A six-million-acre mosaic of public and private lands, the Adirondack Park is the mainstay of the breeding population of Common Loons in New York State.

Periodic surveys indicate that New York's loon population has been gradually increasing in size and expanding its range across the state since the 1970s.

Restore the Call: New York Status Report for the Common Loon

The loon is a key biosentinel of aquatic integrity for lakes and near shore marine ecosystems across North America. In 2013, The Ricketts Conservation Foundation initiated the largest conservation study for the Common Loon. Research for the *Restore the Call* project, conducted by Biodiversity Research Institute (BRI), covers three major areas of North America including New York. The goal is to strengthen breeding populations in their existing range and to restore loons to their former breeding range. This work will advance our understanding of loon ecology and allow us to apply that knowledge to help restore the integrity of ecosystems where loons once thrived. A state working group and an associated conservation plan will be developed in partnership with the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service.

A Series Publication by BRI's Center for Loon Conservation in Partnership with the Ricketts Conservation Foundation

April 2015

Status of the Breeding Common Loon Population in New York

Common Loons (*Gavia immer*) are designated as a Species of Special Concern in New York State, as well as protected under the Federal Migratory Bird Treaty.

Historical records provide limited information about the presence of Common Loons in New York State (Eaton 1910). In the early 1960s, Arbib (1963) estimated the total breeding population between 240-360 pairs, but a survey conducted in the 1970s concluded there were less than 200 breeding pairs in the Adirondacks (Trivelpiece et al. 1979). However, surveys conducted in the 1980s by the New York State Department of Environmental Conservation estimated the Adirondack loon population at 216-270 breeding pairs (Parker and Miller 1988), indicating an expanding population.

Results from the New York State Breeding Bird Atlas (Schoch 2008) support this conclusion, as the number of confirmed breeding pairs increased 66 percent between the 1980-1985 and 2000-2005 Atlases. Since the 1980s, loons have expanded their range in New York in all directions, with pairs now observed in the eastern and southern parts of the Adirondack Park, as well as in central and western New York, and along the St. Lawrence River.

The estimated carrying capacity for all of New York (based on lake area) is between 2,000 and 4,000 territorial loon pairs, indicating that there is considerable potential for expansion of the loon population across the state. In the Adirondack Park, the potential carrying capacity is estimated at ~1,000 territorial loon pairs (Schoch and Sauer unpubl. data). Preliminary results from a citizen-science survey conducted on 420 New York lakes between 2001 and 2012 by the Wildlife Conservation Society and BRI's Adirondack Center for Loon Conservation estimated the current Adirondack summer loon population between 600 and 850 territorial pairs (Sauer and Schoch unpubl. data), more than double the estimated population from the 1980s survey, and indicating that the loon population within the Park may soon be utilizing the majority of the suitable available territories.

Since 1998, 317 Adirondack loons have been banded.

While the New York loon population is expanding, the overall productivity of loons appears to have slowed, another indication that the population may be nearing carrying capacity. In the 1970s, Trivelpiece et al. (1979) observed 0.83 chicks surviving per territorial pair, while in the 1980s, Parker and Miller (1986) found a very high level of 0.96 chicks fledged per pair. However, in more recent years (1998-2007), Schoch et al. (2014) observed an overall productivity of 0.59 chicks fledged per territorial loon pair. This decrease in productivity may reflect increased predation of eggs and chicks by the expanding Bald Eagle (*Haliaeetus leucocephalus*) population, and/or increased human disturbance from boating on breeding lakes, or possibly other factors such as environmental mercury loads. However, in all the New York surveys, the overall productivity does still exceed sustainable levels (0.48 chicks surviving per territorial pair; Evers et al. 2010), reflecting that the New York breeding loon population is on an increasing trend.

