The Squam Lake Loon Initiative

Progress Report, July 2017

LOON PRESERVATION COMMITTEE

The Squam Lake Loon Initiative

Progress Report, July 2017

Executive Summary

Between 2005-2007, Squam Lake experienced an unprecedented decline in its adult loon population, followed by the near-complete reproductive failure of its remaining loon population. Loon Preservation Committee (LPC) launched its Squam Lake Loon Initiative to understand the causes of the declines in Squam's loon population and to restore a healthy population of loons to the lake.

Squam's loons are facing multiple co-occurring stressors that are common to loons throughout the state. However, adult mortality and contaminant burdens that are significantly higher than on other lakes have apparently resulted in disruptions to the loon social structure leading to poor loon breeding success on Squam. In 2016, one of Squam's adult loons was killed in a boat collision and Squam's loons continued to have poor breeding success, with only one surviving chick on the lake. To date in 2017, there are five active loon nests on Squam Lake.

The identification of elevated contaminant levels in unhatched Squam loon eggs has led LPC to work to identify sources of contaminants in the Squam watershed and to monitor contaminants in loon eggs. Two unhatched eggs tested in 2016 were elevated for flame retardants and PCB's respectively, but otherwise were lower than the peak levels found in 2005-2007 and followed a stable trend for contaminant levels since 2008. Sediment sampling conducted by LPC as part of our efforts to identify sources of contaminants has pinpointed three sites of contaminated sediments. Levels of contaminants at these locations are above levels identified as being possibly or likely harmful to aquatic life. LPC has presented these data in a report to New Hampshire Department of Environmental Services (DES) and requested that DES address this issue as soon as possible with options and plans for mitigation.

LPC will continue to work to recover Squam Lake's loon population through greatly increased research, monitoring, management, and outreach as part of the Squam Lake Loon Initiative. This work will continue to inform LPC's conservation efforts for loons on Squam and throughout the state.

Background

Between the fall of 2004 and the spring of 2005, Squam Lake lost seven of its loon pairs. The decline from 16 to 9 pairs represented 44% of Squam's loon population, a drop unprecedented on Squam or any other large lake in LPC's 40-year history of monitoring loons throughout New Hampshire. It also brought Squam's loon population to its lowest level since LPC began to survey Squam Lake in 1975**.** This decline was followed by the near-complete reproductive failure of the remaining loon population. In 2007, only three chicks were hatched on Squam, and only one survived to late August and was presumed to have fledged. Loons on Squam had not experienced a reproductive failure of this magnitude since 1978, the year LPC petitioned successfully to have loons added to the Threatened Species list in New Hampshire.

The Squam Lake Loon Initiative is LPC's response to the decline of Squam's loon population. The Initiative began in 2007 and includes an increased monitoring, research, management, and outreach effort to:

1. Determine the overall survival and reproductive success of Squam's remaining loon population

2. Assess causes of nest failures and collect inviable eggs from failed nests for analysis of a wide range of contaminants

3. Rescue sick or injured loons to increase loon survival

4. Find and collect loon carcasses, determine causes of death, and test dead loons for contaminants and pathogens (disease-causing organisms)

5. Band loons to allow us to identify and track individual birds and collect blood and feather samples for analysis of contaminants, pathogens, and indicators of health

6. Determine survival and breeding success of previously banded and sampled loons, and relate survival and breeding success of individuals to their levels of contaminants and pathogens

7. Incorporate results into a systems dynamics model to determine the relative contributions of a wide range of possible stressors on the mortality and reproductive failure of loons on Squam Lake

8. Restore and maintain a healthy and stable population of loons on Squam Lake as a component of a healthy statewide population of loons.

Squam's Loon Population in 2017

Squam's loon population dropped from fifteen pairs of loons in 2016 to thirteen in 2017, although the two territories from which the pairs disappeared are marginal habitat. To date, nine of the pairs have nested but no chicks have hatched and five nests remain active. Causes of nest

failures to date have included mammalian predation at one nest, two nests that were abandoned after territorial intrusions by other loons, one nest that was abandoned after a combination of loon intrusions and black flies, one nest that was abandoned for unknown reasons, one nest at which the eggs were accidentally kicked into the water by an incubating adult, and one nest that failed for unknown reasons.

Through the end of 2016, the reproductive success of Squam's loon pairs remains far below pre-2005 levels, and productivity has remained low since the period of critical decline in 2005-2007. Loon breeding success from 2008-2016 has been less than half the statewide average and far less than the rate of 0.48 chicks surviving/territorial pair needed to maintain a viable population (Figure 1).

Loons on Squam are facing multiple stressors, such as increased boating and recreational activities, high rates of lead fishing tackle mortality, increasing temperatures and precipitation, increased populations of shoreline predators (raccoons, mink, etc.), and fluctuating water levels. All of these factors are common to loons on lakes throughout New Hampshire, yet declines on Squam have been more severe and protracted than those on other lakes. The factors that set Squam Lake apart from other New Hampshire lakes are the presence of high levels of chemical contaminants and high rates of mortality from lead fishing tackle.

