

Northern Canada

Jennifer Baltzer, Wilfrid Laurier University

Heidi Swanson, University of Waterloo

Heidi Swanson



Merritt Turetsky



Dave Rudolph



Phil Marsh



Chris Spence



Brian Laird



Deb MacLatchy



Masaki Hayashi



Mike English



Jason Venkiteswaran



Roland Hall



Alison Blay-Palmer



Chris Derksen



Sherry Schiff



Jeff McKenzie



Bill Quinton



Oliver Sonnentag



Kelly Skinner



James Craig



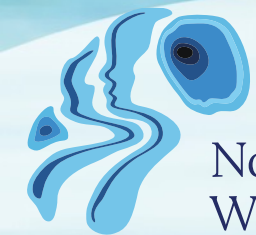
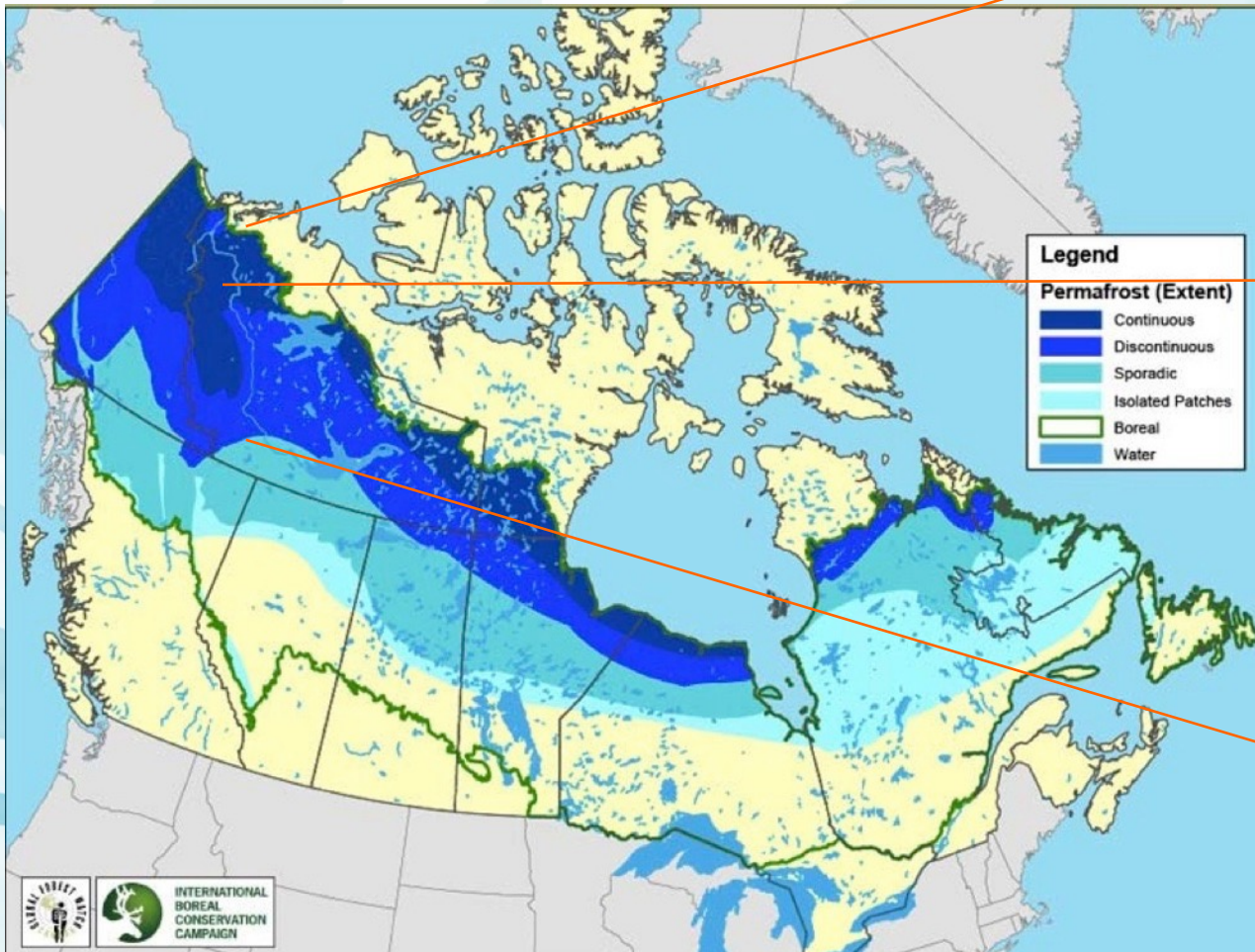
Derek Gray



