2008 Monitoring Results

Fort Chipewyan, June 9, 2009

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RAMP Regional Aquatics Monitoring Program

8/12/2009

What is RAMP?

Initiated in 1997, the Regional Aquatics Monitoring Program (RAMP) is a joint environmental monitoring program that assesses the health of rivers and lakes in the oil sands region.

RAMP Regional Aquatics Monitoring Program

RAMP Objectives

- Monitor aquatic environments in the oil sands area;
- Collect data to better understand the RAMP study area;
- Compare monitoring data with Environmental Impact Assessment predictions; and
- Respond to community concerns.

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RAMP Studies

- Water Quality;
- Sediment Quality
- Benthic Invertebrate Communities;
- Fish Populations;
- Climate and Water Flow;
- Acid Sensitive Lakes
- River Response Networks
- Reporting and Communications

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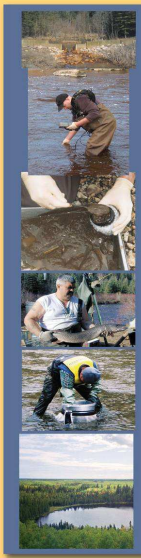
2008 Monitoring Activities - Athabasca River & Delta



- Water quality on Athabasca River
- Fish monitoring – Athabasca-Clearwater rivers, Big Island Lake and Moose (Gardiner) Lake
- Sediment-dwelling invertebrates and sediment quality – Athabasca Delta
- Water Flow – Athabasca River upstream and downstream of oil sands industry

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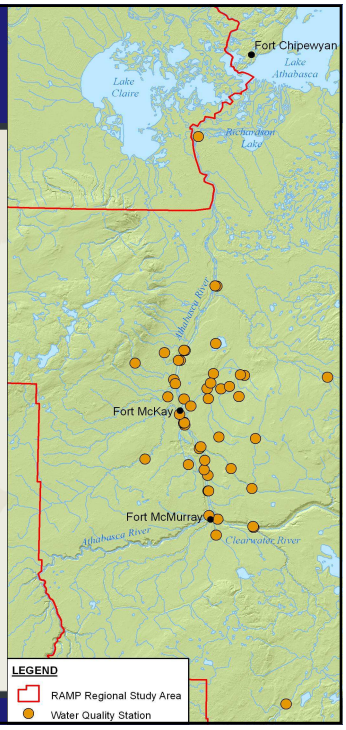
Water Quality Monitoring

- **Where do we sample?**
  - ±45 stations sampled by RAMP each year (seasonally), in Athabasca River and tributaries;
  - In the delta: monthly sampling at Old Fort by Alberta Environment.
- **What do we sample?**
  - ~90 different water properties/chemicals (more @ AENV);
  - Nutrients, metals (mercury, arsenic), organic chemicals, ions (salts), oxygen, acidity
- **What are we looking for?**
  - Change from natural conditions.



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2008 Water Quality Results

- **Changes in water quality in some smaller tributaries (Tar River, Beaver Creek):**
  - Harder, saltier water;
  - More suspended sediment;
  - Higher nutrients (nitrogen).
- **Athabasca River:**
  - Recent water quality values at Old Fort within historical ranges and similar to quality found Upstream of Fort McMurray

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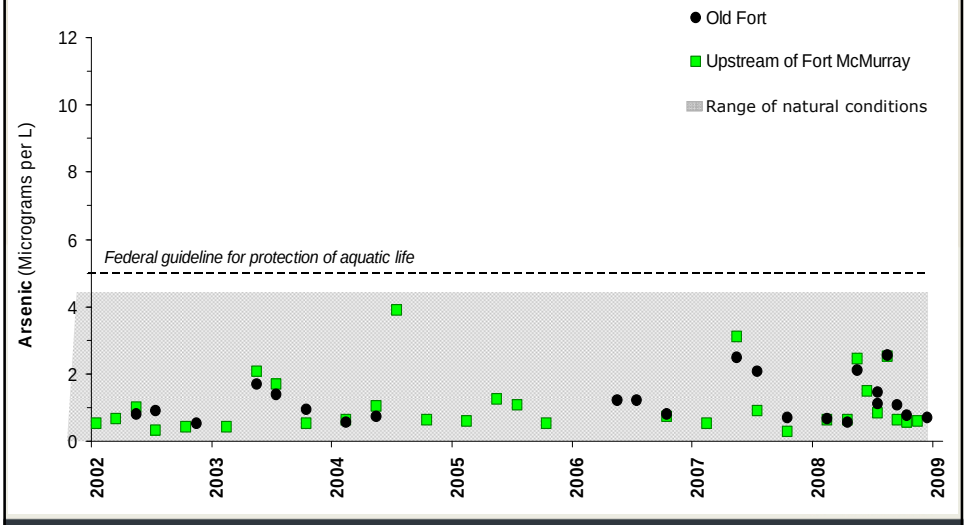
Arsenic in Athabasca River Water