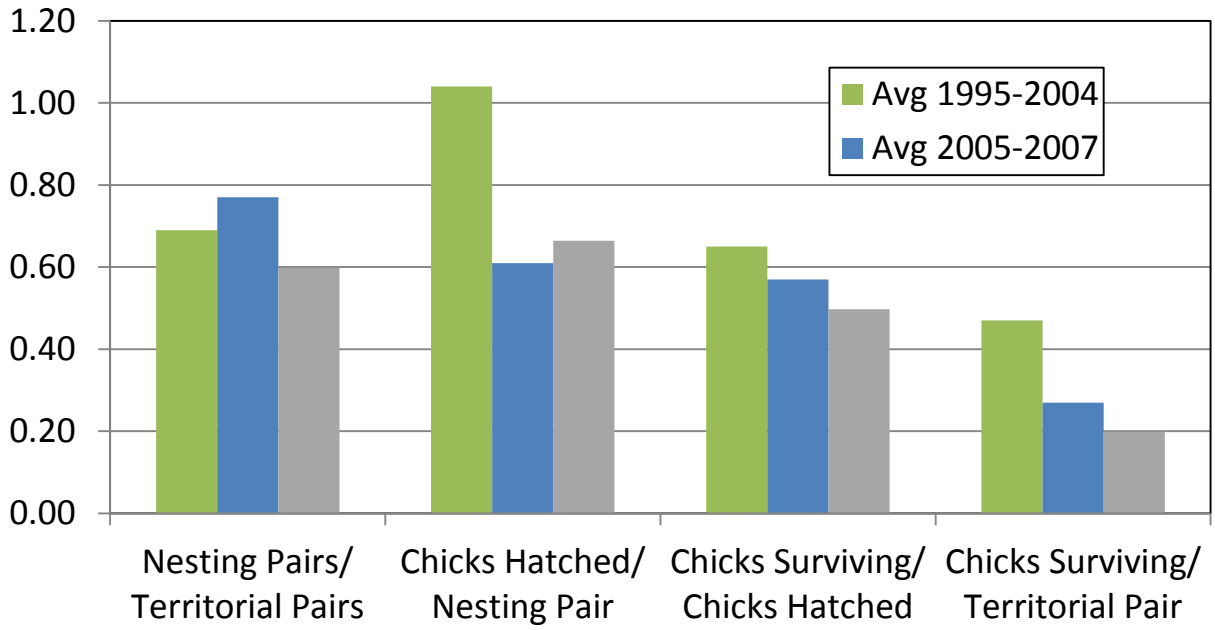

Figure 1: Productivity rates on Squam Lake before, during, and after the 2005-2007 period of decline.

Contaminants in Squam Lake Loon Eggs

Eggs collected from Squam between 2005 and 2007 revealed high levels of a number of contaminants, including PBDE (flame retardants), PFOS (stain guards), PCB (industrial

insulating/cooling agents), DDT and chlordane (pesticides), and dioxins and furans (PCDD/F's; byproducts of industrial processes). Levels of contaminants from Squam during 2005-2007 were **up to nine times higher** than levels found in eggs collected from other lakes, as well as higher than the periods before and after these critical years on Squam. Some of these contaminants were present at levels that have been shown to affect the health and reproductive success of other bird species (Figure 2). The combined effects of these contaminants in wildlife are not well understood.

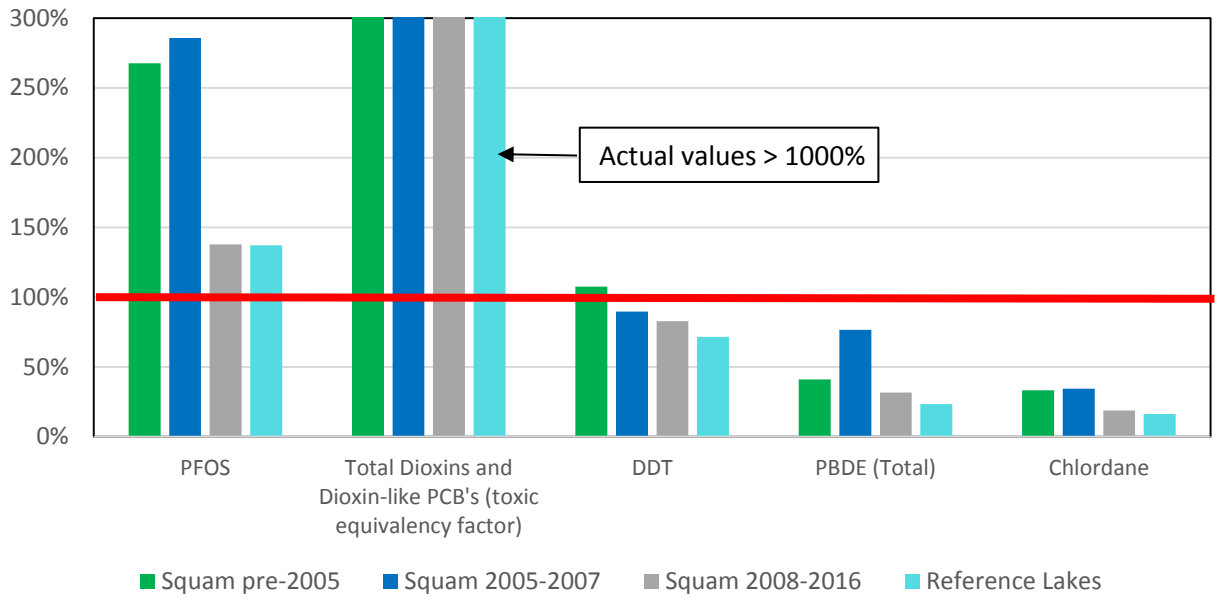

Figure 2: Contaminant levels in Squam eggs as a percentage of lowest levels causing health and reproductive effects in other bird species, as indicated by the black line.

Contaminant levels in Squam loon eggs collected between 2008-2016 have been following a stable to slightly increasing trend, although these levels were lower than the peak that occurred between 2005-2007. LPC tested two unhatched Squam loon eggs from the 2016 nesting season. Levels of contaminants in these eggs were generally lower than levels between 2005-2007, but one of the eggs had PBDE (flame retardant) levels that were similar to those in eggs from 2005-2007, while the other egg had PCB levels that exceeded those of eggs from 2005-2007 (Figure 3). The egg with the high PCB levels was from the same female that had similarly high PCB levels in an egg tested in 2013 (Figure 3).

