0938-78831	2019	M	ATY	Yellow Stripe	White	Green Dot	Silver
Kezar	Alaska Bay	1118-15849	2019	F**	ATY	Yellow Dot	Red	Green Dot	Silver
Kezar	Rock Isl.	0689-09452	2019	UNK	HY	Yellow Stripe	Silver	Blue	Yellow
Trout	Trout	1118-15842	2019	M	ATY	Orange Stripe	Green	Red	Silver
Trout	Trout	0938-78836	2019	F	ATY	Yellow Stripe	Green	Silver	Red

\* HY = hatch year, ATY = adult

\*\* The Alaska Bay banded female has lost the Green Dot band on her right leg.

**Table 4e.** 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

\* HY = hatch year, ATY = adult

\*\* The Fox Cove banded male has lost the White band on his left leg.

#### 4.5 CONTAMINANT ANALYSIS BY YEAR (Tables 5 - 7)

All blood and feather samples, collected were processed and analyzed at Biodiversity Research Institute's (BRI) laboratory in Portland, Maine.

To assess the potential impacts of mercury (Hg) 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 5).

**Table 5.** 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	X High	Endpoint	Reference
<b>Mercury (Hg)</b>						
Adult (blood)	0-1.0	1.0 to 3.0	3.0-4.0	>4.0	40% fewer fledged young	Burgess and Meyer 2008; Evers et al. 2008
Adult (feather)	0- 9.0	9.0-20.0	20.0-35.0	>35.0	Significant asymmetry	Evers et al. 2008
Juvenile (blood)	0-0.1	0.1-0.3	0.3-0.4	>0.4	Lower survival	Evers et al. 2010; unpubl. data
Egg	0-0.5	0.5-1.3	1.3-2.0	>2.0	Significantly smaller egg and reduced hatchability	Evers et al. 2003
<b>Lead (Pb)</b>						
Blood	0-0.12	0.12-0.24	> 0.24		Probable death	Franson et al. 2003; BRI unpubl. data

4.5.1 BLOOD

Blood Hg results are reported in parts per million (ppm) wet weight (ww). The mercury level in the blood of the Kezar Lake, Great Brook male was 3.916 ppm (ww), which keeps him in the high-risk category for possible adverse effects. The mercury level in the blood of the other three loons sampled varied from 0.223 – 1.860. These levels all fall within the low to moderate risk range for adverse effects (Table 6).

**Table 6a.** Results of Hg in blood (ppm, ww), **2022**.

Date Collected	Lake	Territory	Sex	Age*	Blood Hg (ppm, ww)
8/16/2022	Kezar	Great Brook	M	ATY	3.916 high
7/19/2022	Kezar	MB Narrows	M	ATY	1.860
7/19/2022	Kezar	MB Narrows	F	ATY	1.152
8/16/2022	Horseshoe	Horseshoe	UNK	HY	0.223

\* HY = hatch year, ATY = adult

**Table 6b.** Results of Hg in blood (ppm, ww), **2021**.

Date Collected	Lake	Territory	Sex	Age*	Blood Hg (ppm, ww)
8/9/2021	Kezar	Great Brook	F	ATY	2.993
8/9/2021	Kezar	Great Brook	UNK	HY	0.226
8/9/2021	Kezar	Fox Cove	UNK	HY	0.207
8/9/2021	Kezar	Fox Cove	UNK	HY	0.148
8/9/2021	Cushman	Cushman	F	ATY	0.723
8/9/2021	Cushman	Cushman	M	ATY	0.907

\* HY = hatch year, ATY = adult

**Table 6c.** Results of Hg in blood (ppm, ww), **2020**.

Date Collected	Lake	Territory	Sex	Age*	Blood Hg (ppm, ww)
8/19/2020	Kezar	Great Brook	M	ATY	4.071 X high
8/19/2020	Kezar	Great Brook	F	HY	0.200
8/19/2020	Kezar	Rock Island	F	HY	0.160

