Exposure of fish in the Athabasca and Slave Rivers to PAHs potentially derived from Oilsands operations

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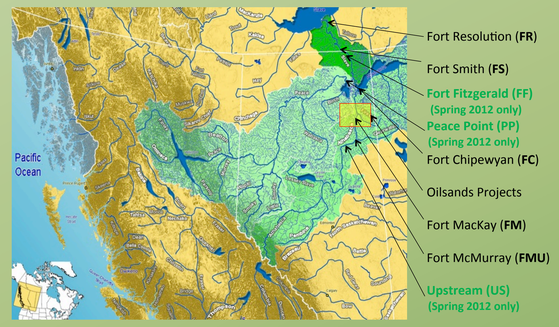
AIM

To investigate the exposure of fish populations in the Athabasca and Slave rivers to Polycyclic aromatic hydrocarbons (PAHs). Specifically, to describe the spatial and temporal distribution of concentrations of PAHs in fish bile, liver and muscle tissue; and to translate the data to estimates of risk for human consumers.

INTRODUCTION

There are four oil sands deposits in Northern Alberta, consisting of approximately 60,000km^2. The near surface proximity of the oil sands has allowed for surface mining activities (SMA) to be an effective means of extracting bitumen. Concern has centered on the polycyclic aromatic hydrocarbons (PAHs), which occur in the hydrocarbon bearing deposits and are released to aquatic ecosystems through either natural or anthropogenic pathways. Some PAH compounds, such as benzo[a]pyrene, are known carcinogens, thus emphasizing the importance of identifying these compounds in the environment.

Since oil sands represent a natural diffuse source of hydrocarbons to the aquatic and proximate terrestrial environments, understanding the source, nature and extent of hydrocarbon contaminants within and around the Athabasca River is important.



Map of Sampling locations

METHODS

In 2011-2012, 1,498 fish were collected over the summer, fall, winter and spring from 8 locations on the Athabasca and Slave rivers. Target sample size for the project was 30 individuals each of 5 species (Goldeye - *Hiodon alosoides*, Whitefish - *Coregonus clupeaformis*, Northern Pike - *Esox lucius*, Walleye - *Sander vitreus*, Burbot - *Lota lota*).

Pike or Jackfish (*Esox lucius*) **JF**

Loche Mariah, Burbot (*Lota lota*) **BB**

Goldeye (*Hiodon alosoides*) **GE**

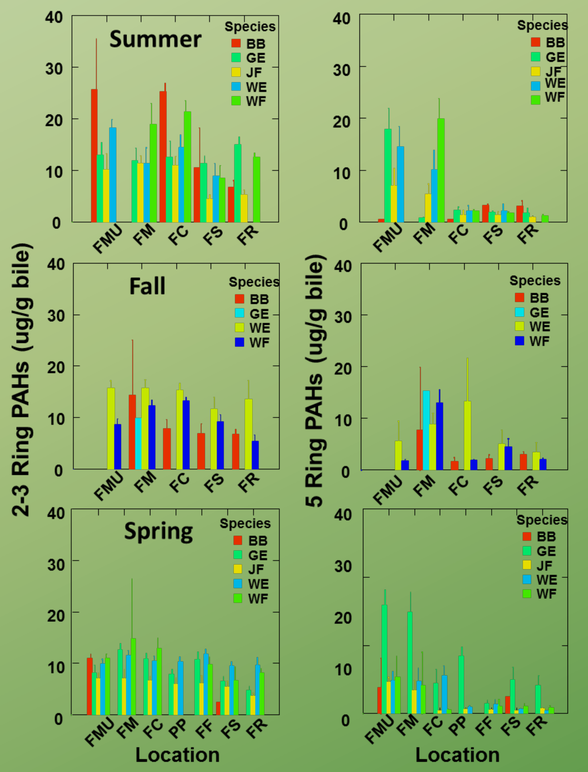
Whitefish (*Coregonus clupeaformis*) **WF**

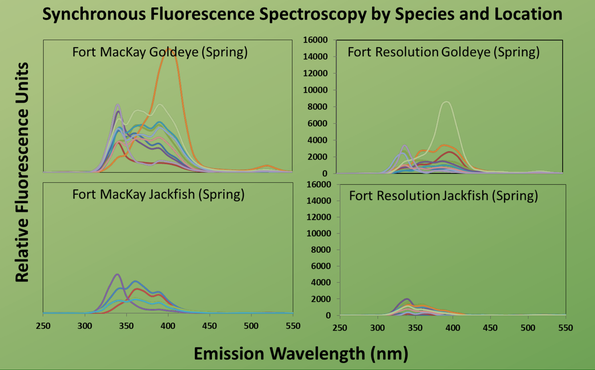
Walleye or Pickerel (*Sander vitreus*) **WE**

	Goldeye	Whitefish	Burbot	Walleye	JackFish
Trophic Level (Fishbase)	3.0 ±0.4	3.1 ±0.4	4.0 ±0.7	4.5 ±0.5	4.4 ±0.7
Migratory	Yes	Yes	Yes	Yes	No
Spawns	Spring	Fall	Fall	Fall	Spring
Consumed	Yes	Yes	Yes	Yes	Yes
Basin wide	Yes	Yes	Med	Yes	Yes

Total concentrations of PAH in bile were estimated by use of synchronous fluorescence spectroscopy (SFS) in a Thermo Scientific Lumina spectrofluorometer with a wavelength differential of 42 nm. A 1000-fold dilution of each sample was prepared with 50% methanol. The solution was centrifuged for 15 min to remove particulates. Calibration curves were prepared using authentic PAH standards. Each sample was analyzed in triplicate.

RESULTS





CONCLUSIONS

- The distribution of lesser molecular weight PAHs is relatively consistent in the river system, higher molecular weight PAHs are more prevalent in the Athabasca River.
- Lower molecular weight PAHs arise from a variety of natural and anthropogenic combustion sources.
- Lower molecular weight PAHs are found in higher concentrations in lower trophic level species
- Concentrations of PAHs indicate greater exposure to PAHs in proximity to oilsands activities, particularly for 5 ring PAHs.
- Bile concentrations reflect recent exposure and may not reflect edible tissue concentrations.
- We are currently measuring concentrations of individual PAH compounds to determine whether PAH profiles can be used to identify and apportion sources.

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