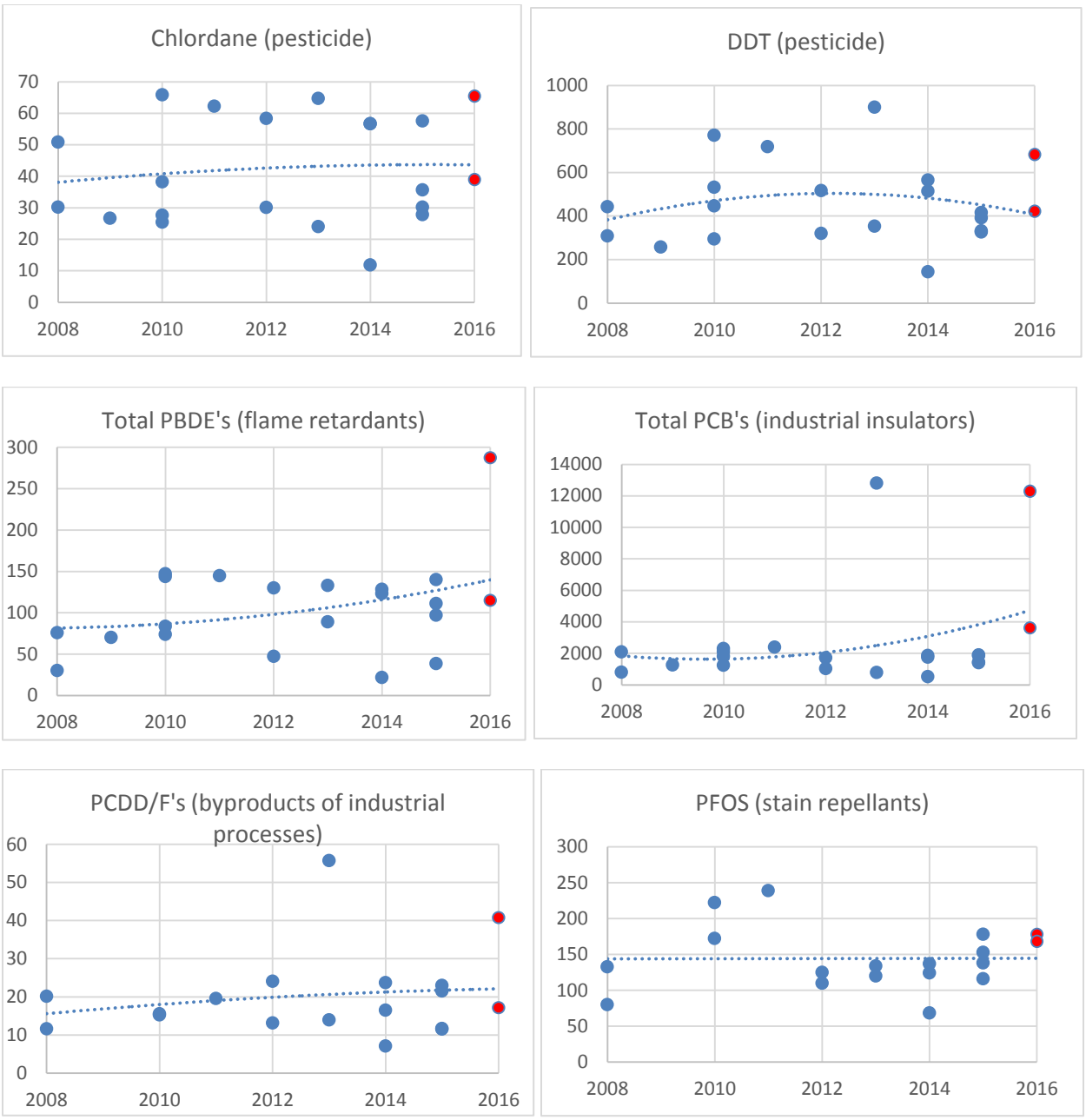

Figure 3: Contaminant levels in Squam loon eggs after the period of critical decline in the Squam loon population (2005-2007). All values are in parts per billion, except for PCDD/F, which uses a toxic equivalency factor in parts per trillion.

The discovery of these contaminants in Squam's loon eggs raised two important questions for LPC:

1) What are the sources of the high levels of contaminants found in Squam's loon eggs?

2) What impact are these contaminants having on Squam's loon population?

Hypotheses as to the Sources of Contaminants

LPC has investigated five hypotheses to explain the high levels of contaminants present in Squam's loon eggs. These hypotheses and the evidence for or against them are listed below:

1) *There was a change in the food web in Squam Lake, which forced loons to feed at a higher level of the food web, thus exposing them to higher levels of contaminants.* Isotope testing did not reveal any change in the levels of the food web at which Squam's loons are feeding.

2) *The age structure of Squam's loon population (i.e., old loons that had accumulated contaminants over their lifetimes) contributed to elevated contaminant levels in the loons.* Banding evidence does not suggest the existence of a cohort of old loons on Squam.

3) *Squam has a unique hydrology, holding water longer than other lakes, which allows for the retention and build-up of contaminants.* Data on flushing rates of lakes collected by Jeff Schloss and Bob Craycraft of University of New Hampshire Cooperative Extension does not support the hypothesis that overall lake hydrology accounts for contaminant levels found in Squam's loon eggs.

4) *Pollution from a diffuse source accounts for the elevated contaminant levels found in Squam loon eggs.* Data collected by LPC working collaboratively with Jeff Schloss and Bob Craycraft of University of New Hampshire Cooperative Extension does not support the hypothesis that the contaminants found in Squam's loon eggs came from a diffuse source.

5) *Pollution from one or more point sources accounts for the elevated contaminant levels found in Squam loon eggs*. A point source posits a single large input of contaminants into a system. Illegal dumping or a rusted-out barrel of chemicals are examples of possible point sources. The evidence suggests contaminants in Squam loon eggs came from multiple point sources in the Squam watershed.

Identifying Point Sources of Contaminants

During the initial loss of adult loons in 2005, loon pairs disappeared from the northeastern section of the lake. LPC hypothesizes that high levels of contaminants could have contributed to the deaths of these loons. This evidence, in conjunction with high levels of contaminants in crayfish sampled from the northeastern coves and tributaries flowing into Squam, supported the hypothesis of one or more point sources for emerging contaminants in the northeast corner of the lake. After further efforts to sample crayfish higher in the tributaries were unsuccessful, LPC staff sampled sediments from key tributaries in the fall 2015 and 2016, collecting 25 sediment samples from different areas of the Squam watershed (Figure 4), which were submitted for contaminant testing.