\* HY = hatch year, ATY = adult

**Table 6d.** Results of Hg in blood (ppm, ww), **2019**.

Date Collected	Lake	Territory	Sex	Age*	Blood Hg (ppm, ww)
8/1/2019	Kezar	Alaska Bay	M	ATY	3.947 high
8/1/2019	Kezar	Alaska Bay	F	ATY	1.828
8/1/2019	Trout	Trout	M	ATY	2.183
8/1/2019	Trout	Trout	F	ATY	1.633
8/29/2019	Kezar	NW Cove	U	HY	0.287
7/8/2018	Kezar	Alaska Bay	U	HY	0.404 X high**
7/24/2018	Kezar	Rock Island	U	HY	0.146

\* HY = hatch year, ATY = adult

\*\* Changed from reported high in 2019 to X high, due to revisions to Table 5 in the interim, adding the extremely high classification.

**Table 6e.** Results of Hg in blood (ppm, ww), **2017 & 2018**.

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

\* HY = hatch year, ATY = adult

#### 4.5.2 FEATHER

Feather Hg results are reported in parts per million (ppm), fresh weight (fw). The mercury level in the feathers of the three individuals sampled varied from 11.926 – 19.771. These levels fall within the moderate to high moderate (Great Brook male) risk range for adverse effects (Table 7).

**Table 7a.** Results of Hg in feathers (ppm, fw), **2022.**

Date Collected	Lake	Territory	Sex	Age*	Feather Hg (ppm, fw)
8/16/2022	Kezar	Great Brook	M	ATY	19.771
7/19/2022	Kezar	MB Narrows	M	ATY	13.446
7/19/2022	Kezar	MB Narrows	F	ATY	11.926

\* ATY = adult

**Table 7b.** Results of Hg in feathers (ppm, fw), **2021.**

Date Collected	Lake	Territory	Sex	Age*	Feather Hg (ppm, fw)
8/9/2021	Kezar	Great Brook	F	ATY	17.753
8/9/2021	Cushman	Cushman	F	ATY	7.672
8/9/2021	Cushman	Cushman	M	ATY	15.333

\* ATY = adult

**Table 7c.** Results of Hg in feathers (ppm, fw), **2020.**

Date Collected	Lake	Territory	Sex	Age*	Feather Hg (ppm, fw)
8/19/2020	Kezar	Great Brook	M	ATY	18.716

\* ATY = adult

**Table 7d.** Results of Hg in feathers (ppm, fw), **2019.**

Date Collected	Lake	Territory	Sex	Age*	Feather Hg (ppm, fw)
8/1/2019	Kezar	Alaska Bay	M	ATY	16.930
8/1/2019	Kezar	Alaska Bay	F	ATY	11.672
8/1/2019	Trout	Trout	M	ATY	16.080
8/1/2019	Trout	Trout	F	ATY	18.845

\* ATY = adult



**Table 7e.** 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

\* ATY = adult

**4.6 BANDED LOON RE-OBSERVATIONS AND RECOVERIES BY YEAR.**

In 2022, 15 of 16 adult loons previously banded returned. Fourteen of the 16 (88%) occupied the same territory or lake. The Kezar Lake, NW Cove male, originally banded in 2018 was observed in the lower bay, unpaired. The Trout Pond male, originally banded in 2019 did not return. Two ABJs (adults banded as juveniles), originally banded on Kezar Lake in 2019 returned (see yellow highlights). In the five-year history of the project this is the first confirmation of offspring returning to their natal lake (Table 8).