Brent Wolfe



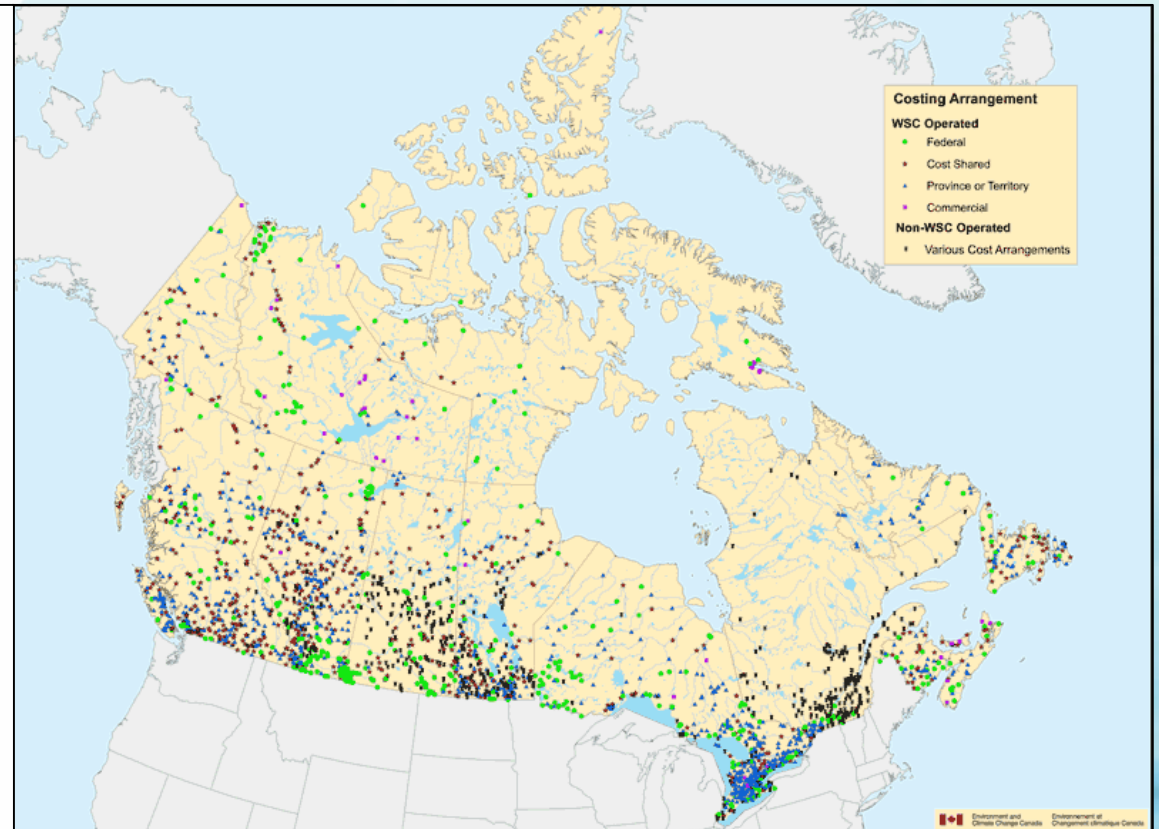
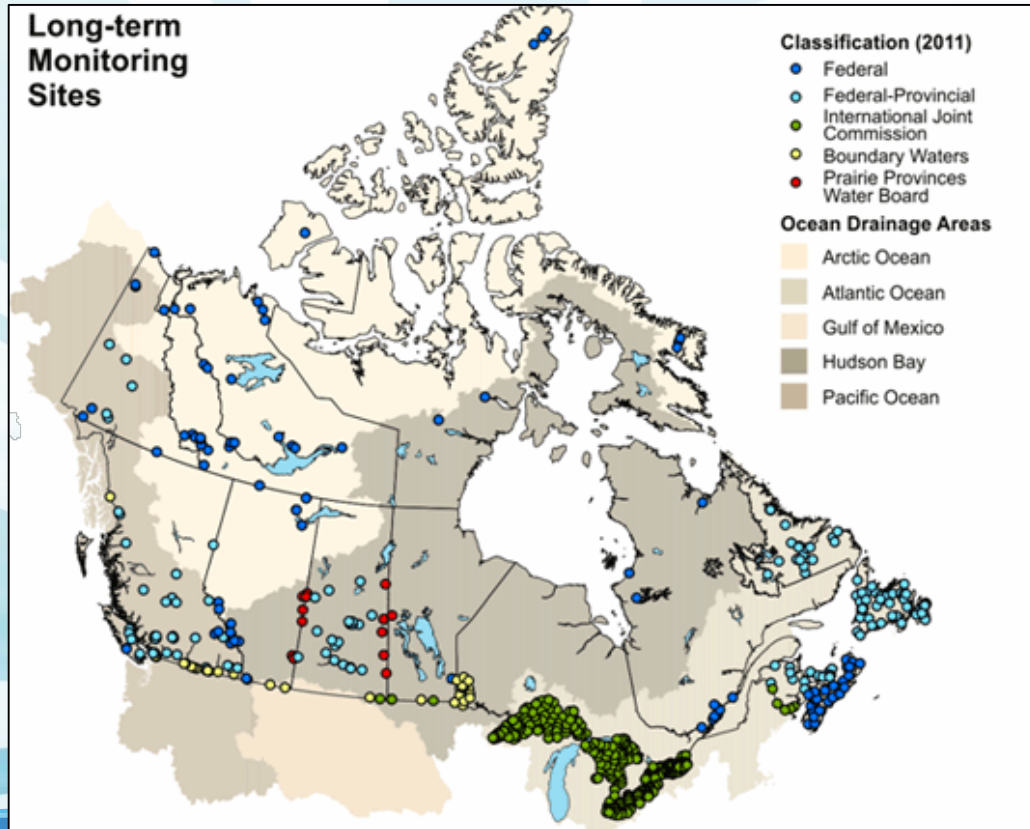
Canada's North