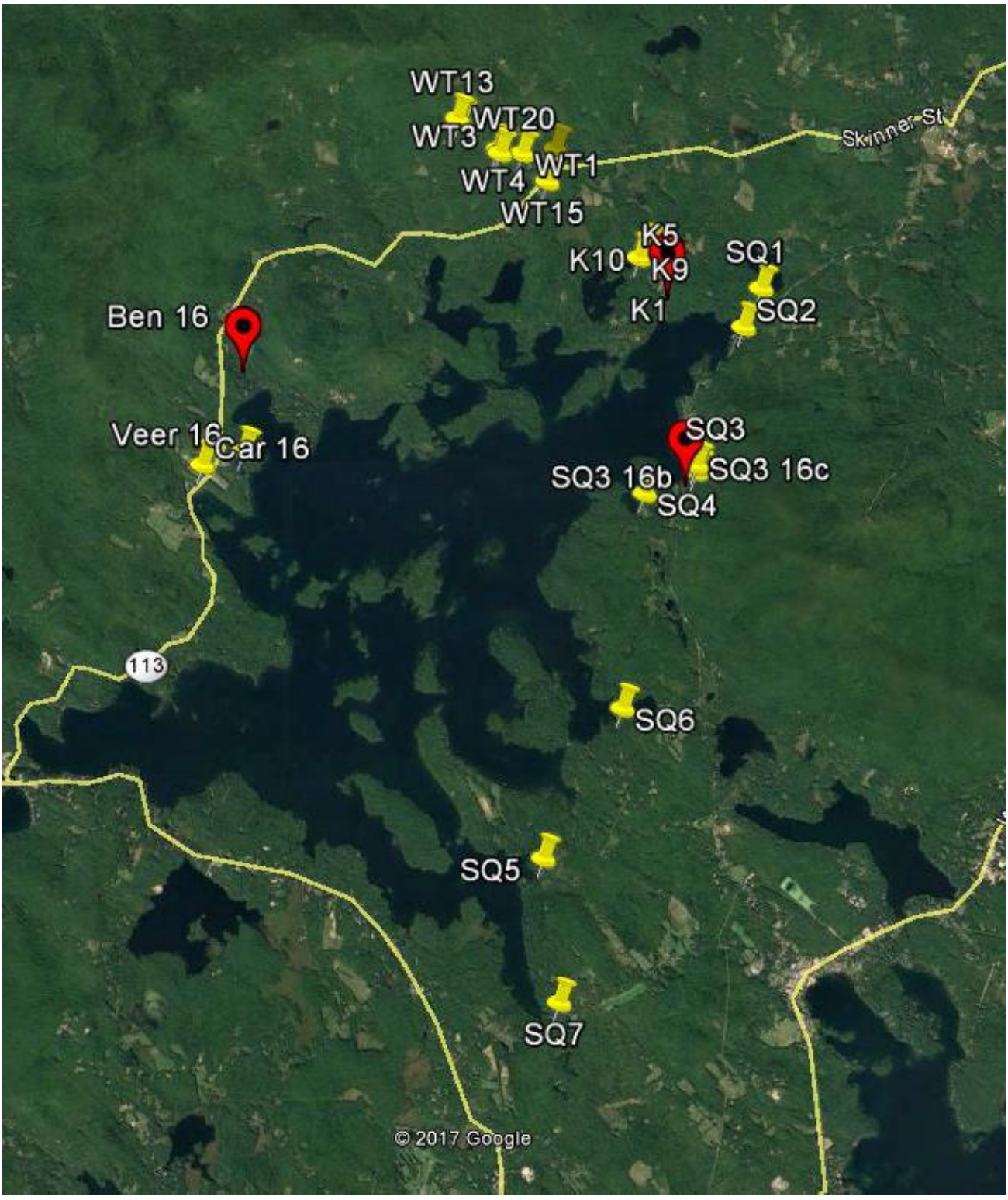

Figure 4: Locations of sediment samples collected in 2015-2016 and submitted for contaminant testing. Red markers indicate sites with elevated contaminant levels.

Results of 2016 Sediment Sampling

LPC's sediment sampling revealed 3 key locations of elevated contaminant levels in sediments. Contaminants at these sites exceeded levels identified by various agencies and researchers as being possibly or likely harmful to aquatic life.

The "K1" site is located on the outflow from Kusumpe Pond into Squam Lake, downstream of a gravel road. This was a site of concern following LPC's 2015 sediment sampling. Subsequent to sampling in the fall of 2015, there was a reported beaver dam blowout and subsequent culvert repair work on the road upstream of the site. LPC re-sampled the site, and testing revealed a substantial increase in PCB levels at this site, which exceeded probable effects levels (Figure 5). There was also a substantial increase in levels of dioxins and dioxin-like PCB's, which exceeded threshold effects levels and approached probable effects levels (Figure 6).

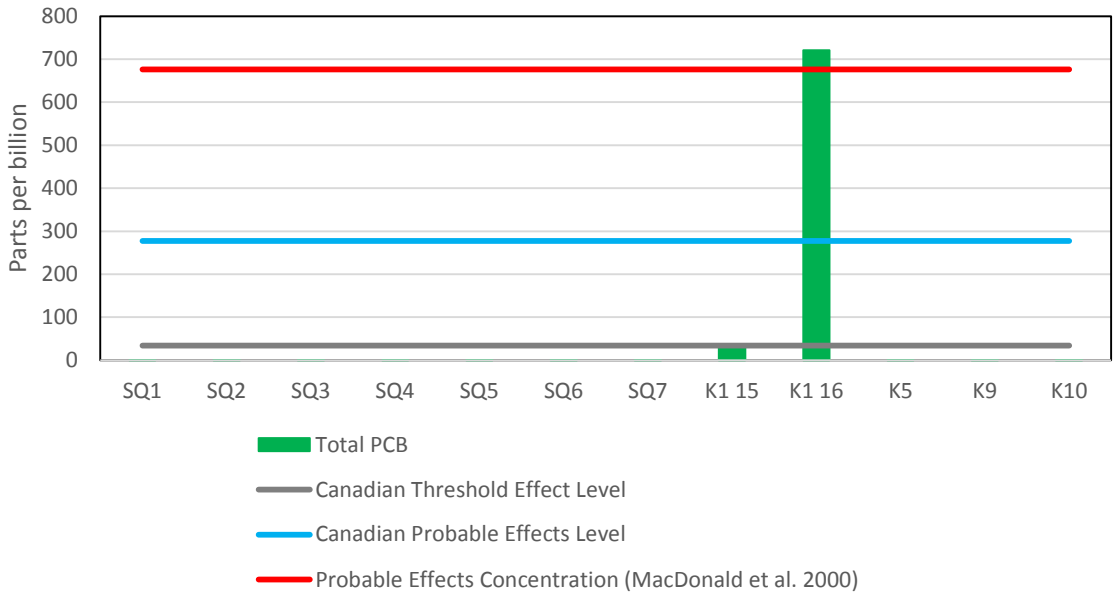

Figure 5: Total PCB levels in sediments collected in the Squam watershed. Levels of total PCB's at the K1 site in 2016 exceed the probable effects level established by the Canadian Ministry of the Environment and by MacDonald et al. (2000).