**Table 8a.** Banded loon re-observations and recoveries, Kezar Lake watershed, **2022.**

Lake Name	Band #	Year	Sex	Age*	2022 Return	Original Territory	2022 Territory
Kezar	0938-03351	2017	M	ATY	Y	Great Brook	Great Brook
Kezar	0938-61715	2017	U	HY	N	Alaska Bay	NA
Kezar	0649-08855	2018	M	ATY	Y	NW Cove	Not paired - Lower Bay
Kezar	0938-78850	2018	F	ATY	Y	NW Cove	NW Cove
Kezar	1118-15844	2018	M	ATY	Y	Rock Island	Rock Island
Kezar	1118-15849	2018	F	ATY	Y	Rock Island	Rock Island
Kezar	0938-78831	2018	M	ATY	Y	Fox Cove	Fox Cove
Kezar	1118-15849	2018	F	ATY	Y	Fox Cove	Fox Cove
Horseshoe	1118-15842	2018	M	ATY	Y	Horseshoe	Horseshoe
Horseshoe	0938-78836	2018	F	ATY	Y	Horseshoe	Horseshoe
Kezar	0938-78831	2019	M	ATY	Y	Alaska Bay	Alaska Bay
Kezar	1118-15849	2019	F	ATY	Y	Alaska Bay	Alaska Bay
Kezar	0689-09401	2019	U	HY	N	Alaska Bay	NA
Kezar	0689-09415	2019	U	HY	N	NW Cove	NA
Kezar	1118-16202	2019	U	HY	Y	NW Cove	Not paired - lower bay
Kezar	0689-09452	2019	U	HY	Y	Rock Island	Not paired - upper lake
Trout	1118-15842	2019	M	ATY	N	Trout	NA
Trout	0938-78836	2019	F	ATY	Y	Trout	Trout
Kezar	0689-09499	2020	F	HY	N	Great Brook	NA
Kezar	0689-09454	2020	F	HY	N	Rock Island	NA
Kezar	0689-15625	2021	F	ATY	Y	Great Brook	Great Brook
Kezar	0689-15646	2021	U	HY	N	Great Brook	NA
Kezar	0689-15636	2021	U	HY	N	Fox Cove	NA
Kezar	0689-15627	2021	U	HY	N	Fox Cove	NA
Cushman	0689-15628	2021	F	ATY	Y	Cushman	Cushman
Cushman	0689-15637	2021	M	ATY	Y	Cushman	Cushman

\* HY = hatch year, ATY = adult

In 2021, 11 of 13 adult loons previously banded returned and occupied the same territory. The Trout Pond male, and the Kezar Lake, LB, NW Cove male did not return. No banded juveniles were observed (Table 8).

**Table 8b.** Banded loon re-observations and recoveries, Kezar Lake watershed, **2021**.

Lake Name	Band #	Year	Sex	Age*	2021 Return	Original Territory	2021 Territory
Kezar	0938-03351	2017	M	ATY	Y	Great Brook	Great Brook
Kezar	0938-61715	2017	U	HY	N	Alaska Bay	NA
Kezar	0649-08855	2018	M	ATY	N	NW Cove	NA
Kezar	0938-78850	2018	F	ATY	Y	NW Cove	NW Cove
Kezar	1118-15844	2018	M	ATY	Y	Rock Island	Rock Island
Kezar	1118-15849	2018	F	ATY	Y	Rock Island	Rock Island
Kezar	0938-78831	2018	M	ATY	Y	Fox Cove	Fox Cove
Kezar	1118-15849	2018	F	ATY	Y	Fox Cove	Fox Cove
Horseshoe	1118-15842	2018	M	ATY	Y	Horseshoe	Horseshoe
Horseshoe	0938-78836	2018	F	ATY	Y	Horseshoe	Horseshoe
Kezar	0938-78831	2019	M	ATY	Y	Alaska Bay	Alaska Bay
Kezar	1118-15849	2019	F	ATY	Y	Alaska Bay	Alaska Bay
Kezar	0689-09401	2019	U	HY	N	Alaska Bay	NA
Kezar	0689-09415	2019	U	HY	N	NW Cove	NA
Kezar	1118-16202	2019	U	HY	N	NW Cove	NA
Kezar	0689-09452	2019	U	HY	N	Rock Island	NA
Trout	1118-15842	2019	M	ATY	N	Trout	NA
Trout	0938-78836	2019	F	ATY	Y	Trout	Trout
Kezar	0689-09499	2020	F	HY	N	Great Brook	NA
Kezar	0689-09454	2020	F	HY	N	Rock Island	NA

\* HY = hatch year, ATY = adult

Of special note; a banded loon on Kezar Lake who was not originally banded there was observed occupying the Upper Bay consistently. Research determined this loon was originally banded as a chick on Quimby Pond in Rangeley, Maine, in 2017. After capture he was translocated to Lakeville, MA, as part of Biodiversity Research Institute's loon reintroduction program.