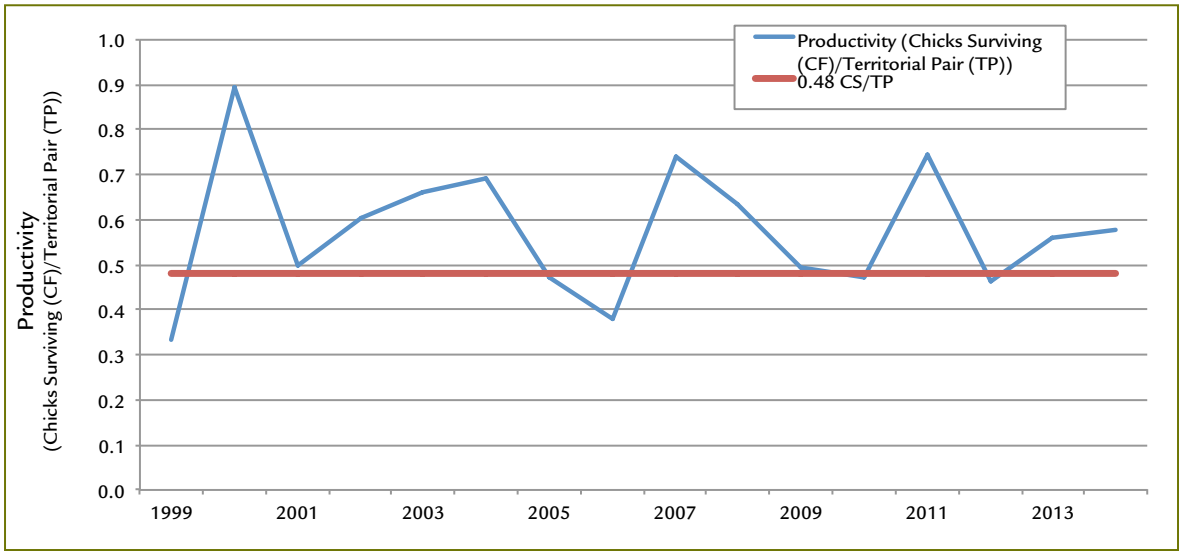

Figure 1. Overall productivity of banded Adirondack Common Loons from 1999-2014. Red line depicts the number of CS/TP needed to sustain a breeding population.