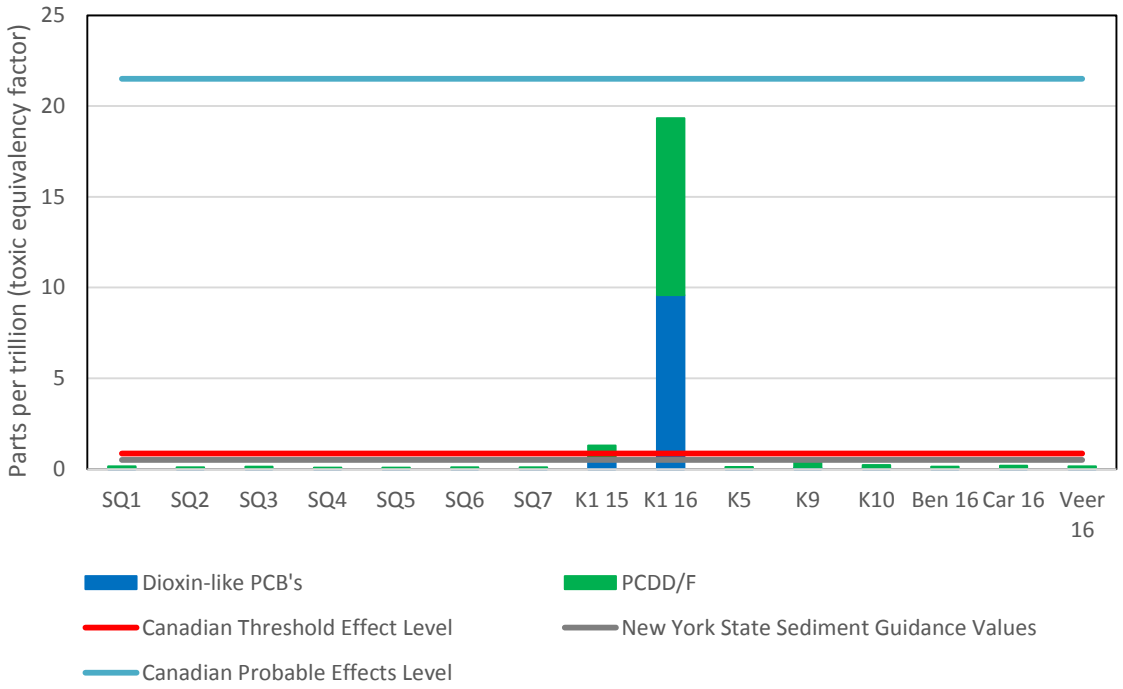

Figure 6: Levels of dioxins and dioxin-like PCB's in sediments collected in the Squam watershed. Levels of these contaminants at the K1 site in 2016 approach the probable effects level for likely harm to aquatic life established by the Canadian Ministry of the Environment.

In 2015, LPC had identified a site (SQ3) that exceeded threshold effects levels (i.e., possible harm to aquatic life) for total DDT established by the Canadian government. LPC staff sampled further up this tributary in the fall of 2016. Testing revealed that the additional sites sampled (SQ3 16B and SQ3 16C) had only background levels of DDT (Figure 7), suggesting that the source of the DDT may be associated with the road upstream of this site. Sampling at 3 previously untested locations revealed one site (Ben 16) that exceeded multiple sediment guideline values (Figure 7). Chemical profiles of total DDT at the original SQ3 site in both 2015 and 2016 (SQ3 15 and SQ3 16) and at the Ben 16 site revealed that the DDT at these locations was largely undegraded, suggesting either recent mobilization of sediments or recent applications of DDT.

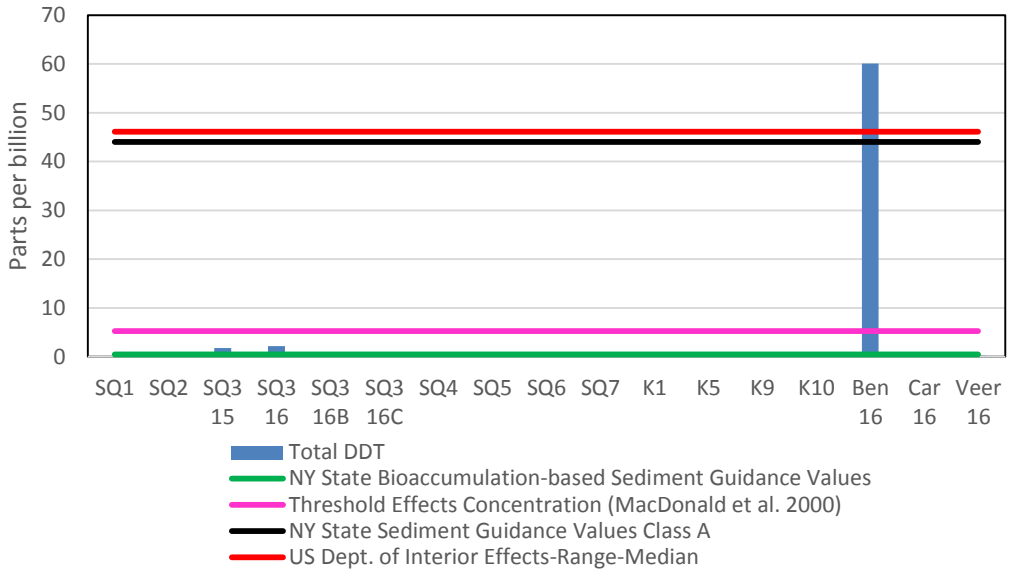

Figure 7: Levels of total DDT in sediments collected in the Squam watershed. Total DDT levels at the Ben 16 site exceed multiple sediment guideline values.

LPC has presented the sediment data in a report to New Hampshire Department of Environmental Services (DES) and requested that DES address this issue as soon as possible with options and plans for mitigation.

Mortality of Squam Lake's Adult Loons

Staff from Tufts University School of Veterinary Medicine and the University of New Hampshire Veterinary Diagnostic Laboratory performed necropsies on 13 adult loons from Squam Lake that were found dead between 2004 and 2016. The majority of these loons died as a result of human causes: 6 loons were killed as a result of ingested lead fishing tackle; 3 loons were killed by boat strikes; and 1 died as a result of a gunshot wound. One of the loons killed in a boat collision was the female from Perch Island, who died in August of 2016. Necropsies on these loons did not reveal excessive parasite burdens or identify other pathogens that might have contributed to the declines on Squam. Many more Squam Lake loons missing during this time period remain unaccounted for and are presumed to have died on their ocean wintering grounds.

