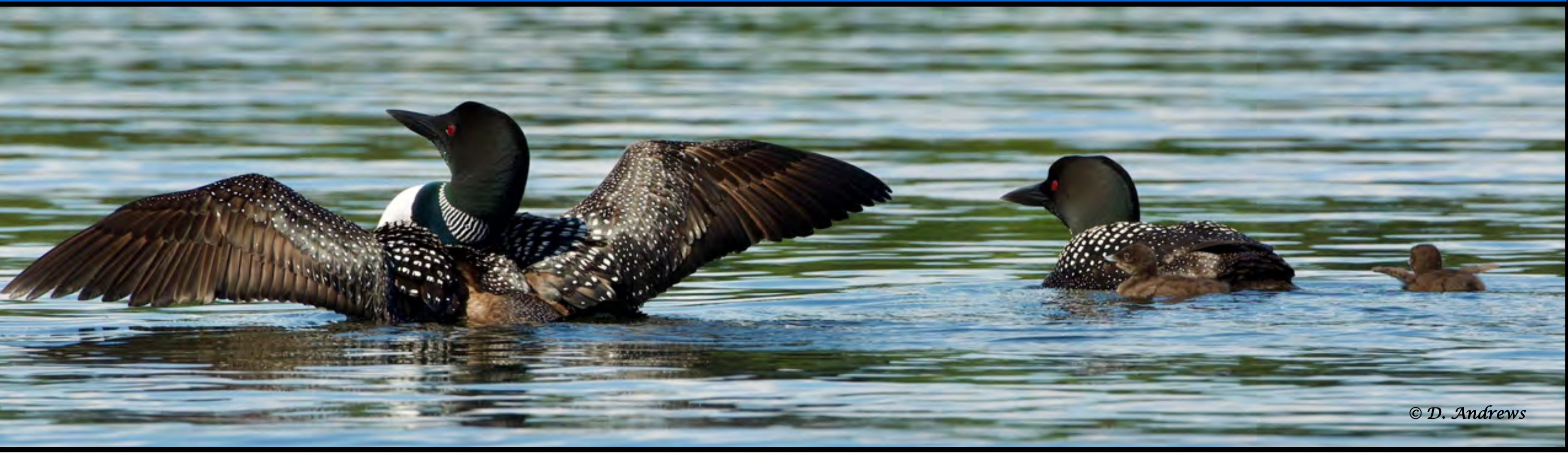
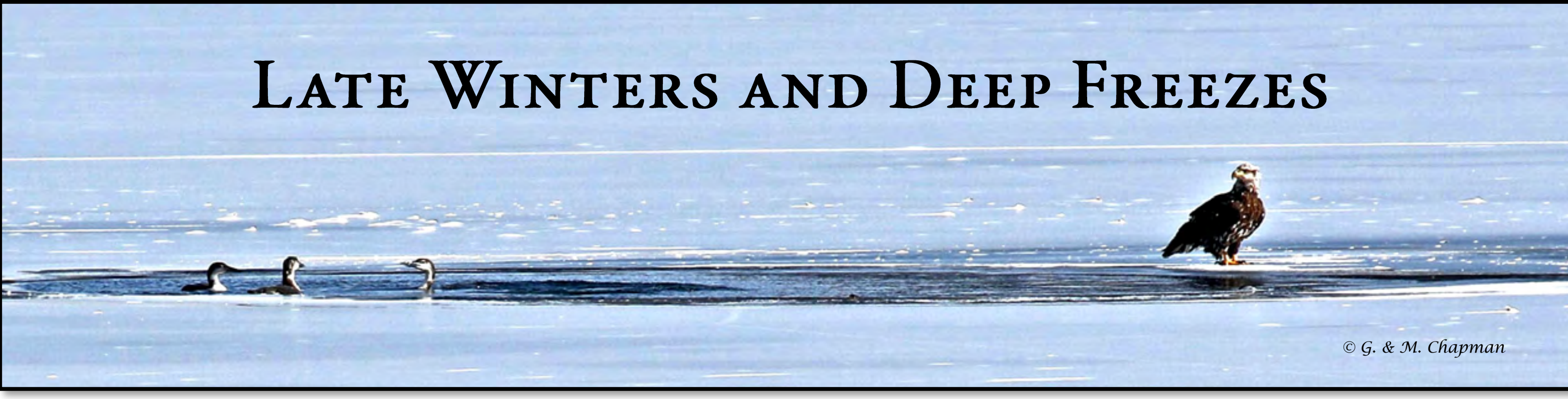
Are Loons on Thin Ice with Climate Change?