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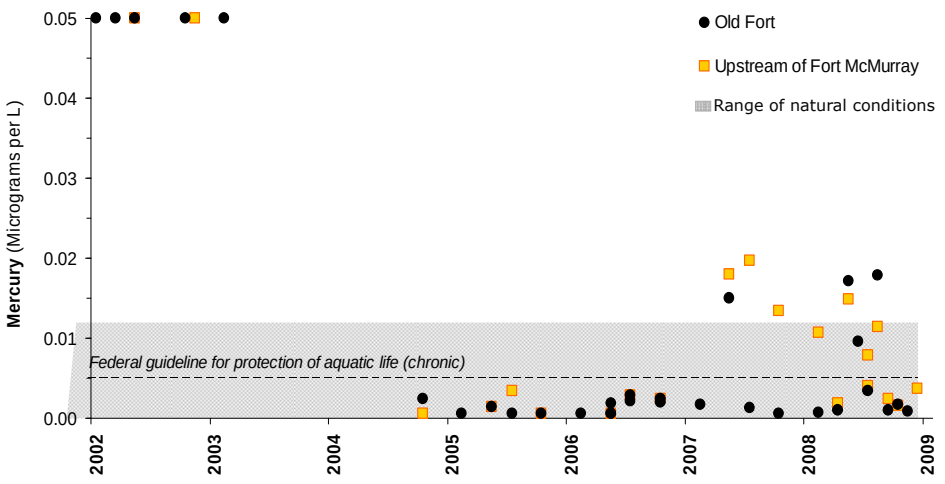
Mercury in Athabasca River Water



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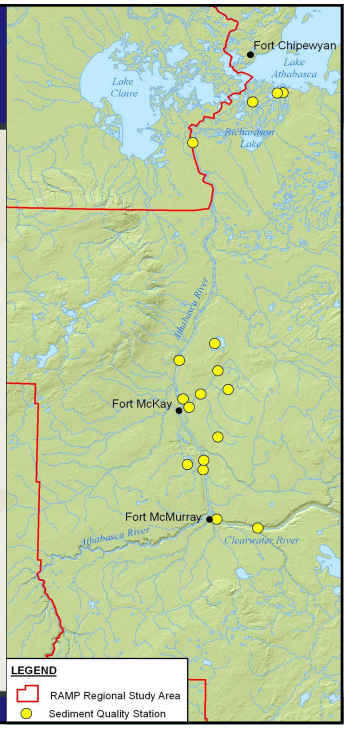
Sediment Quality Monitoring

- **Where and When?**
  - All muddy-bottom locations sampled for benthic invertebrates by RAMP (±16 locations);
  - In the delta: annual fall sampling in Big Point Channel, Fletcher Channel, Goose Island Channel, Athabasca River upstream of Embarras River
- **What?**
  - Particle sizes, organic content, metals, petroleum hydrocarbons & PAHs *(polycyclic aromatic hydrocarbons)*, toxicity testing (at some stations).
  - ***PAHs =*** *organic chemicals found in oil/coal/tar (or created through fires or organic decay) that may be harmful to human or animal health.*



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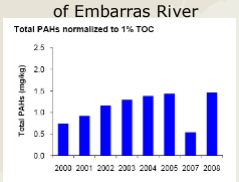
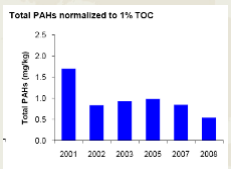
Sediment Quality Results (to 2008)

- All metals (including arsenic & mercury) below guidelines;
- PAHs present in delta sediments, variable over time:

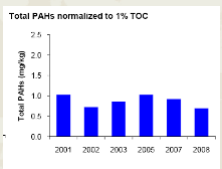
Athabasca River upstream of Embarras River



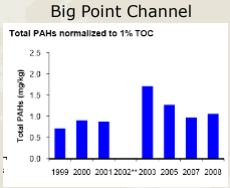
Fletcher Channel



Goose Island Channel



Big Point Channel



- Sediment cores in Delta & Lake Athabasca (sampled in 1998) showed similar PAH concentrations to 1930s/40s; and
- Delta sediments show no negative effect on bottom animals.