In 2020, all adult loons previously banded returned and occupied the same territory, except the Trout Pond male (didn't return), and the LB, NW Cove male (returned but lost territory). No banded juveniles were observed (Table 8).

**Table 8c.** Banded loon re-observations and recoveries, Kezar Lake watershed, **2020**.

Lake Name	Band #	Year	Sex	Age*	2020 Return	Original Territory	2020 Territory
Kezar	0938-03351	2017	M	ATY	Y	Great Brook	Great Brook
Kezar	0938-61715	2017	U	HY	N	Alaska Bay	NA
Kezar	0649-08855	2018	M	ATY	Y	NW Cove	None – lost territory to new male
Kezar	0938-78850	2018	F	ATY	Y	NW Cove	NW Cove
Kezar	1118-15844	2018	M	ATY	Y	Rock Island	Rock Island
Kezar	1118-15849	2018	F	ATY	Y	Rock Island	Rock Island
Kezar	0938-78831	2018	M	ATY	Y	Fox Cove	Fox Cove
Kezar	1118-15849	2018	F	ATY	Y	Fox Cove	Fox Cove
Horseshoe	1118-15842	2018	M	ATY	Y	Horseshoe	Horseshoe
Horseshoe	0938-78836	2018	F	ATY	Y	Horseshoe	Horseshoe
Kezar	0938-78831	2019	M	ATY	Y	Alaska Bay	Alaska Bay
Kezar	1118-15849	2019	F	ATY	Y	Alaska Bay	Alaska Bay
Kezar	0689-09401	2019	U	HY	N	Alaska Bay	NA
Kezar	0689-09415	2019	U	HY	N	NW Cove	NA
Kezar	1118-16202	2019	U	HY	N	NW Cove	NA
Kezar	0689-09452	2019	U	HY	N	Rock Island	NA
Trout	1118-15842	2019	M	ATY	N	Trout	NA – new unbanded male
Trout	0938-78836	2019	F	ATY	Y	Trout	Trout

\* HY = hatch year, ATY = adult

In 2019, all adult loons previously banded returned and occupied the same territory. No banded juveniles were observed (Table 8).

**Table 8d.** Banded loon re-observations and recoveries, Kezar Lake watershed, **2019**.

Lake Name	Band #	Year	Sex	Age*	2019 Return	Original Territory	2019 Territory
Kezar	0938-03351	2017	M	ATY	Y	Great Brook	Great Brook
Kezar	0938-61715	2017	U	HY	N	Alaska Bay	NA
Kezar	0649-08855	2018	M	ATY	Y	NW Cove	NW Cove
Kezar	0938-78850	2018	F	ATY	Y	NW Cove	NW Cove
Kezar	1118-15844	2018	M	ATY	Y	Rock Island	Rock Island
Kezar	1118-15849	2018	F	ATY	Y	Rock Island	Rock Island
Kezar	0938-78831	2018	M	ATY	Y	Fox Cove	Fox Cove
Kezar	1118-15849	2018	F	ATY	Y	Fox Cove	Fox Cove
Horseshoe	1118-15842	2018	M	ATY	Y	Horseshoe	Horseshoe
Horseshoe	0938-78836	2018	F	ATY	Y	Horseshoe	Horseshoe

\* HY = hatch year, ATY = adult

In 2018, the UB, Great Brook male returned and occupied the same territory. The UB, Alaska Bay chick was not observed (Table 8).

