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Monitoring the impacts of exposure to alkylated-PAHs in a bioindicator species, the River Otter (*Lontra canadensis*) through Community-Based Monitoring Programs.

November 24 2016

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Environment and Climate Change Canada



GOOD... GOOD

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PAHs

- Some general characteristics
 - Natural and anthropogenic sources; occurs mostly in complex mixtures
 - Solids
 - High melting and boiling points
 - Low vapor pressure
 - Very low water solubility
- Share similarities with POPs:
 - Hydrophobic, lipophilic
 - Strong interaction with sedimentary organic carbon
 - Often sparingly soluble in water
 - Commonly have low volatility
 - Readily bioaccumulate and are toxic to aquatic organisms
 - Capacity for long range transport

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Why the oil sands?

- Increased inputs from OS industry (Kelly et al. 2010; Kirk et al. 2012; Kurek et al. 2012; Frank et al. 2014, etc...)
- Alk-PAHs
- TK holders are driven by two main questions:

“Is the food safe to eat?”
“Is the water safe to drink?”



Why River Otters?



Why River Otters?

- Mustelids are sensitive to aquatic pollution.
- Top-predator of nearshore or coastal habitats.
- Relatively small home range (20-40 km linear shoreline).
- Seasonally constant home range.
- Neither migrate nor hibernate.
- Exposed year-round to local pollutants.
- Population declines across N. America attributed to pollution.

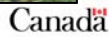


Monitoring River Otters

- > Secretive and elusive
- > Difficult to capture & recapture
- > Direct techniques – expensive, time consuming
- > May influence natural behaviour (invasive) introducing sampling bias



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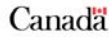


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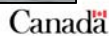


Monitoring River Otters

- > traditional approach of measuring contaminant burden in tissues and/or
- > radio telemetry
- > fecal sampling



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Endocrine Disruption Impacts

- Because PAHs are considered as endocrine disrupting organic pollutants (Lichtfouse et al. (eds.), 2012. Environmental Chemistry for a Sustainable World)
- impedes steroid and thyroid hormone regulation through various possible modes of action
- ↑ in exposure at contaminated sites could impact energetical metabolism, and feeding ecology

OBJECTIVES:

Is there a relationship between increased exposure to alk-PAHs and thyroid and cortisol hormone levels in feces?
Can the endocrine disrupting effect be felt through reduced baculum lengths?

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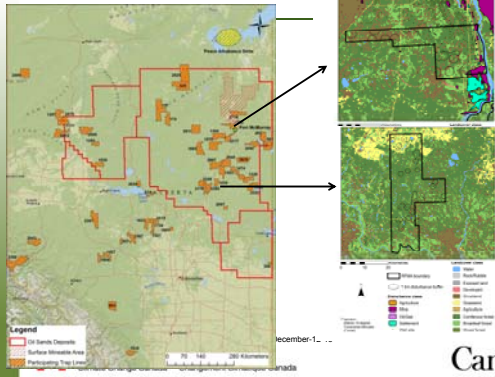


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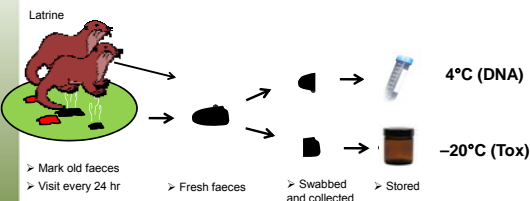
Sites



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Latrine Site Surveys + Carcass Collections



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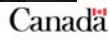
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Working Together



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And Learning From One Another



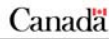
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And Learning From One Another



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River Otter Population Genetics

Figure 1. Allelic patterns across the two sampling sites (HIGH = highly impacted site, LOW = lowly impacted site). Number of alleles (Na), number of alleles with a frequency >= 5%, effective number of alleles (Ne), information index (I), number of private alleles, and trend for mean expected heterozygosity (He) are given.

