Refuge Loons help biologists track toxic environmental mercury across North America

by Ted Bailey

Researchers from the BioDiverstiy Research Institute, Rick Gray (left) and Chris DeSorbo (right), prepare to release two captured loons back to their territorial lake. Credit: Ted Bailey.

This summer I was privileged to help researchers capture several common loons on the Kenai National Wildlife Refuge as part of a long-term monitoring project to track toxic environmental mercury across North America. Scientists use loons as ecological indicators to track levels of mercury contamination because loons are at the top of the food chain in aquatic systems and they are long lived; some live over 30 years. Because of their limited natal and breeding dispersal patterns, loons are exposed to local environmental conditions over long periods of time, and accumulate environmental contaminants such as mercury in the tissues of their body.

Mercury is a highly toxic contaminant. In some places mercury has been discharged directly into water as an industrial pollutant. Perhaps the most famous of this type of mercury pollution was first revealed in Minamata, Japan in 1956 when mercury poisoned hundreds of people that ate fish and shellfish in Minamata Bay and adjacent Shiranui Sea. Early symptoms included numbness of limbs and lips, tremors and other forms of nerve damage. Babies born of mercury-poisoned mothers were severely deformed, mentally retarded, blind and deaf. By 2001, over 2,000 people living there had been "officially" diagnosed with "Minamata Disease"—or mercury poisoning—1,784 of whom died.

But in relatively pristine areas such as Alaska the element mercury can also enter aquatic systems such as lakes through its transport in the air and its deposition on the surface of the water. It is now believed that most the atmospheric mercury that is deposited in Alaska comes across the Pacific Ocean from Asia, especially from the numerous coal burning power plants in China. Alaska loons will thus have the capacity to serve as monitors of this "Asian plume" as China brings more coal-fired power plants online in future years.

Once atmospheric mercury it is deposited in lakes, sulfate-reducing bacteria convert the elemental mercury into biologically active methylmercury, the most toxic form of mercury, which then enters the food chain and eventually ends up in fish and predators that eat fish. One of these predators in lakes is the common loon, which feeds almost entirely on fish.

From the blood and feathers of loons that were first sampled on the refuge in 1995 and similar samples taken from loons across North America, David Evers of the BioDiversity Research Institute in Maine and other researchers, have shown that loon blood mercury concentrations significantly increased from west to east across the following regions of North America: Alaska, the northwestern United States, Upper Great Lake, New England and the Canadian Maritime provinces. Mercury levels generally increased from western to eastern North America, because of wind direction and the numerous coal-burning power plants emitting mercury in the atmosphere across the continent.

Loons in Alaska were used as the reference site because they had the lowest levels of measured mercury while those in the New England Region had the highest. Loons with high levels of mercury contamination had reduced productivity (lower rates of egg laying, nesting and hatching success and chick survival) and

exhibited behavioral alterations (reduced nest site and territory fidelity) that also lowered productivity.

Loons with elevated mercury levels produced 41% fewer fledged young than those in lakes relatively free of mercury and had deformed flight feathers, which made it more difficult for them to fly.

The capture of loons on the refuge this summer was a follow-up to the earlier studies on the refuge in 1995-7 and 2003. Researchers from the BioDiversity Research Institute and refuge biologist Liz Jozwiak targeted individual loons that were previously captured and banded on the refuge to determine if their levels of mercury contamination had increased over time.

I was invited to accompany this year's capture operation which used a new day-time technique that takes advantage of the loons' territorial behavior because I was involved in the first captures on loons on the refuge in the 1990s. We then captured loons in the dark during the night.

On the day I helped this summer we successfully captured both the territorial male and female—simultaneously—on one lake, and one of another territorial pair on a nearby lake. As in the 1990s I again experienced awe as I held one of these magnificent creatures—sometimes called the "spirit of the northern lakes"—in my arms while its measurements and blood and feather samples were taken.

I also experienced a sense of remorse for briefly disturbing these wonderful animals before we released them unharmed back into their territorial lakes. But I knew the information these refuge and other loons provide will eventually help scientists better understand the role and effects of toxic mercury in our environment.

Ted Bailey is a retired Kenai National Wildlife Refuge wildlife biologist who has lived on the Kenai Peninsula for over 32 years. He is an adjunct instructor at the Kenai Peninsula College and maintains a keen interest in the Kenai Peninsula's wildlife and natural history. Previous Refuge Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.