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Fish Population Monitoring

- Fish Inventories on Athabasca (May, July, September) and Clearwater (May, October) rivers:
  - Count of each species;
  - Length and weight measurements;
  - Tagged jackfish and pickerel; and
  - External health assessment.
- Fish tissue studies on Moose (Gardiner) and Big Island lakes and the Athabasca River (September):
  - Mercury in jackfish, lake whitefish and pickerel from lakes; and
  - Metals/fish tainting compounds in lake whitefish and pickerel from the Athabasca River.

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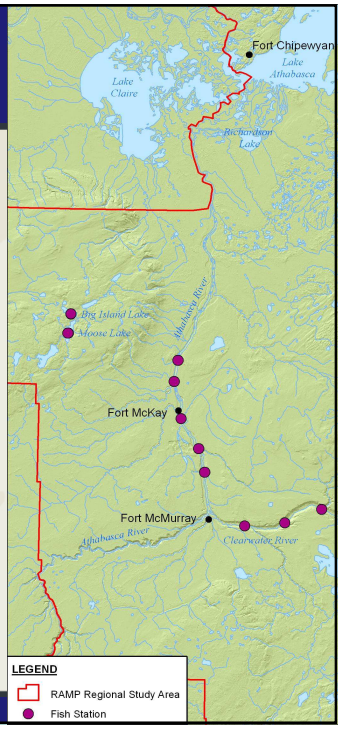
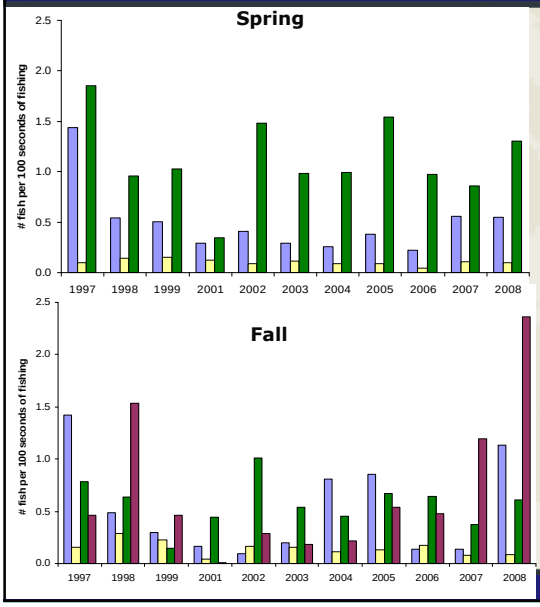


Electrofishing on the Athabasca River

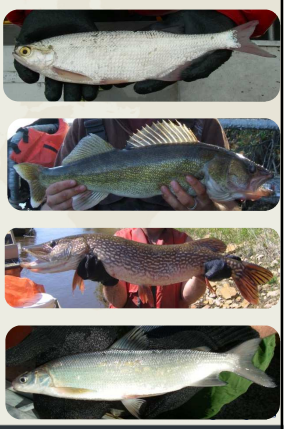
Tagging a walleye

Taking a non-lethal tissue sample

Athabasca River Fish Populations- Capture Success



- Number of fish captured per 100 seconds of fishing
- All fish are released after measuring



Fish Tag Return Program

- Track pattern of fish movement over time in the RAMP regional study area
- Community participation:

  Please report tag number, fish species, capture location to ASRD (780-743-7200) – phone number on tag

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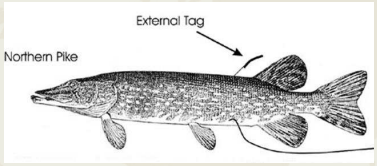
Fish Tag Return Program

- 2008 tagged fish:
  - Athabasca River: 384 (40 jackfish, 344 pickerel)
  - Clearwater River: 228 (100 jackfish, 128 pickerel)
- 2008 recaptures:
  - Anglers: 10 (1 jackfish, 9 pickerel)
  - RAMP: 12 (5 jackfish, 7 pickerel)
- 1998-2008 recapture summary:
  - 20 jackfish
  - 74 pickerel



