Fish provide a rich variety of important nutrients (e.g., omega-3 fatty acids (n-3 FAs) and selenium (Se)). The intake of n-3 FAs from fish consumption promotes healthy growth and development in infants and children (Bianchini & Chow, 2005), supports optimal cognitive health in older adults (Dangour & Lusby, 2008), and reduces the risk of cardiovascular disease (Calder, 2004). The intake of the essential trace element, Se, is important to maintain thyroid function (Arthur, 1991), potentially protect against cardiovascular disease (Rayman, 2012), and may reduce the incidence of some cancer types (Vincent et al., 2014). However, methylmercury (MeHg), a contaminant commonly detected in fish, is known to induce adverse health effects in neurological, cardiovascular, immune, and endocrine systems.

Several lakes in the Dehcho Region contain fish populations with elevated total mercury concentrations (Lockhart et al., 2005). For example, in some inland lakes, the mean Hg concentration of predator fishes like Walleye, Northern Pike, and Lake Trout approached or exceeded the 0.5 ppm Health Canada Hg guideline. Situations among subsistence populations, including Dehcho residents of who have limited alternatives to fish sources, may face the dilemma of weighing the risks and benefits. Focusing solely on the risks of Hg, however, can overlook the nutritional benefits provided by fish consumption.

To promote traditional food use as a pathway to health equity, the following research objectives have been developed:

1. To quantify the levels of Se, n-3 FAs, and Se in fish species harvested from the three lakes in the Dehcho Region, Northwest Territories (NWT).

2. To evaluate the correlations between nutrient and contaminant concentrations and identify which fish species are rich in the most n-3 FA and Se relative to Hg content.

**Data Collection**

- Seven species of freshwater fish included: Burbot (Lota lota), Cisco (Coregonus arted), Lake Trout (Salvelinus namaycush), Lake Whitefish (Coregonus clupeaformis), Longnose Sucker (Catostomus catostomus), Northern Pike (Esox Lucius), and Walleye samples (Sander vitreus).

- Sample collection time frame: August 2013

- The samples were collected from Ekalik, Saugeen, and Trout Lakes in the NWT.

**Laboratory Analysis**

- **Mercury Analysis.** Fish tissue samples were freeze dried without skin and ground prior to analysis. Analysis for Hg was measured via a direct mercury analyzer (PerkinElmer DMA 80).

- **Selenium Analysis.** 100 mg of pulverized fish muscle tissue was digested with 5 mL of HNO3 and 1.5 mL of H2O2. Samples were re-diluted with 3.5 or 5 mL of 2% HNO3, and filtered. Analysis for Se was measured by an inductively coupled plasma mass spectrophotometer (Thermo XSeries II).

- **Omega-3 Fatty Acids Analysis.** 100 mg of pulverized fish muscle tissue was homogenized with 2 mL CHCl3:2 mL MeOH containing 22:3 n-3 ethyl ester as the internal standard. 90 µg/mL of butylated hydroxy volume was also included in the extraction reagents to prevent oxidation. The sample was centrifuged and the organic extract was evaporated under N2 gas by 300 µL of hexane. Analysis for the lipid extract was measured by a gas chromatograph with a flame ionization detector (Varian 3900).

**RESULTS AND DISCUSSION**

**Table 1.** Total Mercury and Selenium Concentrations by Fish Species

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>Total Mercury (µg/g)</th>
<th>Total Selenium (µg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burbot</td>
<td>10.7 ± 0.05</td>
<td>0.11 ± 0.00</td>
</tr>
<tr>
<td>Cisco</td>
<td>4.2 ± 0.03</td>
<td>0.26 ± 0.01</td>
</tr>
<tr>
<td>Lake Trout</td>
<td>1.1 ± 0.01</td>
<td>0.31 ± 0.00</td>
</tr>
<tr>
<td>Whitefish</td>
<td>0.3 ± 0.00</td>
<td>0.11 ± 0.00</td>
</tr>
<tr>
<td>Sucker</td>
<td>0.3 ± 0.00</td>
<td>0.10 ± 0.00</td>
</tr>
<tr>
<td>Pike</td>
<td>0.2 ± 0.00</td>
<td>0.09 ± 0.00</td>
</tr>
<tr>
<td>Walleye</td>
<td>0.1 ± 0.00</td>
<td>0.07 ± 0.00</td>
</tr>
</tbody>
</table>

**Table 2.** Fatty Acid Composition by Fish Species

**Figure 1.** Relationship between total mercury concentration and omega-3 fatty acid content in Lake Trout

**Figure 2.** Comparison of nutrient: mercury ratios to the de minimis ratios from Health Canada’s mercury guidelines

**Table 3.** Comparison of nutrient: mercury ratios to the de minimis ratios from Health Canada’s mercury guidelines

**Fatty Acid Composition**

- There were substantial differences in fatty acid profiles between fish species:
  - Lake Whitefish, the most commonly consumed fish in the Dehcho Region, had n-3 FA levels (1458 µg/g) which were 2.1-fold higher than in some predatory fish species, such as Northern Pike (212 mg/g) and Walleye (230 mg/g).
  - The EPA-DHA concentrations in Lake Trout (965 mg/g) were up to 11.2-fold higher than Burbot (86.3 mg/g), Northern Pike (176 mg/g), and Walleye (198 mg/g).
  - All of the fish species analyzed had greater levels of health promoting n-3 FA relative to their pro-inflammatory n-6 FA content.

- Typically, n-3 FA content was not correlated with fork length or weight; the lone exception was Lake Whitefish (P < 0.01).

- The highest n-3 FA levels (P < 0.05) were observed in Ekalik Lake for Walleye, Saugeen Lake for Lake Whitefish, Trout Lake for Northern Pike.

**More nutrients; less mercury**

**Figure 3.** Comparison of nutrient: mercury ratios to the de minimis ratios from Health Canada’s mercury guidelines

- A method proposed by Tsuichya et al. (2008) defined a de minimis intake ratio of 17 mg DHA to 1 µg of Hg exposure, such that individuals consuming fish over this de minimis ratio would be able to meet the Dietary Reference Intake of DHA (100 mg/day) while not exceeding the U.S. EPA reference dose (90 µg/day) for MeHg (1.0 µg/kg/day).

- To make the de minimis approach more relevant to the Canadian regulatory context, we applied Tsuichya et al. (2008) method using Health Canada’s Hg toxicological reference value (TRV) for pregnant women and women of child-bearing age (Legrand et al., 2010).

- Of the seven freshwater fish species collected in this study, Walleye, Longnose Suckers, Lake Trout, Cisco, and Lake Whitefish, on average, exceeded the de minimis ratio for DHA:Hg (8:3.1).

- In contrast, all of the seven species were below the de minimis molar ratio for Se(Hg:Se = 13:4.1).

- However, it is not yet known how high the Se:Hg molar ratio has to be to protect against MeHg’s adverse effects.

**LITERATURE CITED**