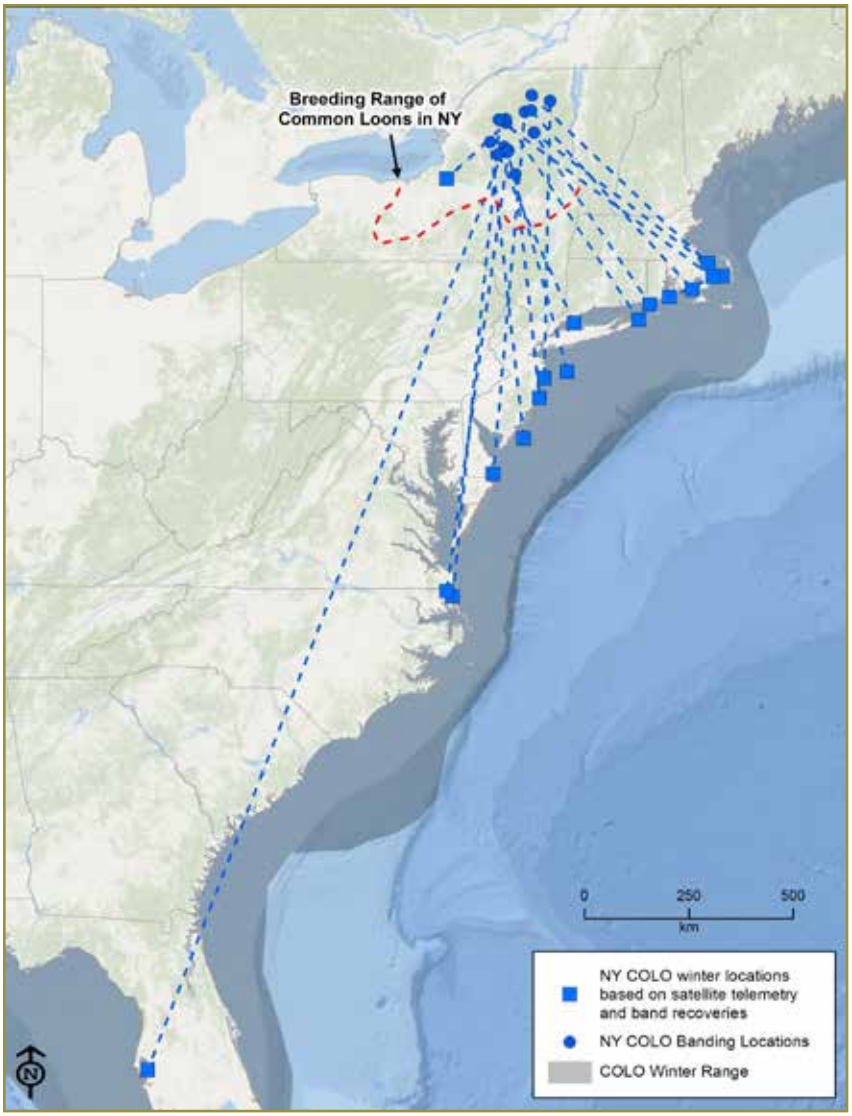

Figure 2. Breeding and wintering ranges of New York's Common Loon population. Movements of loons are based on satellite transmitter data, recoveries, and observations of individual New York loons banded by BRI.

Conservation Concerns

Threats to New York's loon populations include:

- Loss of breeding habitat from shoreline development
- Human disturbance, such as recreational boating activities
- Fishing line entanglement
- Water level fluctuations from dams and storms
- Lead toxicity from ingestion of lead fishing tackle
- Environmental mercury pollution and acid deposition
- Predation
- Botulism type E affecting birds migrating through Lakes Erie and Ontario
- Wintering hazards such as marine oil spills

Additionally, as the New York loon population expands, it is expected that there will be a corresponding increase in intraspecific interactions, potentially limiting the number of breeding pairs. Indeed, observations of such interactions have become more common in recent years (Schoch unpubl. data).

Distribution and Movements

The core of New York's breeding loon population summers in the Adirondack Park, although loons are observed on waterbodies throughout the state during migration, and nesting pairs were confirmed in the Finger Lakes and on the St. Lawrence River in the 2000-2005 Breeding Bird Atlas (Schoch 2008).

BRI's research confirms that loons that breed in New York overwinter along the Massachusetts, New Jersey, Virginia, North Carolina, and Florida coasts (Figure 2). There are gaps in our knowledge about the wintering activities of loons. Continued banding and migration research using such tools as geolocators or satellite transmitters is needed to better understand seasonal movements (317 Adirondack loons have been banded since 1998). More complete information about the seasonal movements of the New York breeding loon population will help improve sustainable management of the species.

In addition to color bands, satellite transmitter tags help us track loon movements.

Botulism Type E: Invasives Take a Toll on Migrating Loons

In 1993, a round goby (*Neogobius melanostomas*) was first caught in Lake Erie. The species was likely introduced when a tanker discharged its ballast water from the Black Sea into the Great Lakes (Jude et al. 1992). By 1999, the population of this invasive bottom-dwelling fish had increased exponentially, becoming widespread throughout Erie (Murray 2001), where it found a favorite food source in the expansive beds of nonnative zebra and quagga (*Dreissenid spp.*) mussels (Jude 1997).

In the fall of 2000, thousands of Common Loons, Red-breasted Mergansers (*Mergus serrator*), and grebes were found dead along the New York shores of Lake Erie, due to botulism type E, which typically affects fish-eating birds. Outbreaks subsequently occurred on Lake Erie annually, and, in 2002, botulism type E was also confirmed to cause a die-off of approximately 1,500 gulls, diving ducks, cormorants, and loons on Lake Ontario. These cases coincided with the rapid spread and expansion of the round goby population in the lakes.

Botulism type E outbreaks result when *Clostridium botulinum*, a spore forming bacteria that is widespread throughout the sediments of the Great Lakes, produces a potent toxin in rich nutrient, low oxygen conditions under favorable temperatures and pH (Brand et al. 1988). Quagga mussels pick up the toxin and round gobies then feed on the mussels. Loons and other fish-eating birds ingest the toxin when they consume the gobies.