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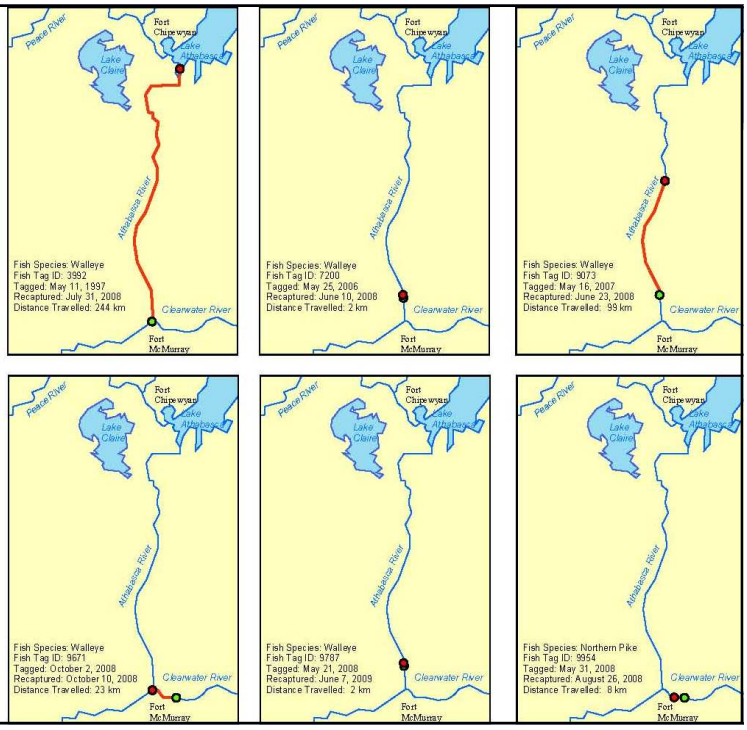
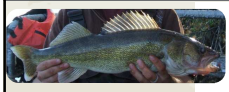
Angler Tag Returns

Where fish was **first tagged**

Where fish was **recaptured**

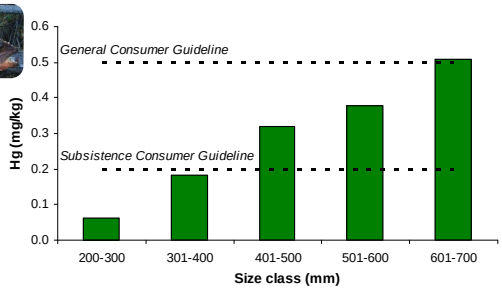


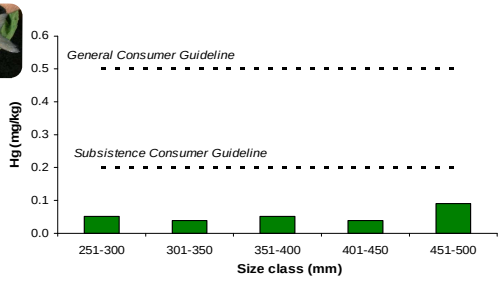
Mercury in fish muscle – Athabasca River 2008

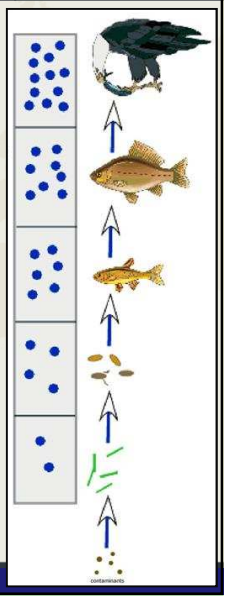


(pickerel)

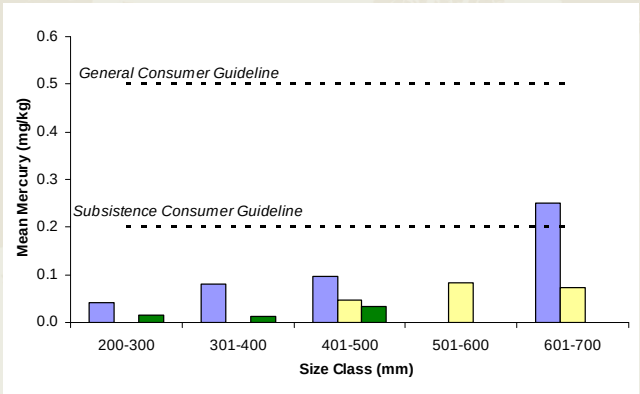
(lake whitefish)