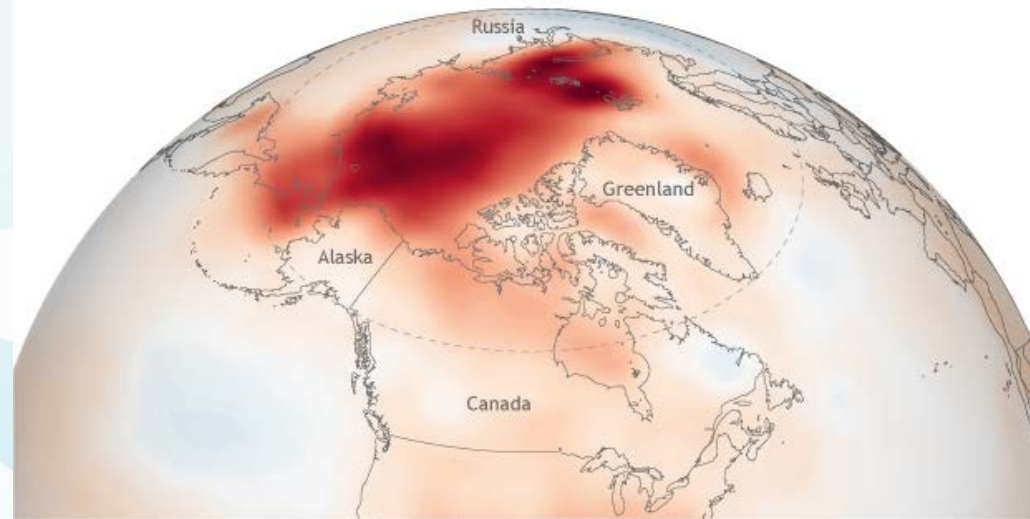
Northern
Water Futures

[www.northernwaterfutures.c
a](http://www.northernwaterfutures.ca)

Monitoring networks in the North



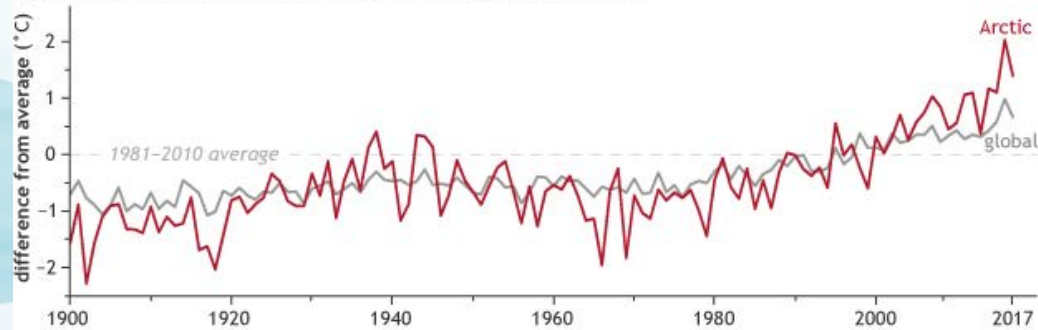
ARCTIC HAD SECOND WARMEST YEAR ON RECORD