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River Otter Population Genetics

Table 2. Summary of genetic diversity estimates, averaged across 11 microsatellite loci for the two study sites (HIGH = highly impact site, LOW = lowly impact site). Number of samples (N), number of alleles (Na), allelic richness (Ar), and private allelic richness (Arp) as calculated in HP-Rare (Kalinowski 2004, 2005) are given. Effective Population Size: High Impact site Ne = 6.2 (95% CI: 2.9 - 10.7) Low Impact site Ne = ∞. Fis estimates

Group	N	Na	Ar	Arp	Fis	SE
HIGH	13	5.214	0.656	4.57	0.79	0.041
LOW	32	0.617	0.041	0.641	0.043	0.028

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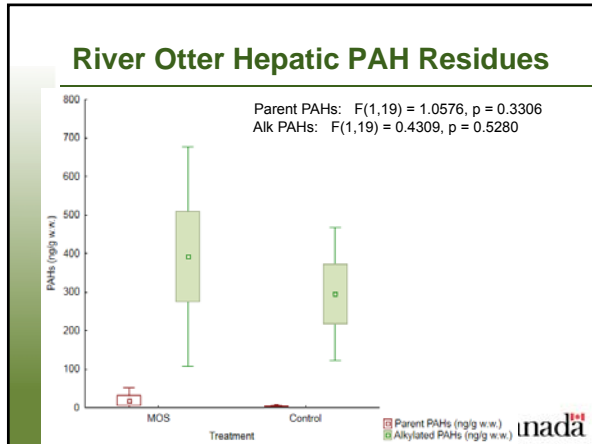
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River Otter Population Genetics

Site	P.O.	F.S.	H.S.
High Impact	1	9	1
Low Impact	12	5	55

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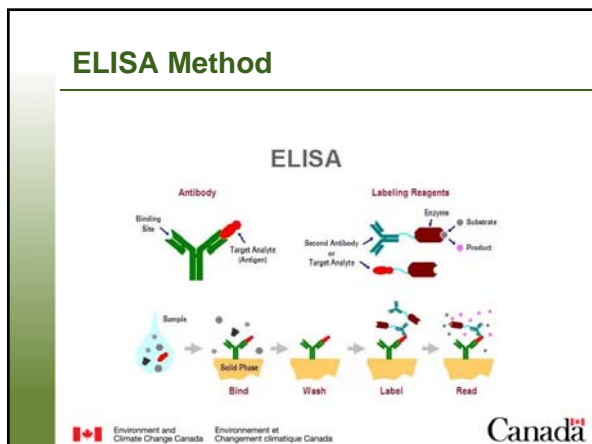
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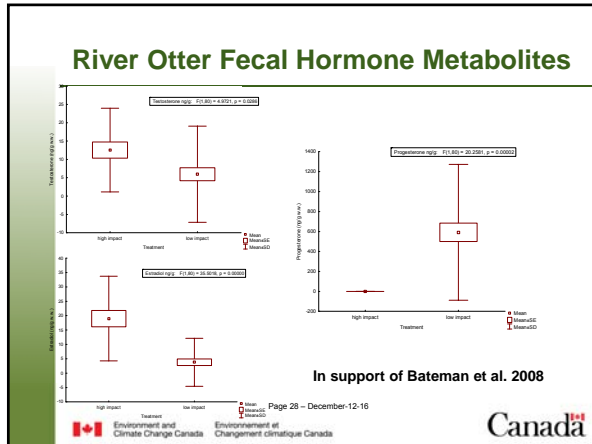


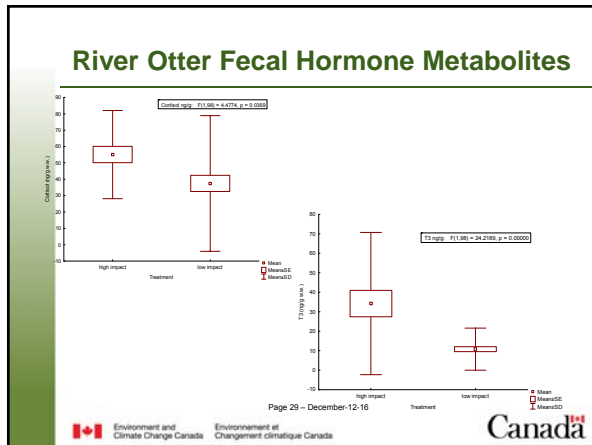
Fecal Sample Preparation

- Scat samples (~0.2g) were extracted with 80% EtOH by agitating/shaking for at least 14 hours. The samples were then centrifuged and the extract poured off for analysis.

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Thank You!!!



- Drs Jules Blais and Laurie Chan
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- MCFN, ACFN, FMFN, Metis Locals
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