Mercury in fish muscle - Big Island Lake 2008



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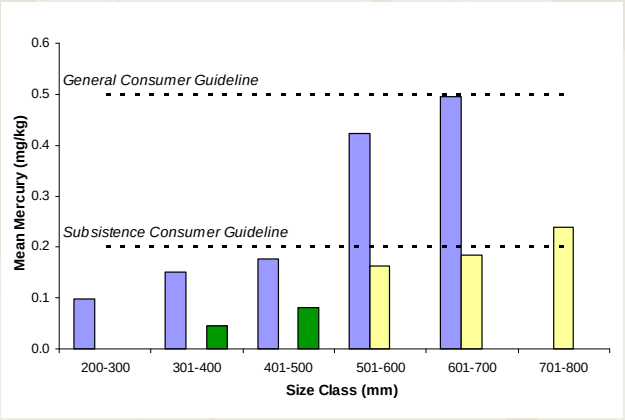
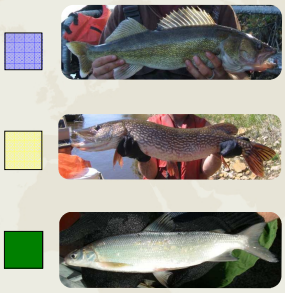
Mercury in fish muscle – Moose (Gardiner) Lake 2008





