GENERAL NOTES

NORTHWESTERN NATURALIST 95:113–115 AUTUMN 2014

THE PRESENCE OF MUSKRATS (*ONDATRA ZIBETHICUS*) IN A HIGHLY CONTAMINATED WATERSHED NEAR YELLOWKNIFE, NORTHWEST TERRITORIES

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Key words: arsenic, Baker Creek, burrow, emergent vegetation, Giant Mine, Muskrat, Northwest Territories, *Ondatra zibethicus*

The Muskrat (*Ondatra zibethicus*) is a large rodent that occupies a variety of aquatic habitats, but is most abundant in areas with a stable water level and rich aquatic vegetation (Eder and Pattie 2001). In the Northwest Territories, Canada, the Muskrat is currently ranked as a secure species (Government of the Northwest Territories 2000) and occurs in Baker Creek, which passes through of the Giant Mine surface lease area near Yellowknife, Northwest Territories. Baker Creek is a small watercourse that drains into Yellowknife Bay off Great Slave Lake, Northwest Territories (UTM: Zone 11, 635861 E, 6927081 N, NAD83). It is approximately 8 km long and comprised of a series of historic Beaver (*Castor canadensis*) ponds in the upper sections, and narrow linear channels and open ponds with slow moving water in the lower sections. Portions of the creek have been channelized as a result of the mining activity from the Giant Mine.

The Giant Mine began producing gold in 1948, and the process used to liberate the gold from the ore resulted in the production of arsenic trioxide (As_2O_3) dust. From 1951 to 1999, As_2O_3 dust was collected and stored in underground chambers and tailing containment facilities, but atmospheric deposition and seepage of arsenic-laced tailings raised concerns over environmental contamination (Steffen Robertson and Kirsten Inc. 2002). The receiving environment around the Giant Mine, including Baker Creek, has been subject to considerable scientific research since the 1970s, and numerous studies indicate that extensive arsenic (As) contamination exists in the area. Water quality has improved since the 1970s; however, high levels of As remain present in Baker Creek, although there are reaches that remain biologically productive (Steffen Robertson and Kirsten Inc. 2002). An ecological risk assessment of the Giant Mine lease area predicted that As intake levels in Muskrats from inadvertent ingestion of sediment and consumption of vegetation would exceed toxicity benchmarks (Steffen Robertson and Kirsten Inc. 2002). The long-term risks associated with the site on the local Muskrat population were of concern because the species plays an important role in the local traditional culture and economy. Due to lack of scientific information on the local Muskrat population, this study was conducted to provide an accurate description of the local Muskrat population to ensure that due consideration of this species was given in the Giant Mine Abandonment and Restoration Plan.

From 29 August to 2 September 2003, a field assistant and I surveyed the lower 4 km of Baker Creek, which is within the Giant Mine lease area, for Muskrat activity in an effort to characterize the resident population. Prior to the initiation of this survey there had been no inventories of Muskrats in Baker Creek or the Yellowknife region. The linear portions of Baker Creek are sporadically vegetated, ranging from sections that are 80% covered with Cattails (*Typha latifolia*) to other sections where only trace amounts of emergent aquatic vegetation are present. Open water areas are dominated by Swamp Horsetail (*Equisetum fluviatile*) and Water Arum (*Calla palustris*). Approximately 1 km of the surveyed area is considered unsuitable habitat for Muskrats because this section is channelized and influenced by human-made structures (such as culverts), with the shoreline consisting entirely of bedrock and being devoid of vegetation. This section is directly in the middle of the lower 4 km of

Baker Creek and comprises 1.5 km of suitable habitat, 1 km of unsuitable habitat, followed by another 1.5 km of suitable habitat. We walked both sides of the entire lower 4 km of shoreline and recorded a total of 60 Muskrat observations, including individuals ($n = 2$), tracks ($n = 15$), feeding platforms ($n = 9$), scat ($n = 17$), runways ($n = 4$), and burrows ($n = 13$). Suitable amounts of aquatic vegetation (such as Cattails) for dwelling construction are not available within Baker Creek therefore dwellings were solely comprised of burrows. Ten of the burrows were considered to be active at the time of the survey based on the presence of fresh signs of Muskrat activity. Generally, we observed burrow systems in areas characterized by suitable water flow (slow flowing) to allow for Muskrat habitation (Proulx and Gilbert 1984). Four of the burrows were in the lower 1.5 km of suitable habitat and 6 where in the upper 1.5 km of Baker Creek.

