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Quesnel Abstract

Assessing Marine-Derived Nutrient and Contaminant Delivery to Quesnel Lake via Sockeye Salmon (*Oncorhynchus nerka*)

Under the guidance of Dr. Aaron Fisk and Dr. James Peterson of the University of Georgia, USA, I am assessing the delivery of nutrients and contaminants to Quesnel Lake via sockeye salmon for my undergraduate thesis. With the help of the Quesnel River Research Centre (QRRC) staff and the Canadian government, I was permitted to sample in the fall of 2005. The knowledge the QRRC staff possess pertaining to the catchment area was an intricate part in making my study a success. In this pilot study, I sampled sockeye (*Oncorhynchus nerka*), lake trout (*Salvelinus namaycush*), rainbow trout (*Oncorhynchus mykiss*), mountain whitefish (*Prosopium williamsoni*), burbot (*Lota Lota*), and forage fishes.

Fish stocks are crucial to the survival of Pacific Rim ecosystems as well as beneficial to human health and welfare. Because of their anadromous life history, Pacific Salmon deliver nutrients (nitrogen and carbon), as well as contaminants (metals and elements), from marine and estuary environments to old-growth forest ecosystems. Assessing nutrient and element delivery to a system is quintessential in maintaining ecosystem and human health as well as addressing food web issues such as trophic position. The largest concerns when considering results from nutrient and element assessments are the potential effects on the watershed and wildlife, and the potential threat to human health via fish consumption.

This pilot study assessed nutrients and contaminant concentrations in sockeye (*Oncorhynchus nerka*), lake trout (*Salvelinus namaycush*), rainbow trout (*Oncorhynchus mykiss*), mountain whitefish (*Prosopium williamsoni*), burbot (*Lota Lota*), and forage fishes. These fishes were chosen to sample because of their varying trophic position and life history. We assessed nutrients by obtaining carbon and nitrogen stable isotope signatures from muscle and liver tissues with a mass spectrometer. The elemental concentrations, such as mercury, were measured with an ICP mass spectrometer.

Some preliminary conclusions: Mercury is near levels seen for lake trout from other systems and needs further evaluation. Lake trout are one trophic position above rainbow trout and mountain whitefish based on N isotopes, but do not appear to be diet items based on C isotopes. Perhaps lake trout feed on other pelagic fishes. Rainbow trout are likely feeding on invertebrates based on N isotopes and their carbon appears to come from a benthic and pelagic source. Mountain whitefish are benthic feeding based on the C isotopes and sockeye may be an important nutrient supplier to the benthic food web based on C isotopes.

We hypothesize that there is a decoupling of carbon, nutrient, and mercury flow between the pelagic and benthic food webs. Benthic carbon does not appear to be significant for the lake trout food web in 2005 based on $\delta^{13}C$ data. Mercury is much higher in lake trout compared to other fish species from the lake, and does not match relationships in other Canadian lakes. We also hypothesize that this potential decoupling of the food webs may vary with the size of the sockeye run. Sockeye and/or benthic species appear to be irrelevant to lake trout in 2005, following a low sockeye run in 2004, but this may change as a result of varying run size.

Currently samples are being analyzed for sulfur stable isotopes, which will vary between marine and freshwater sources. We are also exploring micromilling and laser ablation on ototliths collected for stable isotope analysis. This will allow us to obtain stable isotope signatures from individual annuli of the otolith revealing seasonal changes in signatures.

Future research should include should include sampling every year of the cyclic sockeye run and sampling a lake without a salmon run. Sampling can be intensified by sampling other biota in the food web to include algae, plankton, other plants, sediment cores, and terrestrials.

Figure 1. Sockeye salmon (*Oncorhynchus nerka*) caught in the North Arm of Quesnel Lake.

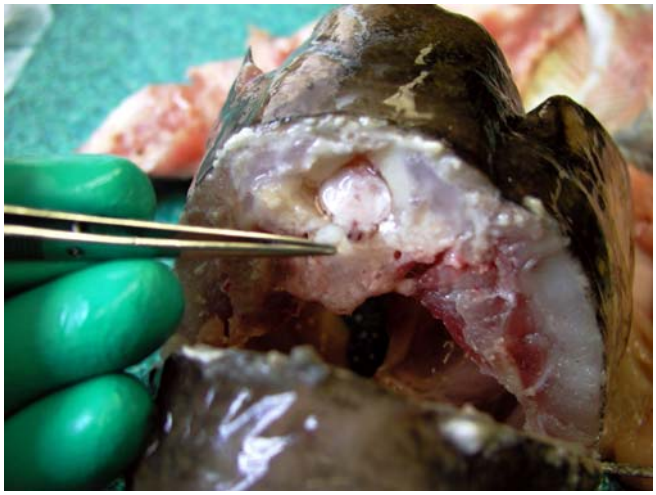

Figure 2. Removal of lake trout sagittal otolith (*Salvelinus namaycush*). Some were aged at 18+ years.

Figure 3. Quesnel River rainbow trout (*Oncorhynchus mykiss*) versus Quesnel Lake Rainbow trout (*Oncorhynchus mykiss*) note the coloration differences.

Figure 4. Some of the mountain whitefish **(***Prosopium williamsoni*) were aged at 15+ years.

Figure 5. Rick Holmes, research director and I.