Birds affected by botulism type E often appear bright and alert, but are weak and unable to move because the toxin binds to nerve receptors, causing flaccid muscle paralysis.

Botulism type E has caused the death of thousands of Common Loons and other waterbirds on Lakes Erie and Ontario since the fall of 2000.

Figure 3. The role of round gobies and mussels in botulism type E outbreaks in Lakes Erie and Ontario (Ruffing 2004).

As the neurotoxin takes effect, the birds become unable to fly, and their inner eyelids (nictitating membranes) also become paralyzed, impairing their vision. They usually die due to drowning because they are unable to hold their heads up when their neck muscles become affected.

Annual outbreaks of botulism type E continue to kill thousands of migrating loons and other waterbirds that stop on the Great Lakes to rest and feed. Common Loons have been hit particularly hard, with mortality varying from a few hundred to thousands of individuals annually.

The long duration of this type E outbreak on the Great Lakes has the potential to impact regional populations of breeding loons. Common Loons migrating through Lakes Erie and Ontario are primarily birds that breed in Ontario, along with some Midwestern and Quebec loons. Over time, the number of Common Loons returning to establish breeding territories in the Canadian provinces and the Midwest could decrease, potentially causing a decline in the breeding Common Loon populations in those areas.

Unfortunately, it has not yet been possible to control the outbreaks of botulism type E on the Great Lakes as the mussel and goby populations are now well established. Efforts have been focused on documenting the impacts of the annual outbreaks, and on research to better understand the etiology of the disease in the lakes. This epidemic affecting the fish and wildlife in the aquatic food web reflects a unique interaction of unplanned human actions with favorable environmental conditions, and reinforces the critical importance of preventing the introduction and spread of nonnative species in ecosystems worldwide.

Common Loon Demographics Across North America

Much is known about the demographics of the Common Loon based on a 28-year monitoring program of color-marked individuals from across North America (n>5,000) and associated movement studies using satellite telemetry (n>50 individuals) by Biodiversity Research Institute.

For example, on average, individual loons produce 5-10 fledged young over a lifetime. This is based on a model using known national rates for fecundity of 0.24 fledged young per breeding female (or 0.48 fledged young per territorial pair), average first year breeding at 6 years of age, 3-year-old survivorship of 48 percent, 3-20 year old annual survivorship of 92 percent, and 20-30 year old annual survivorship of 85 percent.

Models developed by BRI in conjunction with the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service indicate that a long-term average of 0.48 fledged young per territorial pair is needed for a sustainable loon population. Typically around 18-20 percent of the summer adult population represents individuals that may be over-summering, but not attempting to breed (i.e., 3-5 year olds).

Common Loons are poor colonizers; adults disperse an average of 1-2 miles from their previous breeding territory and fledged young disperse an average of 12 miles (although the record is just over 100 miles; Evers et al 2010).

Restore the Call Loon Conservation Study

Following the success in Minnesota in 2014, BRI researchers will translocate loon chicks from New York lakes to Massachusetts in the summer of 2015. This work is part of the *Restore the Call* loon conservation study initiated in 2013. This work is being conducted in collaboration with the New York State Department of Environmental Conservation.

For more information, visit: www.briloon.org/restorethecall

The Importance of Suitable Lake Habitat for Loons

Protection of loon breeding habitat is critical to maintaining the integrity of loon populations and avoiding increased degradation of suitable breeding habitat. Because of its status at the top of the food web, high visibility to people, limited dispersal ability, and relatively slow replacement rate, the loon is widely used as an indicator species for tracking aquatic integrity (Evers 2006).

Human Disturbance Affects Loons

Human recreational activity has high potential to affect breeding Common Loons. High levels of boat-related disturbance can cause formerly occupied territories to be less attractive to potential new pairs. In some instances, wakes from passing boats can erode nesting habitat and flood existing nests. Additionally, when incubating loons are flushed from a nest by humans, the eggs are left vulnerable to predators and chilling, and so may fail to hatch. Human activity may also discourage the birds from getting back on the nest, especially if disturbed during the first week of incubation.