Muskrat burrow density recorded in Baker Creek was 2.5 burrows/km. This density is comparable to studies conducted in James Bay, Quebec (UTM: Zone 17, 609056 E, 5745540 N, NAD83) where on average 2.1 burrows/km were recorded (Nadeau and Decarie 1995). However, in that study suitable habitat included fast and slow moving rivers ($\geq$5 m in width), fast and slow flowing streams ($<$5 m in width), lakes, wetlands, and Beaver ponds. Baker Creek is considered a slow flowing stream ($<$5 m in width, flow rate $\leq$10 m/min), and when the direct comparison of burrow density is made to the amount of slow flowing streams surveyed by Nadeau and Decarie (1995; 3.2 burrows/km) our results are lower. Messier and Virgl (1992) also recorded the number of Muskrat burrows from a northern marsh environment in Saskatchewan (UTM: Zone 13, 395150 E, 5726908 N, NAD83). They found a maximum density of 23 burrows/km, although burrows were predominantly along the shoreline of small islands that were built in the marsh as waterfowl nesting habitat.

A limiting factor for the distribution of Muskrats is the amount of suitable emergent vegetation for foraging (Proulx and Gilbert 1984). In our study, I observed Muskrat sign in all sections of Baker Creek regardless of the amount of emergent vegetation, and there was no significant correlation between burrow location and the presence of emergent vegetation (Spearman's Rank Correlation, $r = -0.1517$, $P = 0.62$), suggesting that Muskrats utilize all sections of Baker Creek.

Muskrats feed primarily on basal shoots, roots, and rhizomes of emergent vegetation with Cattails being the preferred food species (Messier and Virgl 1992). Because of this behavior and the historic contamination of the Baker Creek watershed, toxic effects to Muskrats from As are expected that would influence animal persistence and population levels. The water quality guidelines for the protection of aquatic life is set at 5.0 μg/L (Canadian Council of Ministers of the Environment 2001), whereas the As concentrations in Baker Creek were measured at 70.0 μg/L in 2001 (Steffen Robertson and Kirsten Inc. 2002). The effect of exceeding this toxicity benchmark on aquatic mammals like the Muskrat is unknown, but there is concern over an elevated risk. Other research has shown that Muskrats are able to persist in contaminated areas. Erickson and Lindzey (1983) showed that adult Muskrats at the Tinicum Marsh, Pennsylvania had higher concentrations of lead and cadmium compared to juveniles. Despite these elevated concentrations, the Muskrat population has remained relatively stable. Halbrook and others (1993) measured heavy metals and polyaromatic hydrocarbons in Muskrats in 2 reaches of the Elizabeth River in Virginia. The lower reach was exposed to higher contaminant levels from industrial discharge compared to the upper reach, which also corresponded to higher contaminant concentrations in Muskrats in the lower reach. Physiological data also showed that Muskrats in the lower reach were in poorer health, but there was no difference in the fecundity or density of Muskrats among both reaches (Halbrook and others 1993).

It is evident that Muskrats can exist in association with human activity and are a common species even in developed areas. Based on the observations from my survey, Muskrats utilize the majority of Baker Creek, and despite being exposed to environmental contaminants including As, antimony, and cadmium (Steffen Robertson and Kirsten Inc. 2002) that may even exceed toxicity benchmarks, I expect that the Muskrat population in Baker Creek will persist.

Acknowledgments.—This study was conducted under the Giant Mine Remediation Project under the authority of Indian and Northern Affairs Canada. I would like to thank the members of the Technical and Environmental Services of the Giant Mine Remediation Project who made this work possible.

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* Unpublished.