Oct 2016–Sep 2017

difference from average temperature
-11°F -6°C 11°F 6°C

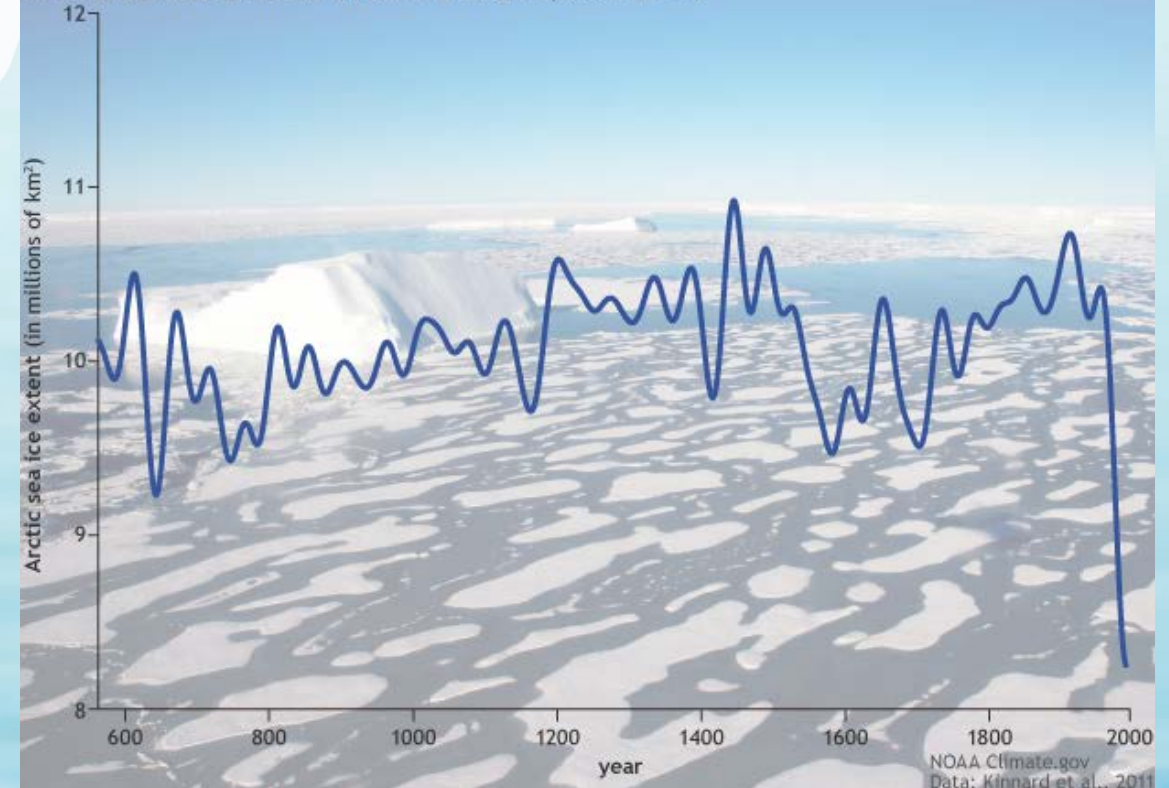
ARCTIC WARMING TWICE AS FAST AS GLOBAL AVERAGE



