Mercury in fish investigation for Williston-Dinosaur Basins

Overview of 2016 and 2017 preliminary findings

Introduction

The Fish & Wildlife Compensation Program (FWCP) recognizes that mercury concentrations of fish caught in Williston and Dinosaur reservoir basins are a concern for local First Nations and stakeholders. Our Action Plan for Reservoirs (2014) identified mercury as a high-priority issue and defines objectives and specific actions to address this in our Peace Region. One of those actions is to collaborate with First Nations and liaise with appropriate agencies in implementing a study to investigate this issue in the Williston-Dinosaur basins. Our Peace Region board selected Azimuth Consulting Group Partnership (Azimuth) to conduct a multi-year investigation to study mercury from key fish species in these basins. Our goal is to improve our understanding of mercury in fish in all parts of the reservoir system and to provide this information to agencies responsible for advising the public on fish consumption. This document provides an overview of preliminary findings based on efforts in 2016 and 2017. Read the full report: 2017 Data Analysis Report: Mercury Sampling Program June 2018 (PDF)

Scope of Work

The scope of work in 2016 focussed on Parsnip and Finlay reaches, as well as two reference lakes; Fraser Lake (lake trout and lake whitefish) and Thutade Lake (bull trout and kokanee). Small numbers of rainbow trout and burbot were also collected. Reference lakes are not connected to the reservoirs and are used as a comparison to the reservoirs. To date, this study has generated 551 tissue samples (221 in 2014/15, 270 in 2016 and 160 in 2017). Fish tissue samples have been collected through targeted fishing efforts and opportunistically by partnering with other groups working on the reservoirs (Ministry of Forest, Lands, Natural Resources and Rural Development [FLNRORD] and Chu Cho Environmental [CCE]), to grassroots community involvement through fishing derbies and working with First Nations communities to gather samples. In 2017, the same species were targeted, but from Peace Reach and Dinosaur Reservoir. While we had planned to collect tissue samples from additional reference lakes in 2017 through FLNRORD efforts, this opportunity was postponed until 2018 due to resources being re-directed towards fire-fighting efforts in 2017.

Mercury, as well as stable carbon and nitrogen isotopes have been analysed in tissues from all species, focused on major reaches as well as from major tributary streams (e.g., Osilinka, Ingenika, Chowika, Finlay, Davis and Parsnip rivers) and reference lakes. Stable isotope data for individual fish provides information on diet and food source of fish across the spectrum of fish size and age, by location.

Overview of 2016 – 2017 Results

Two years of the 3-year study have been completed, characterizing fish mercury concentrations across species, from different geographic areas within the Williston – Dinosaur watershed, relative to nearby reference lakes. *Note that results presented here are preliminary and may change, as further data from the reservoirs and their tributaries are collected*. A detailed statistical analysis of the data will be undertaken at the end of 2018 once all three years of data are collected. The 2017 Data Analysis Report: Mercury Sampling Program March 2017 (PDF) report is available at http://fwcp.ca/mercury-in-fish-investigation-in-williston-dinosaur-basins/

Like 2016, the 2017 report presents a series of summary graphs and tables, depicting relationships between fish size, age and tissue mercury concentration as well as stable carbon and nitrogen isotopes relative to fish size and mercury concentration. Stable isotopes in fish tissue were examined to shed light on the fish's trophic position in the food web, telling us what its preferential diet is, where food is acquired and how diet changes over time. These factors are key in understanding the mercury concentration of individual fish.

Results in 2017 generally confirmed patterns observed in 2016. Lake trout and bull trout consistently had the highest mercury concentrations, ranging over an order of magnitude, from 0.10 mg/kg up to 1.3 mg/kg, depending on fish size. In general, lake trout had higher mercury concentrations than bull trout as they occupy a slightly higher trophic position. There was a positive correlation between increasing fish length and mercury concentration in both species, especially with fish >600 mm in length. In both species, mercury tended to accumulate at higher concentrations in larger fish, a reflection of reduced growth as fish became increasingly older. While changes in diet may also be a factor for individual fish, there was no clear pattern in the stable isotope results that supported dietary shift as a main driver of mercury concentrations for either species. The range and magnitude of mercury concentrations in lake trout from Williston Reservoir was similar to the reference, Fraser Lake in 2016.

Mercury concentrations in bull trout ranged from 0.1 to 1.0 ppm, a bit lower than for lake trout, with about 80% of fish having a mercury concentration of 0.30 ppm or less. In general, mercury concentrations for bull trout from Parsnip Reach appeared slightly lower than from Finlay Reach. Overall however, the distribution of mercury vs size for bull trout from Williston was similar to Thutade Lake (reference lake). The largest bull trout from Williston appeared to have somewhat higher mercury concentrations than the largest trout from Thutade Lake, although sample size was small.

Lake whitefish and kokanee are key prey species in the pelagic (i.e., open water) food chain. Notwithstanding differences in fish size (i.e., lake whitefish from Fraser Lake were larger), mercury concentrations were nearly all below 0.20 mg/kg and similar between Fraser Lake and Parsnip and Peace reaches in 2016/17. Kokanee from Finlay and Peace Reach had a higher range in mercury concentration (0.05 – 0.14 mg/kg) than Thutade Lake (0.02 – 0.05 mg/kg). While some of this difference appears to be size-related (i.e., larger fish in Williston), it is possible that Thutade kokanee have a naturally lower mercury concentration than Williston kokanee.

Mercury was also measured in small numbers of mountain whitefish, rainbow trout, Arctic grayling, longnose sucker and burbot from Peace Reach and all except burbot, were almost always <0.20 mg/kg. When present, mercury concentrations of these species in reference lakes (Thutade and Fraser) appeared to have similar concentrations as Williston Reservoir fish.

Mercury concentrations in fish from Dinosaur Reservoir were low and similar across species, a trend that has been observed from historic data and is consistent with our knowledge of this reservoir.

In summary, notwithstanding differences in size of fish between Williston Reservoir and Fraser and Thutade reference lakes, the range and magnitude of mercury concentrations appeared similar across all waterbodies for most species. Stable isotope data indicate that key species occupy similar trophic positions in the food chain between Williston and reference areas, with similar dietary preferences.

Next Steps

The focus of 2018 work is on Finlay Reach, with continuing efforts to fill data gaps elsewhere from our partnership programs. More data will be gathered from other regional reference lakes, to better put Williston and Dinosaur Reservoir fish in context.

About Mercury

Mercury is found naturally in air, water, sediment, soil, plants, animals and fish. Flooding of organic soil in new reservoirs causes bacteria to convert some naturally occurring inorganic mercury into methylmercury, which is the form of mercury that bioaccumulates in fish. Over time, the concentration of mercury in fish in reservoirs increases, but returns to baseline, usually within 25 years after reservoir creation. Learn more at http://www.fwcp.ca/mercury-in-fish-investigation-in-williston-dinosaur-basins/