Restore the Call: Massachusetts Status Report for the Common Loon

Home to more than 1,100 lakes and nearly 1,500 miles of ocean shoreline, Massachusetts offers prime habitat for breeding and wintering loons. Extirpated in the early 20th century, Common Loons returned to the state in 1975 as a nesting species. Over the last four decades, breeding loons have made a comeback— in 2018, there were 43 territorial pairs in the state.

The loon is a key biosentinel of aquatic integrity for lakes and near shore marine ecosystems across North America. Supported by a grant from the Ricketts Conservation Foundation (RCF), Biodiversity Research Institute (BRI) initiated the largest conservation study for the Common Loon. The goal is to strengthen breeding populations in their existing range and to restore loons to their former breeding range. This work advances our understanding of loon ecology and allows us to apply that knowledge to help restore the integrity of ecosystems where loons once thrived. State working groups and associated conservation plans have been developed in partnership with the Massachusetts Department of Conservation and Recreation, MassWildlife, and the U.S. Fish and Wildlife Service.

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September 2018

Status of the Breeding Common Loon Population in Massachusetts

As a result of human activities such as sport hunting and shoreline development, breeding loons in Massachusetts were extirpated in the early 20th century (Forbush 1925). By the time the Federal Migratory Bird Treaty Act of 1918 was enacted, Common Loons (*Gavia immer*) had already disappeared from the state. In 1975, a nesting pair was discovered on Quabbin Reservoir (Clark 1975; Blodgett and Lyons 1988). However, recolonization is slow for Common Loons, and they are currently designated as a Species of Special Concern in Massachusetts.

Rafts have proven to be an effective management tool in reproductive studies on New England lakes and ponds—hatching success increased by 51% on lakes with stable water levels and 119% on those with fluctuating systems in NH and VT (DeSorbo et al. 2007). Over the past 10 years, only 38% of MA pairs have nested on rafts but have hatched 172% more chicks than natural nesting pairs (Spagnuolo 2012).

Distribution and Movements

In New England, nearly 2,000 territorial pairs of Common Loons currently breed in Maine, New Hampshire, and Vermont (Evers et al. 2010). In Massachusetts, a disjunct breeding population exists (Figure 2). However, the loon population is recovering in the state. Since 1985, this population has increased six-fold; by 2018, 43 territorial pairs were found on 18 lakes (Figure1). While the population has increased, overall productivity—chicks surviving per territorial pair (CS/TP)—has slowed since the late 1990s.

In 14 of the last 21 years, the productivity rates in Massachusetts has been below sustainable levels (0.48 CS/TP; Evers et al 2010; Figure 3). The carrying capacity for Massachusetts is estimated to be about 300 pairs based on lake area, depth, and phosphorus concentrations (Spagnuolo 2012). Therefore, larger breeding populations are feasible.

Data from breeding loons banded in New England and New York, found recovered or re-observed live on wintering areas, ranged from Canada to Florida. Coastal Maine (36%) and Cape Cod, Massachusetts (36%) accounted for 72% of all wintering areas. This was followed by the mid-Atlantic (10%), southern New England (8%), Long Island, New York (6%), and coastal New Hampshire (4%). Continued banding is needed to better understand seasonal movements (since 1999, 107 loons have been banded).

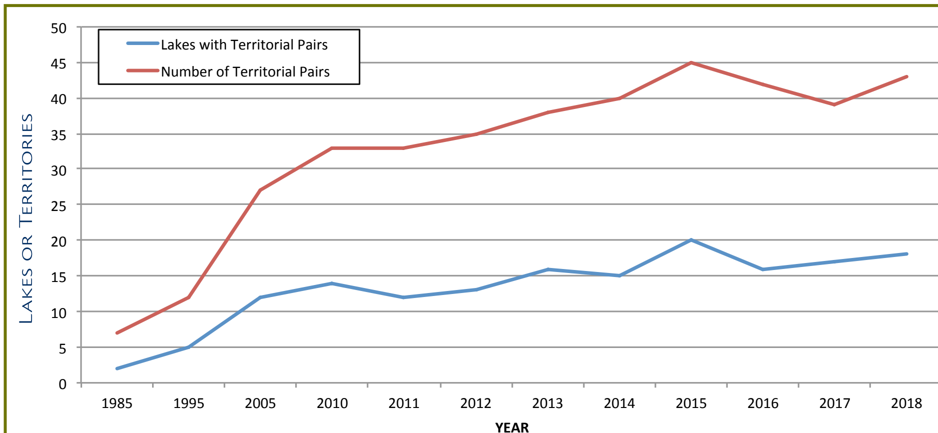
There are gaps in our knowledge about the wintering activities of loons. We do know that winter densities are highest around Nantucket and Monomoy Islands. More complete information about the seasonal movements of the Massachusetts breeding loon population will help improve sustainable management of the species.