The Common Loon (*Gavia immer*) is an iconic water bird known for its haunting calls and distinctive breeding plumage. In North America, Common Loons summer on waterbodies across Canada and the northern United States, with New York's Adirondack Park located in the southernmost part of their breeding range. These fascinating birds provide valuable insight into the health of the aquatic ecosystems where they live. Loons are a long-lived (*25-35 years!*) species at the top of the aquatic food web, thus they are an excellent sentinel of environmental concerns, including contaminants, human disturbance, and climate change.

The Adirondack Common Loon population has been increasing since the 1970's, with an estimated 2,000 adult birds now residing throughout the Park. However, while the number of adults has grown, the chick survival rate has decreased (*Adirondack Center for Loon Conservation unpubl. data*). Common Loons require 0.48 chicks per pair to survive to fledging to account for the number of adult mortalities each year (*Evers et al. 2020*). Rates below 0.48 will lead to a population decline because there are not enough chicks to compensate for the number of adults who die annually. Declines secondary to low productivity will have delayed impacts on overall population numbers because loons do not reach maturity for several years, and only produce one or two young per year (*Tozer et al. 2013*). Although the Adirondack adult loon population is currently strong, there is concern for the future with a productivity rate of only 0.43 chicks per pair.

Climate change is a primary concern impacting loon populations. Studies have shown that waterbirds, including loons, are particularly susceptible to climate change, and a recent study indicates that the Common Loon will have an anticipated breeding range loss of 27% across North America loons move their breeding territories northward to cooler areas (Audubon.org 2019) .





Late Winters and Deep Freezes

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Molt-Migration Mismatch

In the Adirondacks, climate change has resulted in warmer winters, causing larger lakes not to freeze until mid to late winter, if at all. As long as open water remains, loons may delay their fall migration. In mid-winter, loons simultaneously molt all their flight feathers at once, and so, are completely flightless for more than a month. However, if a sudden deep freeze occurs, causing a lake to ice up overnight, and a loon hasn't yet migrated to the coast, it can get trapped by the rapidly forming ice. Typically, an iced-in loon keeps a little pool of water open by swimming, or if it gets cold enough, a loon may end up sitting on top of the frozen lake, where it could easily get caught by an eagle if it's not rescued and moved to open water.

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The freezing of lakes and ponds now occurs much later in the season, and is less predictable than even 20 years ago. Shorter winters and warmer temperatures greatly affect aquatic ecosystems, including reduced ice cover on waterbodies throughout the Northeast. Reduced ice cover also has potential to indirectly impact loons by reducing suitable habitat and food supply. Less ice cover is associated with shortened lake turnover periods and reduced nutrient mixing, resulting in decreased phytoplankton production, which negatively impacts the number of fish in a lake (*Vincent, 2009*). Reduced fish populations could lead to a shortage of food for loon chicks, contributing to poor chick survival (*Alvo, 2009*).

Over the last decade, the Adirondack Center for Loon Conservation has rescued dozens of iced-in Common Loons who were trapped by a sudden deep freeze. The majority of these birds were adult loons molting back into their breeding plumage, which they do in mid-winter. Thus, they were flightless as they waited to regrow their flight feathers. It is unknown if these birds have established breeding territories in the Adirondacks, or if they had migrated from further north and stopped when they found open water before reaching the Atlantic coast. The rescued iced-in loons have been much smaller than the loons with summer breeding territories on Adirondack lakes, so it is likely they breed further north (*Gray et al. 2014*). Interestingly, one iced-in loon that was rescued from Lake George one winter, was recaptured after being iced-in on Lake Champlain the following winter. It is unknown if this bird summered in the Adirondacks or further north. It had molted its flight feathers and was smaller than loons who summer in NY, so it is likely it was a bird who summers further north and stopped to winter on NY's bigger lakes.

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Because of their specialized anatomy, most loons require a long runway (~1/4 mile) to take off from the water and get airborne, as they are unable to fly directly from land. Thus, even if a loon has its flight feathers, they can be trapped by encroaching ice when there isn't enough water for them to take off.

Rescuing distressed loons is essential to maintaining the population because loons are a long-lived species with delayed maturity and low reproduction rates. Thus, their population growth is sensitive to small fluctuations in adult mortality (*Evers et al. 2020; Grear et al. 2009*).
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Nest Failure and Disease

Climate change is expected to affect bird species severely due to the rapid rate of change the environment is facing. Extreme weather events secondary to climate change are now common and unpredictable. In the last few decades, the Adirondack Park has experienced warmer, wetter summers, including torrential rainfall events of many inches in a short time period.