Loons, Lead, and Line

The incidence of Adirondack loons becoming entangled in fishing line has been increasing in recent years, likely because there are both more anglers and more loons on the water. Loons and other wildlife occasionally eat a fish that still has fishing tackle and/or line attached after an angler's line breaks. Unfortunately, this can detrimentally impact a loon who swallows a piece of lead fishing tackle or gets tangled in the line dangling from the fish. Lead is poisonous to animals when swallowed, as it breaks down in the acidic fluids in the stomach where it is absorbed, affecting the bird's behavior and organ function, including the gastrointestinal and neurologic systems. A loon that accidentally ingests lead fishing tackle or gets tangled in fishing line will suffer and potentially die over the course of two to three weeks.

Loons can become entangled in fishing line when they eat a fish that has broken a line.

Evidence of the loon's ability to acclimate to human disturbance suggests that properly designed mitigation efforts and, more importantly, outreach initiatives can be successful in many instances (Evers 2007).

The Impact of Environmental Mercury Pollution and Acid Deposition to Loons

The combustion of fossil fuels, particularly the emissions from coal-fired electrical power plants, has been the primary source of mercury and acid deposition in the Northeastern United States. Recent levels of available methylmercury in aquatic ecosystems in the Northeast pose significant risks to human and ecological health (Smith and Trip 2005; Scheuhammer et al. 2011). Humans and wildlife are exposed to mercury pollution primarily through the consumption of contaminated fish and aquatic organisms.

Mercury is of especially high concern in acidic environments, such as in many Adirondack lakes, where elemental mercury is converted at a higher rate to methylmercury, the toxic form that biomagnifies through the aquatic food web (Schoch et al. 2014). This synergistic effect can significantly impact the behavior and reproduction of Common Loons (Evers et al. 2008; Burgess and Meyer 2008).

Water Quality Affects Loons

Loons breed in a wide variety of freshwater aquatic habitats. However, they prefer lakes larger than 60 acres with clear water, an abundance of small fish, numerous small islands, and an irregular shoreline that creates coves. Lake size and configuration, as well as undisturbed shoreline, are important determinants for loon density. Water quality is an important habitat feature for breeding loon success; loons are visual predators, therefore clear water is crucial for foraging efficiency.

Actions Needed for Maintaining Sustainable Loon Populations

Evidence of the loon's ability to acclimate suggests that properly designed conservation efforts can be beneficial in many instances (Evers 2007). Over the years, BRI's research has found the following actions to be successful or have potential for success:

Monitoring

A critical component of monitoring is to determine the cause of nest failure or chick loss. Standardized survey methods are used to collect data about the number of territorial pairs, nesting pairs, location of nests, chicks hatched, and chicks surviving >six weeks of age. BRI's Adirondack Center for Loon Conservation conducts such surveys annually on almost 100 lakes in New York's Adirondack Park (Schoch et al. 2014).

Research

Research to track individual loons statewide by capturing and banding them, and to determine their contaminant (e.g., mercury and lead) body burdens is conducted by BRI's Adirondack Center for Loon Conservation, the New York State Department of Environmental Conservation and their collaborators throughout the Adirondacks. Geolocators and satellite transmitters are utilized to determine inter- and intra-seasonal movements of Adirondack loons (Kenow et al. 2009).

Outreach

A variety of interactive outreach techniques, including exhibits, dioramas, school curricula, social media, and communication pieces (brochures, videos, and slide presentations, which can be available online), are utilized to create greater awareness of the presence and requirements of loons.

Restoration and Management Plans

Baseline data is utilized to create territory-specific restoration and management plans. Plans should include compensation measures for (1) the loss of nests by water level fluctuations or predation (i.e., nest platforms); (2) loss of nests/chicks from human disturbance (i.e., temporary closures); (3) adverse impacts from changes in prey or predator populations, such as Bald Eagles; and (4) the loss of territorial pairs (i.e., translocating loon chicks).

Long-term monitoring of loons provides valuable information about their reproductive success, habitat utilization, and behavioral ecology.

Blood samples from banded Common Loons provide essential information about their health and exposure to environmental contaminants, such as mercury and lead.

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