<table>
<thead>
<tr>
<th></th>
<th>Texas</th>
<th>NWT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (km²)</td>
<td>696,241</td>
<td>1,746,106</td>
</tr>
<tr>
<td>Population</td>
<td>26,448,193</td>
<td>41,462</td>
</tr>
<tr>
<td>Density (people/km²)</td>
<td>98.1</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Resource extraction a major source of income

Environmental management ‘devolved from the federal to territorial government in 2014

Close to 100 major projects under investigation or in approval process
Community Based Monitoring

**Pros**
- Transparency
- Efficiency
- Communications
- Public confidence (history of mistrust in the NWT)

**Cons**
- Data consistency and quality issues
- Management
- Training and infrastructure
Key Questions For Monitoring SWEEP

Is the Water Safe to Drink?

Are the Fish and Wildlife Safe to Eat?

Are the Plants and Animals Healthy? – for my children’s children
Five types of monitoring programs

<table>
<thead>
<tr>
<th>Category of monitoring</th>
<th>Primary data gatherers</th>
<th>Primary users of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Externally driven, professionally executed</td>
<td>professional researchers</td>
<td>professional researchers</td>
</tr>
<tr>
<td>2. Externally driven with local data collectors</td>
<td>professional researchers, local people</td>
<td>professional researchers</td>
</tr>
<tr>
<td>3. Collaborative monitoring with external data interpretation</td>
<td>local people with professional researcher advice</td>
<td>local people and professional researchers</td>
</tr>
<tr>
<td>4. Collaborative monitoring with local data interpretation</td>
<td>local people with professional researcher advice</td>
<td>local people</td>
</tr>
<tr>
<td>5. Autonomous local monitoring</td>
<td>local people</td>
<td>local people</td>
</tr>
</tbody>
</table>
Cumulative Effects

- Global Climate Change
- Upstream Industrialization (Oilsands)
- Agricultural inputs
- Hydroelectric damming and flow regulation
- Water abstraction

1946  2013
Guiding Principle – Two-Eyed Seeing

Two-Eyed Seeing is the Guiding Principle brought into the Integrative Science co-learning journey by Mi'kmaw Elder Albert Marshall in Fall 2004.

.... learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing ... and learning to use both these eyes together, for the benefit of all.
Type 1 indicators
Low cost
Carried out locally
Interpretable by community members
Moderate sensitivity
High local relevance

Type 2 indicators
High cost
Carried out at distant labs
Interpretable by Western scientists
High sensitivity
Moderate local relevance

Ideal: long term data for calibration of indicators
Methods

- Indigenous Knowledge incorporation
- Fish Health assessment
- Aquatic Invertebrates
- Wildlife abundance and movements
- Hydrology – water quality and quantity
- Ice quality quantity and dynamics
Fish Health Assessment

- Fish most commonly caught and consumed
- Areas most frequently used to harvest
- Development of local capacity for health assessment
- Collection and archiving of tissue samples
Condition Factor (CF) by Location and Season

- CF = weight/(Length^3) * 100
- General indicator of health and fatness
- ‘Skinny’ species will have lower CF – e.g. pike

Summer

Fall
Temporal Changes in CF for Whitefish Across Seasons
Ice Dynamics

- Freeze up and break up times
- Ice damming – or the lack of
- Water over ice events

- In conjunction with satellite imagery and analysis
Ice Dynamics

- Ice thickness, type, snow and water depth
- Surveys along river transects
- Major highways during winter hunting and fishing
- Changes due to damming, GCC, abstraction
- Satellite imagery and modelling
RADARSAT-2 image of Slave River Delta (Dec. 2013)
Results to date:

- The samplers were colonized by a good diversity of animals (mayflies, stoneflies, caddisflies, midges).
- The samplers were colonized by a manageable number of animals.
- Not the ‘depauperate’ community we were expecting.
- The students were very capable and enthusiastic about the whole thing, including data analysis!
- Imbedded in school curriculum.
Jean River
13 Taxa
Sensitive to Insensitive
6 EPT
939 animals/m²
86-213 animals per sample

Steamboat Channel
11 Taxa
Sensitive to Insensitive
6 EPT
1414 animals/m²
52-422 animals per sample
Water Quality

- Ongoing work by federal and Territorial Agencies
  - Parks Canada, Environment Canada, AANDC
  - Environment and Natural Resources (Govt. NWT)
  - Local Communities (drinking water monitoring)

- Challenge is collection and integration of data and presentation in timely and accessible manner
DIFFERENT WAYS OF MEASURING WATER QUALITY

This is an example of a Type 1 indicator, something that can be measured locally at low cost.

LOOKING DOWN THE TUBE

TURBIDITY TUBE

The water is drained until the top person can see the disc at the bottom. If the water is muddy, there will be only a little bit left in the tube (10 to 20 cm). If it is clear, the tube will be full (100 to 120 cm).
Bayesian Belief Network

Amenable to multiple input data types

- Type 1 indicators (community)
- Type 2 indicators (Western Science)
- TEK

‘Useful’ Outputs

- Facilitates Dissemination to Communities
- Facilitates Local Decision making

- Currently finalizing what the input variables might look like
- Postdoctoral Fellow beginning development
Acknowledgements

- Erin Kelly and ENR personnel
- Slave River and Delta Partnership (SRDP)
- Peace-Athabasca Delta Environmental Monitoring Program (PADEMP)
- Deninu School, Fort Resolution
- Aurora College, Fort Smith
- Deninu Kue First Nation, Fort Resolution Metis Council, Hamlet of Fort Resolution, Salt River First Nation, Smith’s Landing First Nation, Town of Fort Smith, Fort Smith Metis Council, Athabasca Chipewyan First Nation, Mikisew Cree First Nation
The Slave River and Delta Partnership

Northwest Territory Métis Nation

Town of Fort Smith
Hamlet of Fort Resolution

Deninu K’ue First Nation
Fort Resolution & Fort Smith Métis Councils

[Logos for various universities and organizations]