Conservation Concerns

Threats to Massachusetts' loon population include:

- loss of breeding habitat from shoreline development
- human disturbance such as recreational activities
- water level fluctuations from dams
- contaminants such as lead and mercury
- wintering hazards such as marine oil spills

(Source: Evers et al. 2010)



	1975	1985	1995	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
Lakes with Territorial Pairs	1	2	5	12	14	12	13	16	15	20	16	17	18
Number of Territorial Pairs	1	7	12	27	33	33	35	37	40	45	42	39	43

Figure 1. Number of lakes and territories occupied by loons in Massachusetts.

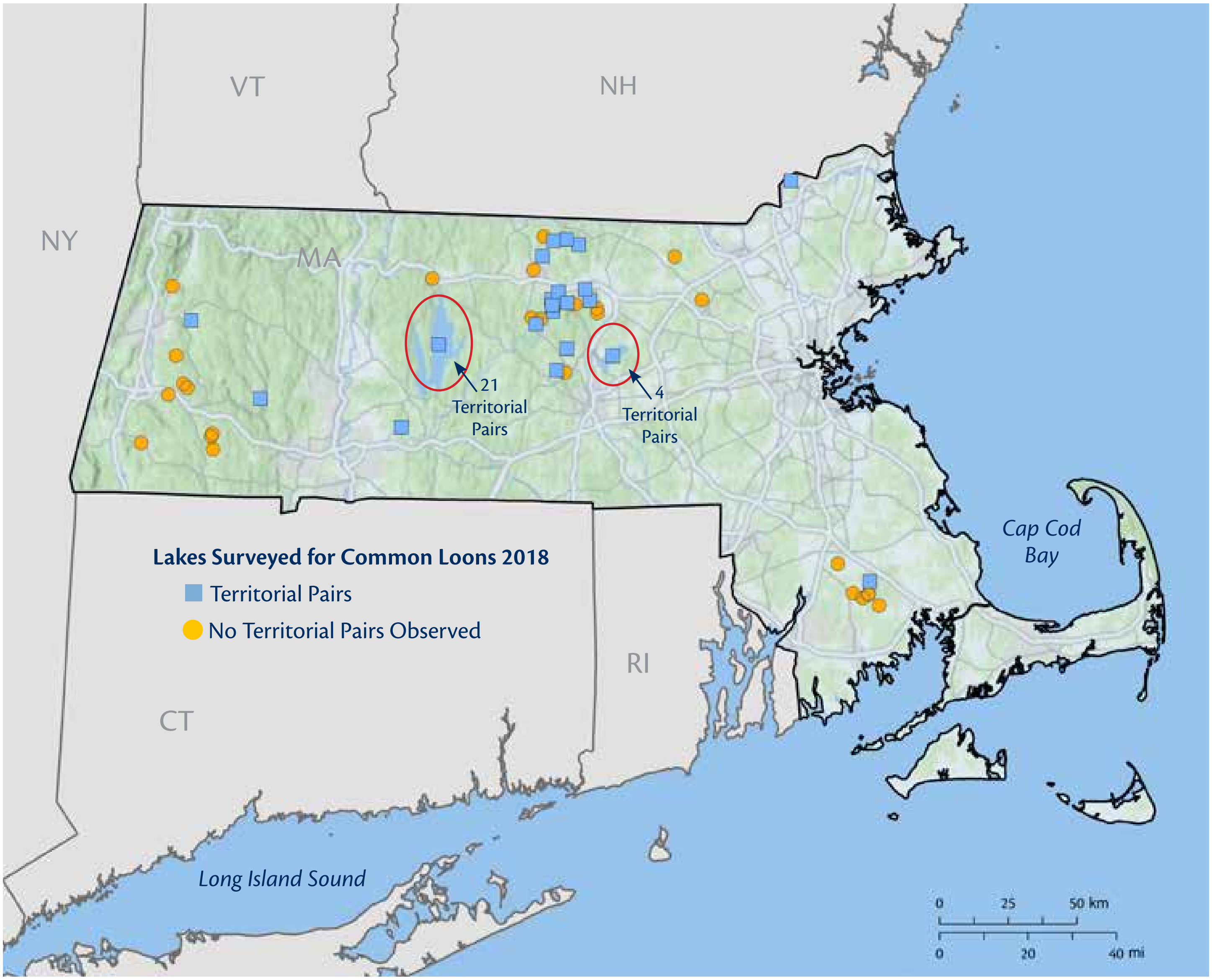