**Table 8e.** Banded loon re-observations and recoveries, Kezar Lake watershed, **2018**.

Lake Name	Band #	Year	Sex	Age*	2018 Return	Original Territory	2018 Territory
Kezar	0938-03351	2017	M	ATY	Y	Great Brook	Great Brook
Kezar	0938-61715	2017	U	HY	N	Alaska Bay	NA

\* HY = hatch year, ATY = adult

## 5.0 DISCUSSION

In 2022, five of seven lakes (71%) 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 and Farrington Pond in Lovell were the only lakes unoccupied by a pair of loons. Loons were not observed on Farrington Pond, but local property owners reported observing loons on the pond. One survey was conducted on Bradley Pond, and a single adult loon was observed. No nests were found. Bradley Pond has an adequate fish population and good nesting habitat. Future occupancy by a pair, and breeding is possible on both of these lakes.

Nesting conditions were favorable in 2022, with no documented threats to active nests from rising water levels during the nesting period. Blackflies were observed pestering loons in large numbers during May, the heaviest blackfly period in the watershed. Recent records show an influence from this blackfly disturbance with delayed nesting concentrated in very late May and early June.

Thirteen of the 15 pairs (87%) confirmed in the watershed nested and eight successful nests produced 14 chicks. Ten of the 14 chicks hatched survived to fledge (71%). The highest chick productivity observed in the past five years (0.67 CS/TP) was directly attributable to a high percentage of nesting pairs combined with good hatching success and excellent chick survival.

The 2022 productivity of .067 CS/TP is well above the established sustainable population threshold of 0.48 CS/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.

There were eight documented nest failures in 2022. Mammalian predation along the western shore of the Middle Bay remains the leading cause of nest failure. Evidence from nest monitoring cameras confirmed four cases of mammalian egg predation in this area. Eggs were abandoned at two other nests, and two nests failed for unknown reasons (eggs disappeared). It is important to continue to monitor and learn more about loon nesting behaviors and particularly causes of nest failures. It is hoped better utilization and results from nest monitoring cameras in the future can help with this effort.

Ten artificial nest platforms (rafts) were initially introduced in the watershed in 2014, with the hope of increasing nest productivity. Between 2014 – 2017 none of the rafts were used. In 2018, after professional analysis and repositioning of several rafts, three of the ten rafts were used, and all three pairs were successful. A total of 15 rafts were placed in 2022, and six were used (40%). Four of the six pairs (67%) who nested on rafts were successful hatching a chick(s). This high success rate continues to demonstrate the value of utilizing rafts, where appropriate, to aid chick productivity.

There were two documented mortalities on Kezar Lake. The Great Brook male was recovered in the lower bay. An x-ray showed he had ingested a large fishing jig which contained lead. Subsequent necropsy results confirmed he died from lead poisoning. A chick, also from the Great Brook territory was found on the shore, severely wounded from a bald eagle attack\*. Due to the severity of the wounds it had to be euthanized.

Samples analyzed for mercury (Hg) contamination showed continuing high levels of mercury in the Kezar Lake, UB, Great Brook male (high category). These results re-confirm there are elevated levels of mercury in the Upper Bay of Kezar Lake. Mercury results from loons sampled in the MB Narrows territory demonstrate a steady decline in mercury levels as you move further south in the lake.

In its fifth 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.

\*Note - the Great Brook chick's overall health was compromised prior to the bald eagle attack. Days earlier it was rescued with a large fishing lure embedded in its bill, which had to be removed at a rehabilitation facility. After it was returned to the lake, observers noted it was frequently beaching itself for extended periods of time. Based on these observations it is likely lingering health issues related to the fishing gear entanglement played a role in the chick's cause of death.

## 6.0 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 2023:

- 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), and expand research into Hg levels in fish and potentially other food sources in the Upper Bay of Kezar Lake.
- Increase outreach and education efforts to communicate and reduce threats from fishing line entanglement, boat wakes, etc. Steps could include signage at boat launches and installment of containers for disposing of fishing line.
- 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.

## 7.0 ACKNOWLEDGMENTS

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