Since the opening of the reconstructed public boat launch in 2001, the rate of mortality from lead fishing tackle on Squam Lake has increased by 63% (Figure 8) and is almost twice the overall statewide rate of lead mortality during the same period. Loon populations may be negatively impacted by the loss of even 0.4% of their population annually from human causes; and, between 2001 and 2015, Squam lost on average 1.5% of its adult loon population annually due to lead fishing tackle alone. Although it is not possible to demonstrate causation, it is worth noting that, since 2001, the number of boats counted in the annual Squam Lakes Association boat census, the number of fishing tournaments, and the number of boats participating in fishing tournaments have all increased significantly.

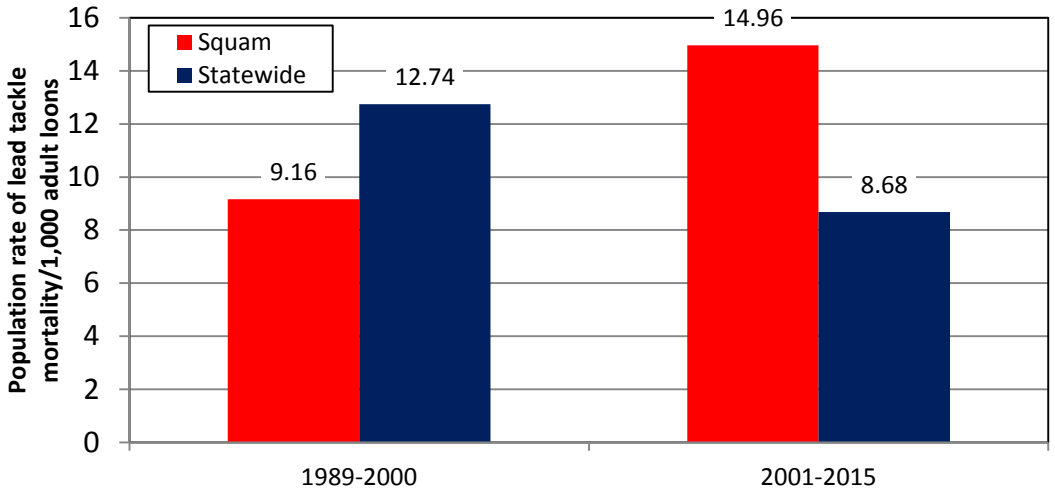

Figure 8: Population rates of lead mortality on Squam Lake vs. statewide rates of lead mortality.

Taking into account both loons known to have died and annual band returns, Squam's loons endured a period of particularly poor survival from 2003-2012, when the average annual survival rate dipped to 0.88 (Figure 9). From 2001-2016, the average survival rate of Squam's loons was 0.92, equaling the estimated statewide survival rate of adult common loons in New Hampshire. The survival rate of Squam's banded loons has been above average from 2013-2016, although the death of the Perch Island female in 2016 to a boat collision was a serious loss of the population. To date, 4 of Squam's banded loons remain unaccounted for in 2017. It is hoped that these loons remain alive and will be re-sighted before the end of the season.

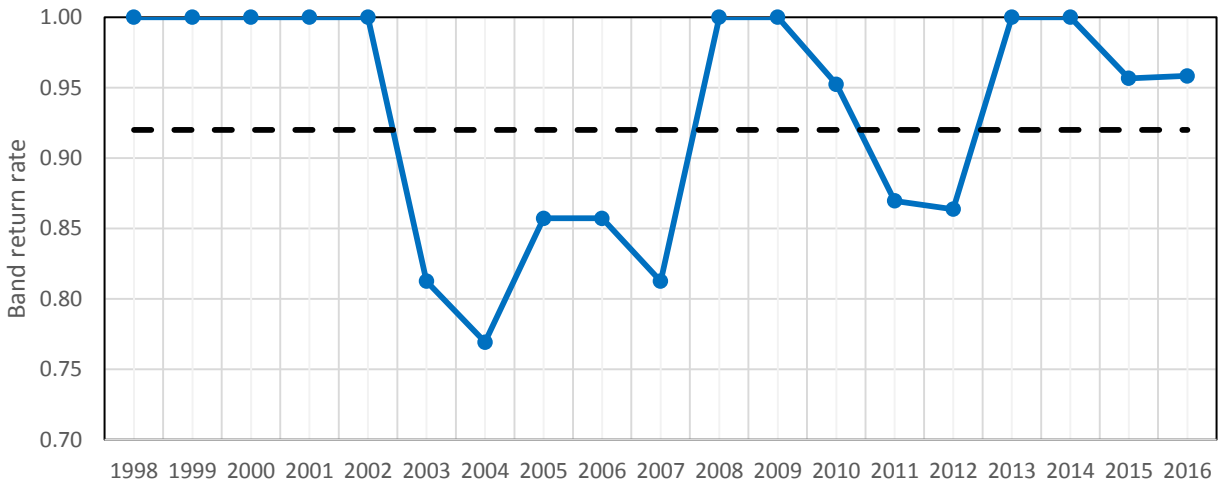

Figure 9: Band return and survival rates of loons on Squam Lake. This graph takes into account both banded adult loons known to have died and those which did not return in a given year.

The dotted line marks the estimated survival rate of adult common loons of 0.92 (Mitro et al. 2008).

Working Hypothesis to Explain the Impact of Contaminants and Other Stressors on Squam's Loon Population

The discovery of high levels of contaminants in Squam's loon eggs raised the question of what impact these contaminants had on the loon population in concert with the many other stressors facing Squam's loon population. LPC has a working hypothesis to understand the impacts of combined stressors on Squam's loon population. ***This is a hypothesis only and subject to change as new evidence and analyses become available.***

Like loons throughout New Hampshire, Squam's loons have been experiencing increasing stressors over time, from increased recreational pressure to increasingly hot summers and more intense precipitation events. On Squam, recreational and fishing pressure became more intense in the years following 2001, coincident with the reconstruction of the public boat launch in the same year, and mortality from lead fishing tackle increased in the same period (Figure 8). In approximately 2002, evidence suggests that there may have been an influx of contaminants into the lake from point sources on tributaries flowing into Sandwich Bay and perhaps Bennett Cove, likely as a result of increased runoff (Figure 10). By 2004, these contaminants had worked their way up the food chain to loons. These contaminants concentrate in fat reserves and may have contributed to the deaths of many of Squam's loons during the winter of 2004/2005 as their fat reserves were metabolized for the fall molt and migration. The loon pairs that survived to reproduce in subsequent years deposited high levels of contaminants into their eggs, possibly contributing to poor productivity.