Figure 2. Distribution of Common Loon surveys in Massachusetts for 2018 depicting known territories and lakes without loons.

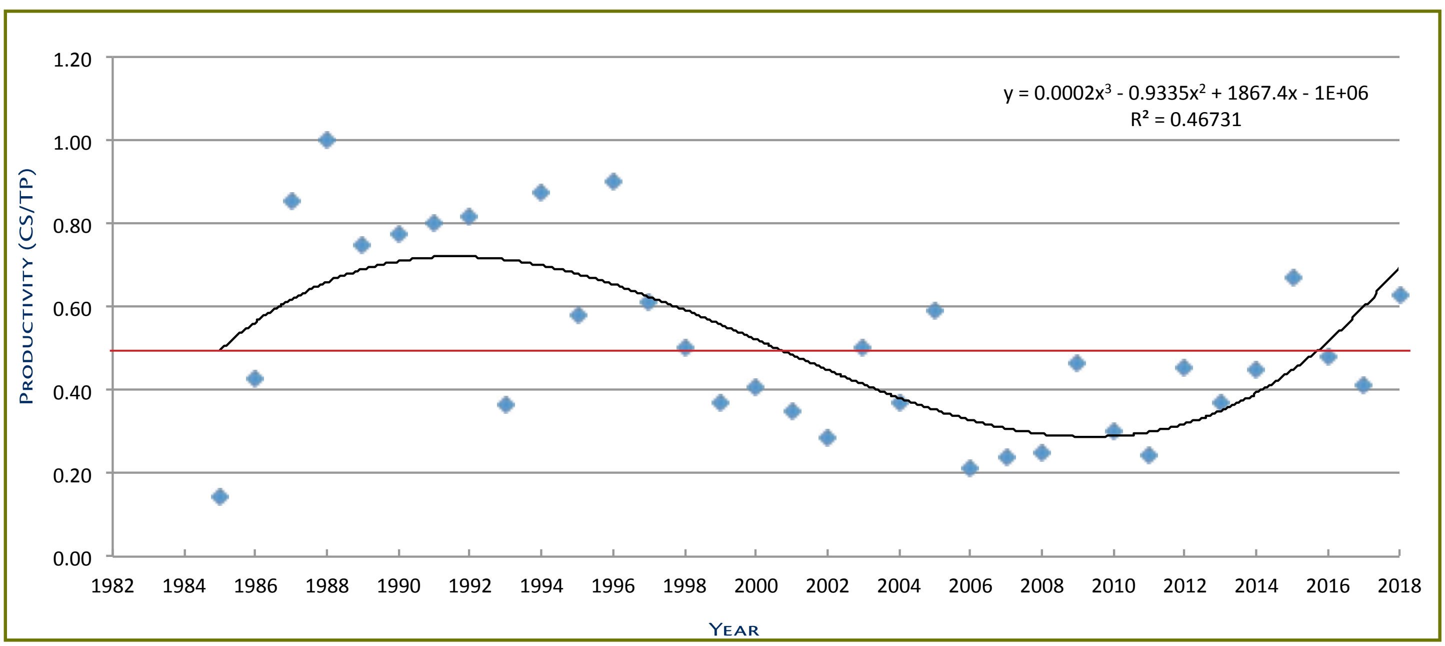


Figure 3. Overall productivity of Common Loons. Red line depicts the number of CS/TP needed to sustain a breeding population.

The Concern for Loons in Massachusetts

Mercury's Impact in the Environment

Humans and wildlife are exposed to mercury pollution mainly through the consumption of contaminated fish and other aquatic organisms. Wildlife directly linked to aquatic ecosystems have an increased exposure risk to mercury compared to species living independent of aquatic food webs because the conversion of mercury to methylmercury is enhanced in wet soils that are low in oxygen.

