The importance of fish to the Cree Nation of Mistissini and concerns regarding uranium mining in the Otish Mountain watershed

The Otish Mountains is an important place for the traditional Cree territory as it serves as the head of the immense watershed. Water travels from the Otish Mountains down the Temiscamie River into Albanel Lake, and then Mistassini Lake, which empties into Hudson Bay via the Rupert River, and which is Quebec's largest (2335 km^2) natural lake and one of its deepest (180 m; Statistics Canada 2005). The Otish watershed contains many tributaries of Mistassini Lake that harbour vital brook trout and walleye spawning grounds of the Pepeshquasati, Cheno, and Takwa Rivers. For example, fish recruitment from these rivers sustains more than 50% of the entire annual harvest for these species in Mistassini Lake by local fishers and tourists (Fraser and Bernatchez 2005a; Dupont et al. 2007).

Mistassini Lake has been largely un-impacted by human activity and is indeed home to diverse populations of fish species that hold both historical and contemporary socio-economic and cultural importance. Fish populations have long been harvested by local Cree populations for subsistence. Recently, there has been an increasing demand on the fish populations from the expanding local community and sport-fishing industry. Despite this, Mistassini Lake has not been heavily overexploited, it has never been stocked, it is geographically remote (Dupont et al. 2007) and it remains largely undeveloped. It is thus considered unique in being a pristine lake ecosystem of such a large size.

Since 2000, the Cree Nation of Mistissini has invested substantial resources into researching many of the fish species found in its territory to ensure the longevity of these species. By monitoring the status of fish in the territory, the Cree can adjust management, conservation and harvesting strategies as needed. Biologists from Laval University, the Great Lakes Fishery

Commission and Concordia University have worked collaboratively with community members to collect thousands of samples and to gather local Traditional Knowledge, to help assess the characteristics, potential productivity of local fish populations, and population trends. Diverse brook trout (*Salvelinus fontinalis*) and walleye (*Sander vitreus*) populations were studied previously by Fraser et al. (2004); Fraser and Bernatchez (2005a,b), Fraser et al. (2006), Dupont et al. (2007), as well as lake trout (*Salvelinus namaycush*) by Zimmerman et al. (2007) and currently by Marin and Fraser (unpublished data, Concordia University 2014). These species are among the most important socio-economic and cultural fish species in Mistassini Lake. Each is targeted by Cree subsistence fishers, and by sport fishers that fish from local Cree operated outfitting camps, the community of Mistissini, and the Réserve Faunique des Lacs Albanel-Mistassini-et-Waconichi. By investing in the studies mentioned above, the Cree are ensuring the conservation of fisheries resources in the region for future generations, both from a socio-economic and cultural perspective. Published literature from these fish studies are found in Appendix A.

The pristine waters of Mistassini Lake and the surrounding Otish Mountain watershed are highly interconnected, with large of amounts of water traveling through the whole system. Sources of water contamination, from uranium mining and processing, could detrimentally deplete the fish populations that are targeted by both the Cree and outfitting camp clients. Previous research has shown that in north temperate ecosystems, effluent, from treated uranium mining and milling, released into the local aquatic environment has been shown to increase certain metals and salts above background levels in the water, sediment and fish (Pyle et al. 2001, Klaverkamp et al. 2002). Effluents from uranium mines typically include elevated levels of trace elements (such as lead,

cadmium, molybdenum, nickel, selenium, uranium), ions (such as sulfate), and many radionuclides (Burns and Finch 1999).

Previous research in Saskatchewan, Canada, have found elevated concentrations of selenium (Se) downstream of uranium mining and milling processes, in water, sediments and fish (Klaverkamp et al. 2002). Se is an essential element that naturally occurs in bedrock, which can easily bioaccumulate in the aquatic food chain, even in low concentrations. Lemly (1999) reported that Se accumulated in aquatic organisms 100 to 300,000 times more than its concentration in water, reaching levels that could impair fish reproduction. Typically, Se is biomagnified through trophic levels in aquatic environments by the pathway: periphyton < plankton < invertebrates < foraging fish < predatory fish (Lemly 1997a). Se can be easily deposited into the surrounding sediment and substrate and potentially re-enter the food chain in future years. Furthermore, mammals and birds that feed on any of the tropic levels mentioned above could further biomagnify Se and potentially reach toxic levels. Se concentrations exceeding 2µg/L have been reported to impair waterfowl reproduction and survival (Lemly 1993). The toxicological effect of Se on fish causes developmental malformations. Various studies have shown that chronic Se exposure during the larvae development of causes skeletal, craniofacial and fin deformities (Lemly 1997a). Many of these deformed fish do not reach adulthood and therefore can severely impact fish populations due to the decline in recruitment (Lemly 1997b). Se uptake and toxicity in fish has been studied to a lesser extent in north temperate aquatic environments.

Selenium and many of the other elements, ions and radionuclides, some of which have unknown effects on fish in north temperate environments, could potentially enter the Otish Mountain watershed from uranium mining and milling effluent. Groundwater, surface water, soil contamination from these processes could easily travel through the watershed and have negative

effect on the survival of the fish that have been long harvested, managed and protected by the Cree. The local community has invested, through many years of fish studies, into the local fisheries to ensure that survival and prosperity of the fish in Mistassini Lake and surrounding waters for future generations to come. As fish and the water they inhabit are a vital part of the Cree life and the food web of north temperate ecosystems, it is essential that the fish are protected from sources of contamination.

Questions for the panel

1. What are the current background levels of Se and other trace elements in the water of Temiscamie and Rupert River and Albanel and Mistassini Lake?
2. What are the current background levels of Se and other trace elements in fish of Temiscamie and Rupert River and Albanel and Mistassini Lake?
3. What will be done to ensure the protection of fish in the Otish Mountain watershed?
4. Based on the Strateco's history in North America, what is the likelihood of contamination of Se or any other by-products in the effluent in the watershed?
5. If there is contamination of the Otish Mountain watershed what are the mechanisms for restitution and reclamation?
6. What is the responsibility of the company to compensate the Cree Nation of Mistissini for any damages to the fishery?
7. If any contamination is to occur in the Otish Mountain watershed with respect to Se and other trace elements found in the uranium mining effluent, how will Strateco take responsibility?
8. What is the monitoring plan for Se and other trace elements found in the uranium mining effluent in water (surface and groundwater)?
9. Can the monitoring plan be reviewed and approval required by the Grand Council of the Crees prior to project commencement?
10. When sampling aquatic biota both the wet and dry weight of Se should be reported. Does the monitoring plan include this during baseline/background monitoring and monitoring during the life of the mine and after its closure?

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