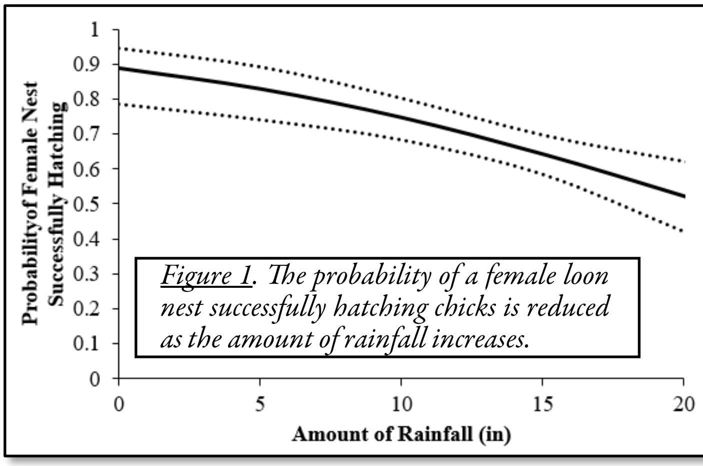

Figure 1. The probability of a female loon nest successfully hatching chicks is reduced as the amount of rainfall increases.

The amount of rainfall during the nesting season was determined to be the primary factor affecting the reproductive success of female Adirondack loons over two-decades. The probability of a loon nest successfully hatching chicks decreased as the amount of rainfall increased (Figure 1, *Buxton et al. 2019*) and the percent of loon nests failing due to water level rise has been on a steadily increasing trend (Figure 2, *ACLC unpubl. data, and Karniski et al. 2016*). Even if a nest hatches, loon chicks are very sensitive to wet weather, as adult loons spend less time foraging for food during wet summers, which can reduce the survival of their chicks (*Evers et al. 2020*).

Wetter, warmer, and less predictable weather events in loon breeding areas are a serious concern for the stability of loon populations and their exposure to avian diseases. However, loon population impacts secondary to climate change may not be immediately obvious due to the delayed maturity and low reproductive success of loons. Initially impacts may only be reflected in reduced hatching success, as is currently being observed in Adirondack loons (Figure 2, *ACLC unpubl. data*). Warm, wet summers also increase the prevalence of disease vectors, such as mosquitos and blackflies, which thrive in such conditions, thus increasing the exposure of loons to such diseases as avian malaria (*Martinsen et al. 2017*) and West Nile virus (*Wünschmann 2021*).

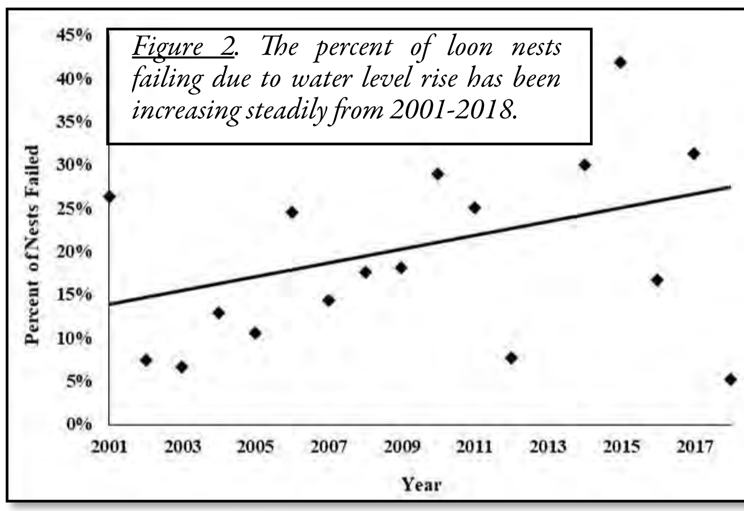

Figure 2. The percent of loon nests failing due to water level rise has been increasing steadily from 2001-2018.

Artificial Nest Rafts

A Conservation Tool to Mitigate Nest Failure from Climate Change

Loon nests are extremely vulnerable to water level changes, as they are built on the water's edge. In the summer of 2015, the Adirondacks received more than 10" of rain in less than 3 weeks at the height of the loon nesting season, and more than 40% of loon nests failed due to their eggs being submerged in high water (*ACLC unpubl. data*). However, some loons, such as the pair in these photos, nested on floating artificial nest rafts, which rise and fall with fluctuating water levels. Because rafts float up and down with rising water, the eggs did not get flooded out, and the loons were able to continue incubating despite the high water.

Mitigating the Impact of Climate Change on the Adirondack Loon Population

The Adirondack Center for Loon Conservation conducts a variety of research and conservation programs to better understand how climate change affects New York's loon population, including:

- Monitoring more than 100 Adirondack lakes each breeding season to determine loon reproductive success;
- Placing trail cameras at loon nests to determine factors affecting nest success;
- Implementing nest protection tools, such as floating nest rafts, buoys, and signage, to protecting nests from predators, water level changes, and human disturbance;
- Analyzing loon tissue samples to determine their exposure to disease and environmental contaminants; and
- Rescuing individual loons in distress, e.g., from being iced-in, entangled in fishing line, and other concerns.

Improved understanding of the health of Common Loon populations provides valuable insight into the condition of the aquatic ecosystems these intriguing birds inhabit.

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