Mercury, when ingested, can have a wide range of effects on an animal. Survival, reproduction, immune response, song, and endocrine function are all aspects of avian ecology that may be adversely affected by elevated blood mercury levels (Jackson et al. 2011; Evers et al. 2012), especially in loons (Burgess and Meyer 2008; Evers et al. 2003, 2008, 2011).

High mercury levels in loons are most common in four scenarios: (1) where water chemistry is sensitive to mercury input; (2) when summertime lake level fluctuations are greater than six feet; (3) where large mercury point sources exist; and (4) where shoreline wetlands are common.

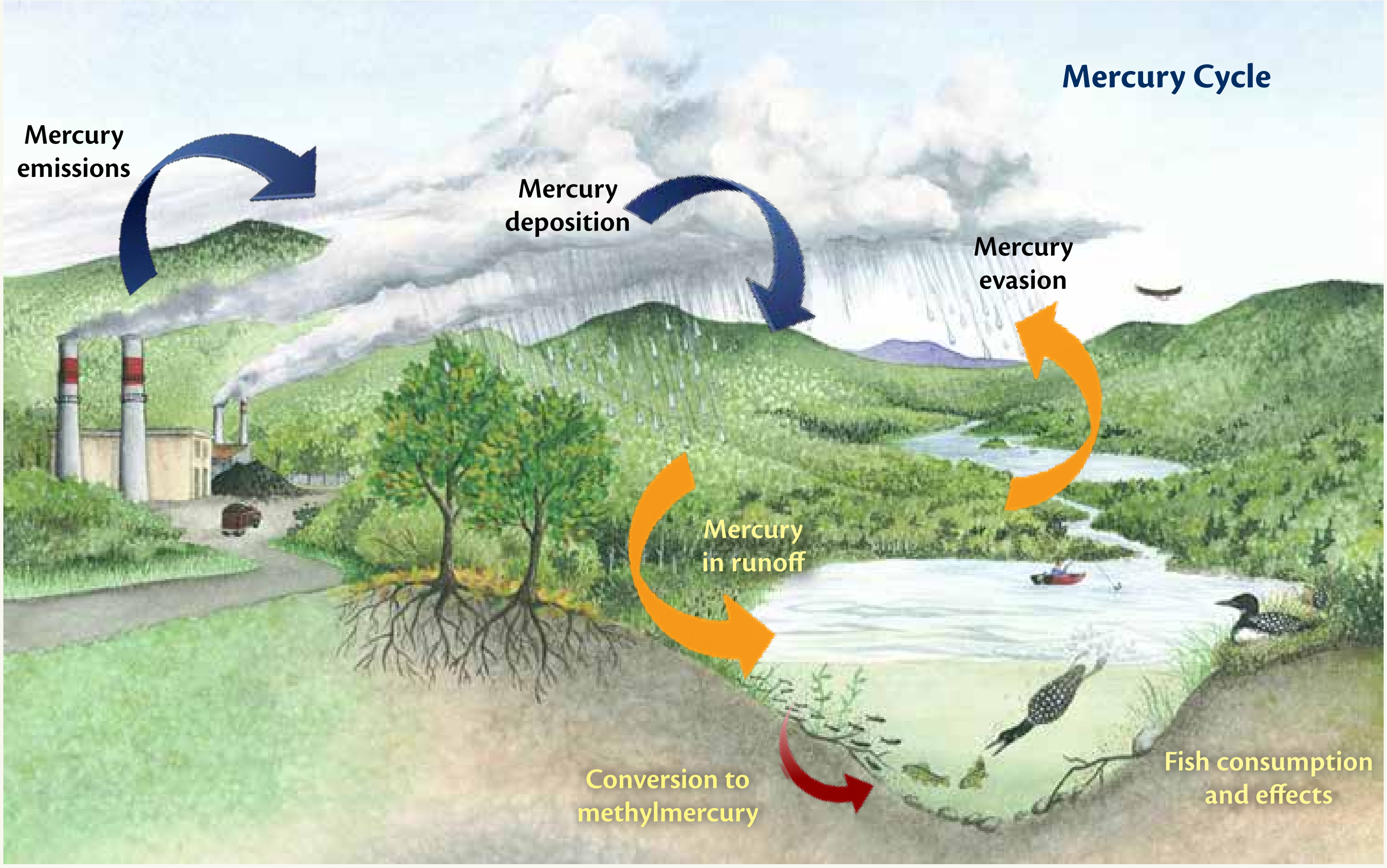


Figure 4. This simple version of the mercury cycle illustrates how mercury enters and moves through an ecosystem. Sources of mercury in Massachusetts are varied. Coal-fired power plants (particularly those in the Ohio River Valley) are a major source of air emissions. Recent reductions in air emissions from incinerators have proven effective in rapidly reducing mercury in loons and fish (Evers et al. 2007). Water-borne sources are still not fully known.

Common Loons Help Us Monitor Mercury in the Environment

Recent levels of available methylmercury in aquatic ecosystems in the Northeast pose significant risks to human and ecological health (Smith and Tripp 2005; Scheuhammer et al. 2011; Sunderland et al. 2013).

Loons—large, long-lived birds that feed exclusively on fish—generally bioaccumulate more mercury than other bird species. Loons are therefore widely recognized as the key avian indicator for lakes in North America (Evers 2006).