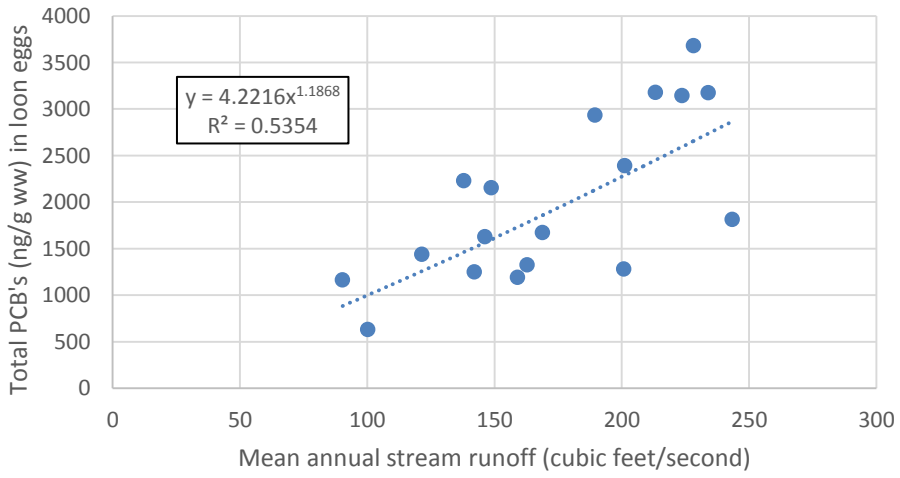

Figure 10: Mean annual stream runoff correlates strongly with total PCB contaminant levels present in Squam loon eggs two years later, long enough for contaminants to work their way up the food chain to loons. We use total PCB's as an example, but other classes of legacy contaminants followed the same pattern with a two-year lag between runoff and occurrence in loon eggs.

By 2008, some of the contaminants released from the point sources seem to have flushed though the Squam system, as evidenced by declining contaminant levels in Squam's loon eggs from 2008-2010. However, evidence suggests that ongoing high levels of adult mortality from lead fishing tackle and other anthropogenic causes continue to undermine the recovery of Squam's loon population. The loss of so many established, experienced adult loons has led to the immigration of new loons to fill the vacant territories, who are intruding into territories, driving remaining established loons out of their territories, disrupting nesting, and, in some cases, killing chicks. While these behaviors are typical for territorial disputes, the effects on Squam are amplified due to ***extremely high human-caused adult mortality*** and the resultant large number of vacant territories. Loons have evolved to thrive in a stable environment and stable social structure, and Squam's loons have had neither since 2001. These disruptions seem to be evident in the ongoing decline in nesting propensity and chick survival in recent years. The rate of chicks hatched per nesting pair has increased, as would be expected with a decline in contaminant levels in eggs if contaminants are affecting breeding success (Figure 1). Continued monitoring of contaminant levels in loon eggs is warranted.

The critical factor to restoring a healthy population of loons to Squam Lake seems to be ***keeping the adult loons alive,*** and allowing them to survive long enough to stabilize the social structure. By using non-lead fishing tackle and educating lake users about the dangers of lead and the need to boat carefully around loons, everyone can help reduce the threat of human-caused mortalities to loons. As the social structure stabilizes, there is reason to hope that productivity on the lake will improve, as the disruptions Squam loons are currently facing during nesting and chick-rearing will likely abate. The evidence from the declines of loons on both Squam Lake (2005-2007) and Lake Umbagog (2002) suggest this will take time. LPC has learned from both of these events that perturbations to the system cast a long shadow over a loon population, which could be expected in a long-lived bird like a loon. While the causes of the declines of the loon population on Umbagog are unknown and the adult population there has not recovered, in the last two years the remaining pairs of loons on Umbagog have finally experienced a recovery in productivity. As would be expected in a complex biological system, the experience of loons on Umbagog and Squam are not directly comparable, but the experience of Umbagog suggests that, with time, Squam's loons can recover. And on Squam, we understand much better the impacts of human activities on the decline of the loon population and ***how we can work together to help the population recover***.

The Squam Lake Ecosystem Model

LPC is working with Lori Siegel of Siegel Environmental Dynamics (SED) to integrate results of its research into a systems dynamics model to better understand recent changes in Squam's loon population. This model seeks to gain insight into whether any given stressor is enough to drive the population decline or, as might be expected in such a complex system, is enough to compromise the integrity of loons such that, in concert with other stressors, it threatens the population. The model differentiates between impacts to loon survival, chick hatching, and chick survival and allows us to isolate impacts at each lifecycle focal point. Table 1 outlines the factors identified by the model to date as impacting loons at each stage of their life history while

on Squam Lake. In supporting LPC's evidence and research on these stressors, the model will help LPC and others protect Squam's loons and the ecological integrity of Squam Lake.

Table 1: Factors influencing loon survival and breeding success on Squam Lake identified by the systems dynamics model.

Life history parameter	Factors influencing outcome
Adult loon survival	• Lead fishing tackle mortality • Increased angler tournament activity • Other contaminants
Chick hatching rate	• Immigration of new loons • Excessive precipitation • High temperatures • Human disturbance • Contaminants
Chick survival	• Human disturbance • Adult mortality from lead fishing tackle • Contaminants

Nest Cameras

LPC deployed four nest cameras in 2017 to study causes of nest failures and the effects of changing climate and human disturbance on loon nesting success. Cameras were placed prior to nest initiation to avoid disturbing the loons once nesting began. Loons nested at two of the locations where cameras were placed. Both of these nests failed. Cameras at one of the nests captured the male loon accidentally kicking the eggs into the water while climbing up on the nest (Figure 11).

The cameras provided valuable insights into events at nest sites and potential sources of disturbance and threats to nesting loons. In 2014, the cameras captured important evidence of human disturbance of the nest sites during the pre-nesting period, a critical time for loons in selecting nest sites. As a result of this photographic evidence, LPC worked with the New Hampshire Department of Fish and Game for permission to place protective ropes and signs around nest sites prior to egg laying to ensure that loons are not disturbed during the crucial nest initiation period.

Figure 11: Loon losing its balance as it is climbing onto its nest. The red circle highlights its foot right by one of the eggs, about to kick it into the water.

