

Lemming cycles

The heartbeat of the tundra

By Dominique Fauteux

For 10 years, starting with my Ph.D research and now as a scientist with the Canadian Museum of Nature and adjunct professor at Université Laval, I have had the fortune to observe, and study, many of the amazing animals that populate the Canadian Arctic.



Dominique Fauteux handling a Northern bog lemming on the tundra near Salluit in July 2021. It was an unexpected discovery, as the species was found much further north than its known distribution. © Greg Rand, Canadian Museum of Nature

But the focus of my research, as a wildlife ecologist, is lemmings, the most abundant mammal in the tundra. This tiny creature has an impact on Arctic food webs that might surprise many, and I am collaborating with other scientists to unravel the complex interactions that underlie their population cycles, which I like to refer as the “heartbeat of the tundra”.

After all, through notions of ecology, we learn that every species from an ecosystem is connected in one way or another. In the tundra, almost every mammal and bird is connected to lemmings, whether through

consumption or by sharing the same predators and habitat.

As a result, when lemmings are abundant, the tundra bursts with life for the summer with lots of baby foxes, owls, hawks, jaegers, geese and sandpipers. Even bumblebees often use in summer what lemmings build in winter and leave behind in spring—nests made of dried grass that become the perfect spot to raise the bees’ larvae. The regular pulse of lemmings creates a regular pulse of life on the tundra.

An Ungava collared lemming. This species is easily distinguished from the closely related Meadow vole by its very short tail and the length of its hind feet. Meadow voles, in contrast, have tails equal to three to four times the length of their feet. This species is only found in Nunavik. © Greg Rand, Canadian Museum of Nature



Facts about lemmings

There are six species of lemmings found in Canada’s Arctic. They are the:

- Northern collared lemming (*Dicrostonyx groenlandicus*); the most common lemming in the Canadian Arctic Archipelago;
- Ungava collared lemming (*Dicrostonyx hudsonius*); a species endemic to Nunavik and nowhere else;
- Richardson’s collared lemming (*Dicrostonyx richardsoni*); a species mainly found in northern Manitoba, southern Nunavut and eastern Northwest Territories;
- Brown lemming (*Lemmus trimucronatus*); second most common lemming in the Canadian Arctic, it is found in all the territories and northern British Columbia;
- Northern bog lemming (*Synaptomys borealis*); a species found in the Yukon, Northwest Territories and Nunavik;
- Ogilvie mountain lemming (*Dicrostonyx nunatakensis*); but this species is still not fully documented. It is found in the Ogilvie Mountains in the Yukon.

Lemmings are well adapted to the Arctic winter and breed easily under the snow. By building nests made of dry grass near the ground deep under the snow (sometimes up to two metres), they can keep themselves and their young warm. By eating willow buds, mosses, and other frozen plants, lemmings consume enough energy to remain active all winter long. This is why peak lemming abundances are reached just before the snow melts!

A Brown lemming as seen on Bylot Island. Scientists have been studying wildlife on the island for decades, including the population cycles of lemmings.
© Dominique Fauteux, Canadian Museum of Nature.



Searching for the cause for lemming cycles

The important role of lemmings in the Arctic is well known in Inuit Qaujimagatuqangit, and ecologists became interested in the phenomenon a century ago—modern ecology is indeed relatively young. What fascinated ecologists was the regularity of the lemming’s population growths and declines, which happen every three to four years. In one year, there may be no lemmings to be seen, and in the following year, people on the land would need to be careful to not step on them!

Because such cycles are so common over the whole Arctic and also for many vole populations in boreal forests, there has been much research to decipher the mechanisms behind this regularity, especially in northern Europe. Cycles of abundance are not unique to lemmings. Snowshoe hares, Western tent caterpillars, and Scottish rock ptarmigans are examples of other species with cycles. However, lemmings and voles are special, not only because of their shorter cycles, but also because of how common they are over a large geographical range.

Despite a century of research, pinpointing a single factor driving lemming cycles has proven to be very difficult: instead, the complexity of such a phenomenon has been brought to light. Extreme meteorological events, seasonal migrations, parasitism, overgrazing, increasing plant defenses against herbivores, social stress and aggressivity, and



An ermine on Bylot Island, one of the numerous predators of lemmings. The impact of ermines on lemming populations is new areas of study for Fauteux and his colleagues.
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View of the field research camp on Bylot Island.
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A Northern bog lemming observed near Salluit, July 2021. © Greg Rand, Canadian Museum of Nature

the structure of the whole food web, such as what plant and predator species are present, must all be considered.

So, how do we learn about and study these factors? Much evidence has come from field research on Bylot Island at Sirmilik National Park, near Pond Inlet. After 30 years of study by researchers from the Centre for Northern Studies, of which I have been involved for about 10 years, evidence shows that predation is the most important factor responsible for the lemming cycles there.

Our studies have shown that the plants lemmings eat barely change throughout their cycles, which tells us their food remains available and abundant. We also found that by fencing an area to keep all predators away (including a net to keep birds away), the abundance of lemmings doubled compared to outside the fence. The fencing also succeeded in slowing down the population decline, although not completely because lemmings could leave the fence.

Comparing lemming cycles in the Canadian Arctic

In 2018, my collaborators and I decided to study if other lemming populations of the Arctic were cycling. To do this, we started field monitoring programs in both Salluit in Nunavik and Cambridge Bay in western Nunavut to make comparisons with the field site on Bylot Island and determine if the factors driving the cycles are the same.

We already know that Cambridge Bay has a different habitat than Bylot Island with less microtopography caused by the melting of permafrost, and less common mossy wetlands, which are typical habitats for brown lemmings.

In Salluit, which I most recently visited in the summer of 2021, we were surprised that in addition to the one and only Ungava collared lemming, a species only found in Nunavik, we found Northern bog lemmings, a species that was never recorded there, and Meadow voles in very similar habitats.

We are very excited to pursue our monitoring over the next few years to understand how these three species interact and whether they all cycle together or not. **AB**

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