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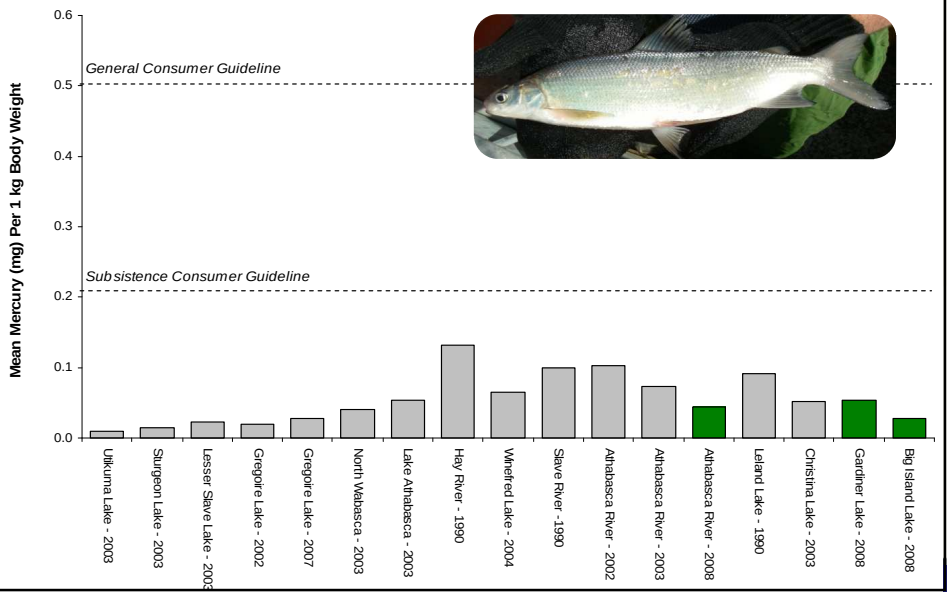
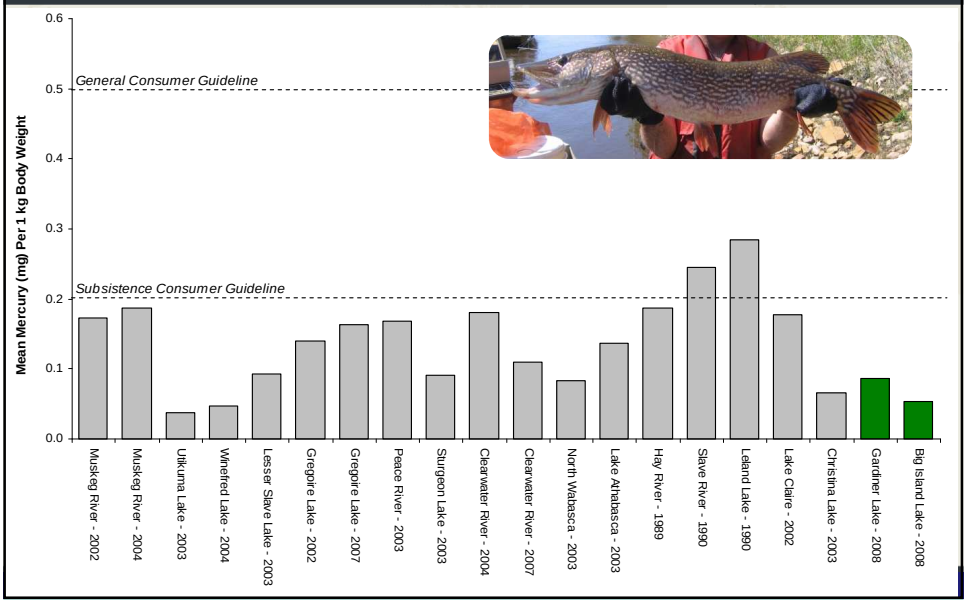
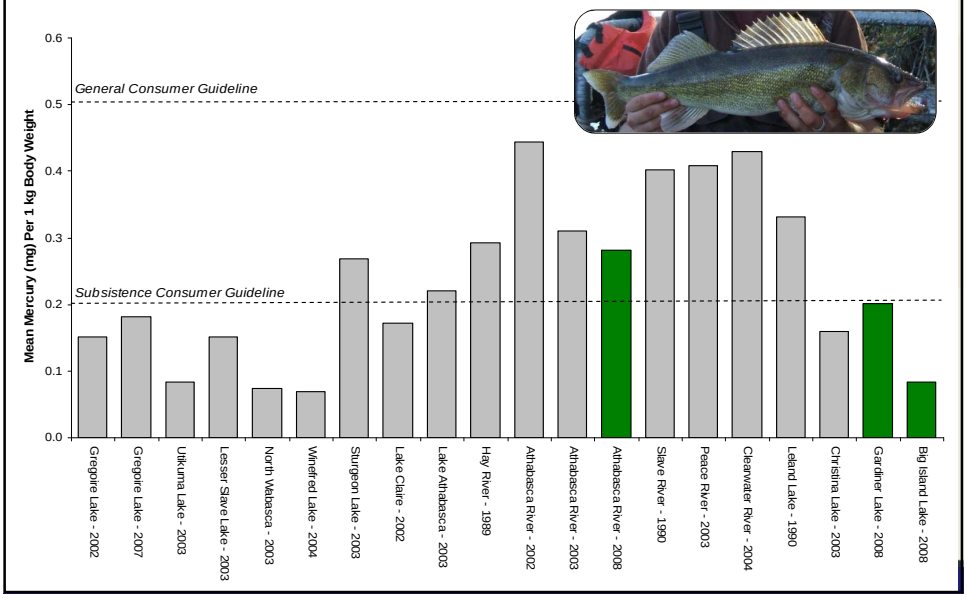
Regional Results - mercury in lake whitefish muscle



Regional Results - mercury in jackfish muscle

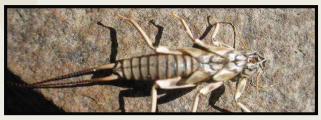


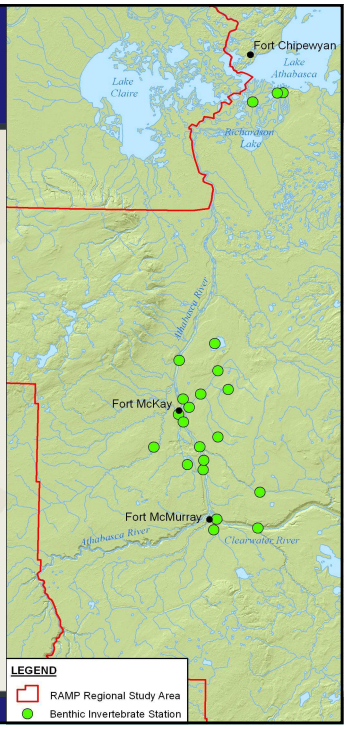
Regional Results - mercury in pickerel muscle



Benthic Invertebrate Monitoring

- Collect insects, snails, clams, and other animals that live on and in the sediments of rivers and lakes
- Good indicators of water and sediment quality
- Sampled delta sediments since 2002
- Look at:
  - Total number of animals
  - Number of different types of animals
  - Percentage of sensitive animals
    = mayflies, caddisflies, stoneflies