Continental trends in mercury pollution indicate a significant increasing gradient—west to east with the highest blood and egg mercury levels in the Northeast (Evers et al. 1998, 2003, 2007). As such, this region contains *biological mercury hotspots*. North-central Massachusetts is one area of concern (Evers et al. 2007). Blood samples from 114 adults taken between 1999 and 2017 ranged from 0.67 to 6.58 parts per million (ppm) with a mean of 2.30 ± 1.14 (ppm, wet weight [ww]; Dalton and Savoy 2018).

These results indicate that, on average, 17% of Massachusetts' breeding Common Loon population contains a blood mercury concentration (≥3.0 to 3.5 ppm) associated with a 40-50% reduction in surviving young. Additionally, 80% of Massachusetts' loons contain a blood mercury concentration above 1.5 ppm, a level with potential to cause a 10% decrease in fledged young. These findings may explain lowered productivity observed in Massachusetts over the past 15 years (Figure 6).

Lowered reproductive success is partly due to behavioral changes, such as increased time spent away from the nest, which then increases egg exposure to excessive cold or heat, as well as to predators.

Mercury and Air Toxic Standards

In April 2015, the U.S. EPA Mercury and Air Toxics Standards rule went into effect. The rule limits emissions of toxic air pollutants, including mercury and other heavy metals. The aim is to reduce mercury emissions in the United States by 91%.