Remediation

LPC is working to address the challenges loons are facing on Squam and restore a healthy population of loons to the lake in the following ways:

1) *Limiting mortality from lead fishing tackle:* LPC's data was the impetus for Senate Bill 89, a bill to increase protections of loons from lead fishing tackle. Mortality from lead fishing tackle has likely contributed to the current social chaos and resultant low productivity on the lake. LPC has submitted a paper detailing our lead tackle mortality data to a peer-reviewed scientific journal as an important step to buttress Senate Bill 89 against any efforts to repeal the bill, as well as to communicate our findings to the scientific community. Educating the public about the dangers of lead to loons forms a major part of all outreach activities on and around Squam Lake. The evidence suggests that the most important thing we can do right now to restore a healthy population of loons on Squam is to ***keep adult loons alive***. Protecting loons from lead fishing tackle is a critical component of that effort.

2) *Limiting human disturbance:* LPC is continuing intensive management on Squam Lake to increase the reproductive success of loons, including the provision of artificial nesting rafts where appropriate, roping and signing loon nesting areas, and the placement of "Caution: Loon Chick" signs to alert boaters to the presence of loon chicks. Evidence from the nest cameras has resulted in enhanced management activities to protect loons

from human disturbance in the pre-nesting stage. Educating the public about the needs of loons and the importance of maintaining a respectful distance forms an important part of LPC's outreach activities. LPC has dramatically increased its outreach to the Squam Lake community and visitors through weekly presentations at the Rockywold-Deephaven Camps (RDC) on Squam Lake and twice-weekly loon cruises on the lake in partnership with the Squam Lakes Natural Science Center. In addition to these regular talks, LPC gives other presentations in the Squam area, including annual presentations at the Holderness Central School's environmental education week and programs at the Squam Lakes Association. These outreach opportunities resulted in a record number of presentations (45) in and around the Squam Lake area in 2016. LPC is also collaborating with the Squam Lakes Association to re-establish a Loon Chick Watch program on Squam to protect loon chicks from boat disturbances and collisions.

3) *Mitigating effects of climate change:* Covers on loon nesting rafts help protect loons from avian predators and provide shade for incubating loons, which can easily overheat. LPC has also placed nest cameras at nests on Squam to help us understand the impacts of climate change on loons and causes of loon nest failures on Squam.

4) *Identifying levels and sources of contaminants:* LPC has presented a report on the results of our sediment sampling to Department of Environmental Services and requested that DES address this issue as soon as possible with options and plans for mitigation. We will be working with state and federal agencies to facilitate possible remediation of these contaminated sites.

Next Steps

The Squam Lake Loon Initiative has already provided critical baseline data on contaminants and other environmental stressors on loons which will be invaluable to assess changes in, and effects of, contaminants and pathogens in the future. The collaboration of researchers formed as a result of the decline of loons on Squam Lake is unprecedented, and the testing being done on loon samples is the most comprehensive undertaken anywhere to date. The SLLI has resulted in an accurate record of loon populations and productivity on Squam Lake, including causes of nest failures; the quick response to sick or injured loons to increase chances of survival of these loons; an increased number of banded and sampled loons on Squam to increase our knowledge of the survival and breeding success of known individuals, and the relationship of survival and breeding success with contaminant burdens; a model to elucidate the effects of multiple co-occurring stressors on the survival and breeding success of loons; and protection and outreach sufficient to recover and maintain the Squam Lake loon population. We anticipate that this initiative will help avoid future declines of loons on Squam and on other lakes; bring to light what could be a much larger, more systemic problem on Squam indicated by the decline of loons; inform other LPC initiatives such as the New Hampshire Loon Recovery Plan; and help LPC and others make more informed decisions to protect Squam's loons, other wildlife, and the ecological integrity of Squam Lake, as well as lakes throughout New Hampshire.

Objectives for the Squam Lake Loon Initiative in 2017 include:

1. Working with state and federal agencies to facilitate remediation at potential point sources
2. Testing collected loon eggs from failed nests on Squam in 2017 to monitor current contaminant trends
3. Testing eggshell thickness for eggs with known contaminant levels to determine the effect of contaminants on eggshell thinning and nest failures
4. Banding loons on Squam Lake to measure adult survival, productivity, and contaminant levels of known individuals
5. Testing loon blood samples to identify pathogens and other health concerns, including cyanotoxins
6. Inspecting data from nest cameras to investigate disturbances at nests and explore the influence of climate on incubating loons
7. Analyzing egg contaminant results in preparation for submission of a paper to a peer-reviewed journal
8. Analyzing retention of water within the basins of Squam Lake to investigate whether basin retention relates to contaminant concentrations
9. Incorporating new data into the systems dynamics model to better understand factors influencing survival and reproductive success of loons on Squam
10. Continuing intensive monitoring, management, and outreach to support Squam's loons

Squam Lake will continue to play a leading role in advancing our understanding of loons and their challenges in New Hampshire, and the groundbreaking research being conducted on Squam Lake will continue to inform LPC's efforts to preserve loons throughout New Hampshire.

Acknowledgements

LPC would like to thank our many collaborators and partners who have contributed technical expertise or opportunities for outreach to the Squam Lake Loon Initiative:

- Biodiversity Research Institute: Lee Attix, Mike Chickering, Chris Persico
- Environment Canada: Robert Letcher
- Environmental Protection Agency: Mark Cantwell
- LPC's Technical Committee: Kristen Begor (LPC Board), Mark Brennan, Jacquie Colburn (NH Department of Environmental Services), Anne Kuhn (US Environmental Protection Agency), Drew Major (US Fish and Wildlife Service), Chris Martin (NH Audubon), Brian Reilly (LPC Board), Vincent Spagnuolo (Biodiversity Research Institute)
- New Hampshire Veterinary Diagnostic Laboratory: Inga Sidor
- Plymouth State University: Lisa Doner, Amanda Hollenbeck, Nicole Ramberg-Pihl, Kerry Yurewicz
- Rockywold-Deephaven Camps
- Squam Lakes Association: Brian Gagnon, E.B. James, Kyle Salmons
- Squam Lakes Natural Science Center
- Tufts University Cummings School of Veterinary Medicine: Mark Pokras
- University of New Hampshire Cooperative Extension: Bob Craycraft, Jeff Schloss

LPC would also like to thank the many people, foundations, and efforts (e.g., The Swim) that have made our work to understand and reverse the declines of loons on Squam Lake possible.