Athabasca River Delta

- Numbers and types of animals fluctuate a lot from year to year, particularly at Big Point channel
- No overall decline in animals over time at delta stations
- Animals sensitive to pollution continue to be present at all delta stations - in 2008 an increase of 16% at Big Point channel

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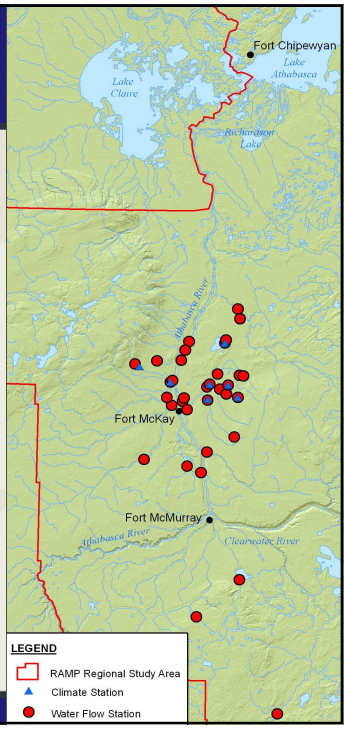
Climate and Water Flow Monitoring

- Water flow monitored at 34 stations;
- Climate measurements at 7 stations;
- Climate measurements: precipitation, air temperature, amount of sunshine, snow on the ground, wind speed and direction;
- Snow depth and water content monitored in February, March and April.



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Athabasca River Water Flow

- Stations on the Athabasca River located upstream and downstream of oil sands development
- Look at possible changes over time
- Measure actual flow of the Athabasca and compare it to what the flow would be like if there were no withdrawals, discharges, land clearing, tailings ponds etc.,

= water balance

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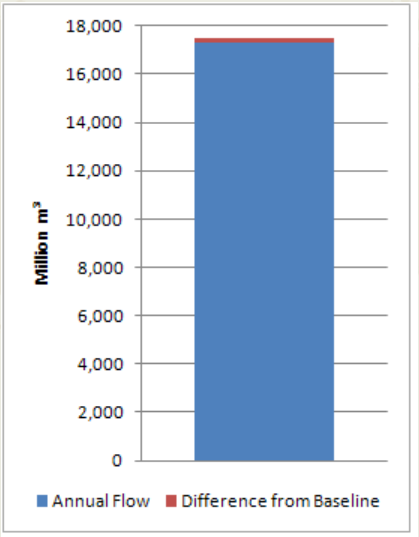
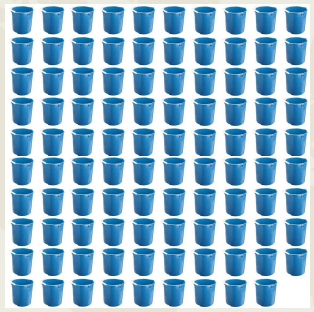
Athabasca River Flow 2008





Athabasca River Flow 2008

Industry (1%)

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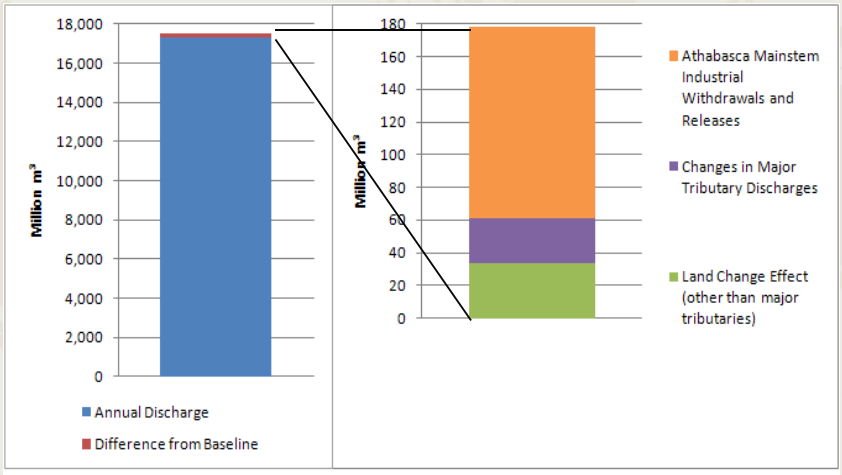
Athabasca River 2008 Water Balance



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