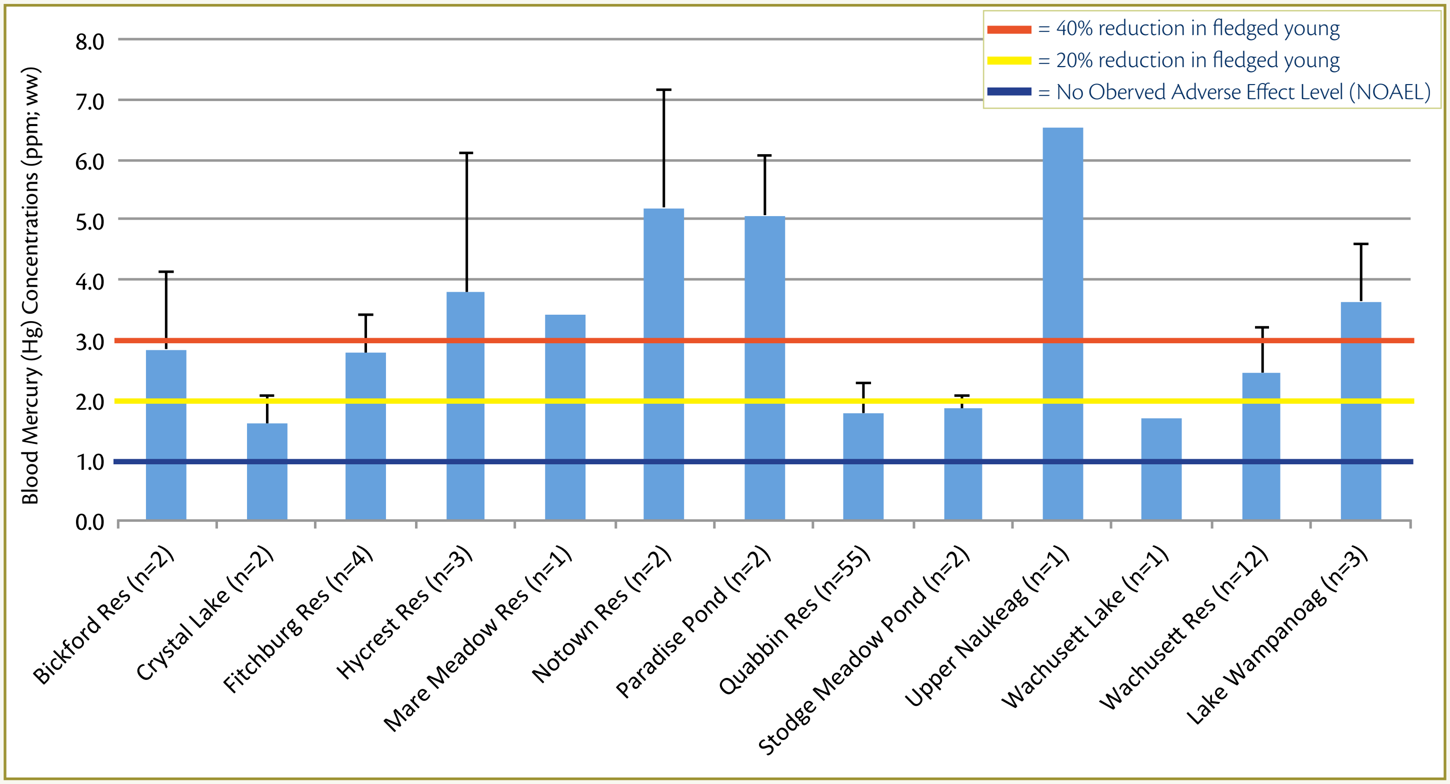


Figure 6. Mean blood mercury concentrations in adult Common Loons sampled on Massachusetts waterbodies (1999-2017; n=90). The three colored lines represent mercury effect thresholds in Common Loons: **red** = 40% reduction in fledged young; **yellow** = a 20% reduction in fledged young; and **dark blue** = No Observed Adverse Effect Level, or NOAEL (Evers 2018).

Marine Oil Spills: Applying Successful Approaches

Bouchard Barge 120

On April 27, 2003, the Bouchard Barge 120 (B120) struck ground near Cape Cod Canal. Between 22,000 and 98,000 gallons of No. 6 fuel oil spilled into Buzzards Bay (U.S. Coast Guard 2003; Hall 2003).

This event occurred during migration of several bird species including the Common Loon. Approximately 200 dead or moribund loons were collected and a rapid field assessment was coordinated by the U.S. Fish and Wildlife Service (USFWS) through the Loon Preservation Committee (LPC) and BRI to document the range and fate of dispersing individuals (Taylor et al. 2004).

Oil Fingerprinting

Dispersed loons with oiled plumage were identified in Maine, Massachusetts, and New Hampshire. A total of five loons were observed with oil in Maine and New Hampshire. One of these loons was identified by its color bands and found on its traditional breeding territory in central New Hampshire.

Another loon captured in New Hampshire was tested and found to have been contaminated by the B120 oil spill. This finding and other observations documented that the "footprint" of impact was greater than the immediate Buzzards Bay area. Pre- and post-spill data from monitored breeding loon populations in the Northeast helped identify further potential impacts to reproductive success.

Proven Restoration Strategies

In a precedent-setting 10-year restoration effort for the North Cape Oil Spill in Rhode Island, BRI worked with the USFWS to identify and purchase the best lake shoreline properties for mitigation. We then monitored the protected loon pairs on a weekly basis for two to six years. This long-term approach was helpful in replacing and determining the loon years lost (adult loons that died from the spill as well as their lost future progeny). This strategy is worth considering for the B120 spill.

Above: Bouchard Barge 120 aground near Cape Cod Canal, April 2003. Oil washed ashore for more than two weeks, impacting a variety of natural resources, including wildlife, across more than 90 miles of shoreline.

Left: An oiled Common Loon on Horseneck Beach, MA.

Northeast Loon Study Working Group

Organized in 1994, the Northeast Loon Study Working Group (NELSWG), led by the LPC and USFWS, is a consortium of federal and state agencies, universities, and nonprofit organizations from New England states and eastern Canadian provinces created because of wide-spread concerns about the health of loons in the Northeast.

With input from members, NELSWG coordinates cooperative research and other actions on issues, such as the development of standardized methodologies, that are beyond the scope of any one of its member organizations.

NELSWG is working with the B120 trustee council to help identify potential restoration solutions to counter the loss of loons from that oil spill.

Critical Gaps in Understanding

Monitoring and banding efforts have allowed a detailed examination and understanding of the breeding loon population in Massachusetts—its demographics and natural history, as well as comparisons and benchmarking with neighboring state populations. Additional data is required to more fully determine the biological parameters used in NRDA's calculations for loon-years gained through conservation actions resulting from the B120 oil spill. These knowledge gaps and recommendations to address them are presented in the following sections.

Adult and Juvenile Survivorship and Breeding Site Fidelity

Monitoring banded breeding loons in Massachusetts should continue during the breeding season. The annual count of returning loons and their associated reproductive outcomes will allow us to refine the demographic parameters required to model loon-years lost due to oil spills.

Translocated Loon Chick Return Rates and Dispersal

Documenting the successful fledging, returning, and breeding of translocated loon chicks is important for guiding restoration plans that utilize translocation as part of an effort to restore loon-years lost.

Translocated chicks have fledged from both captive rearing and direct release approaches. We documented their successful return as adults in summer 2018. Monitoring southeastern Massachusetts to resight returning loons translocated to that area will be important to document habitat use, movements, and any territorial behavior.

Wintering Range and Winter Site Fidelity

Few wintering band resights and recoveries have occurred for Massachusetts loons due to the small number of banded loons and difficulty of obtaining these data points. In order to increase the understanding of this aspect of the population's natural history, satellite telemetry tracking devices (PTT–Platform Transmitter Terminal) should be deployed on male Massachusetts loons. Data obtained from this effort would provide insight into migration timing and pathways, wintering locations, and winter home range. Alternatively, the geolocator approach to investigating wintering loons requires recovery of the devices in subsequent breeding seasons, and the resulting location data lacks precision (100+ km spread in data points).

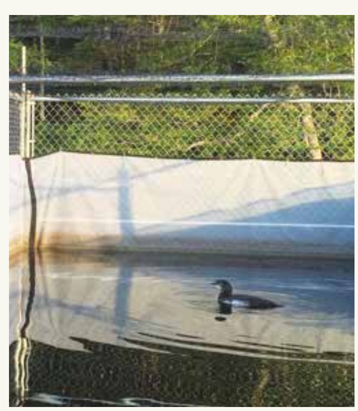
Massachusetts Habitat Assessment and Carrying Capacity

Prior to extirpation, loons occupied a large part of Massachusetts but have only recolonized a small portion of their former range in the state. Carrying capacity estimates by Spagnuolo (2014) reported quality breeding habitat across the state as well as the potential for 295 territorial pairs. This effort could be revised and refined to better understand the potential population gains from loon restoration efforts in targeted areas (i.e., southeastern Massachusetts and the Berkshires).

Translocating Loon Chicks to Massachusetts

In 2015, in collaboration with the New York State Department of Environmental Conservation and the Massachusetts Division of Fisheries & Wildlife, BRI successfully moved seven chicks from New York's Adirondack Park to a lake in the Assawompsett Pond Complex (APC) in southeastern Massachusetts. In 2016, BRI translocated nine chicks to the APC (four from New York, five from Maine) with assistance from the Maine Department of Inland Fisheries & Wildlife and Maine Audubon Society. In 2017, eight chicks were translocated from Maine to Massachusetts. Overall, 24 chicks were successfully translocated to Massachusetts.

Five adult loons returned to the lakes in Massachusetts to which they were translocated and captive-reared, and then from which they fledged. Their return marks a major milestone in the efforts to translocate Common Loons. See BRI publication: *Loon Translocation: A Summary of Methods and Strategies for the Translocation of Common Loons* at **www.briloon.org/loons2018.**



BRI staff developed methods for captive rearing loon chicks in aquatic pens (far left). When they are able to forage on their own, the loons are released and carefully monitored until they fledge.

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BRI's mission is to assess emerging threats to wildlife and ecosystems through collaborative research and to use scientific findings to advance environmental awareness and inform decision makers.

dcr Massachusetts

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Credits

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