NOAA Climate.gov
Data: ARC 2017

High latitude warming

ARCTIC SEA ICE EXTENT OVER THE LAST 1,500 YEARS



NOAA Climate.gov
Data: Kinnard et al., 2011

2017 Arctic Report Card: NOAA



Northern
Water Futures

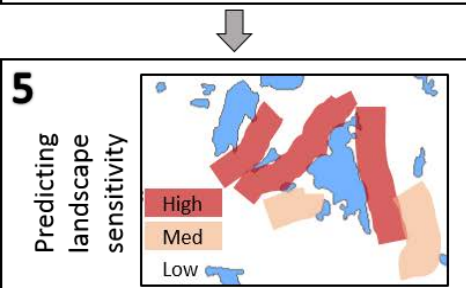
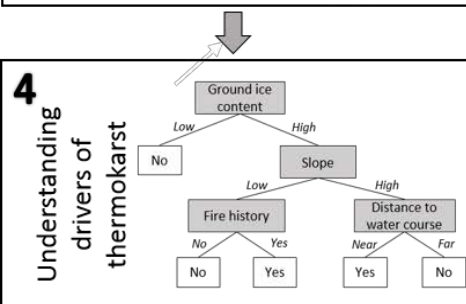
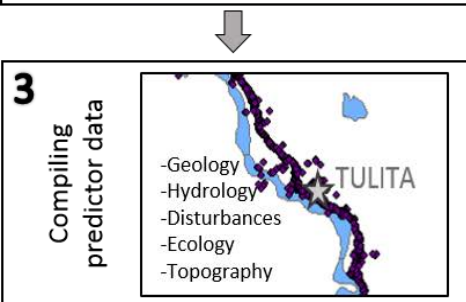
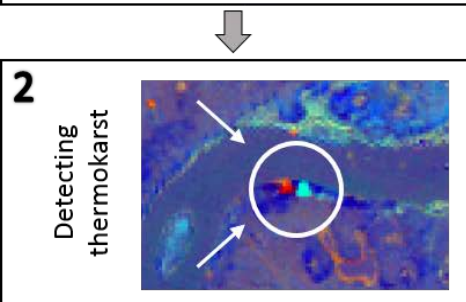
www.northernwaterfutures.ca

What does warming mean for northerners?

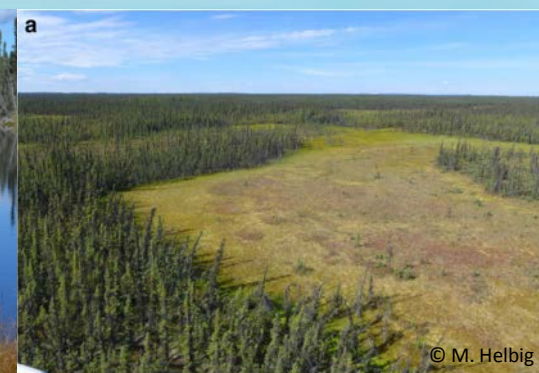
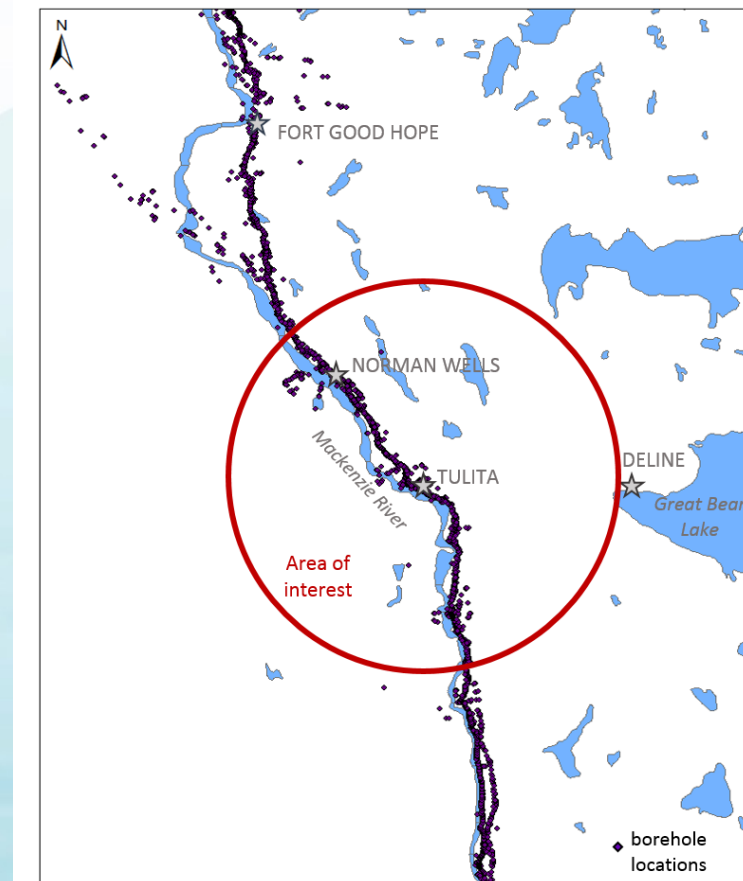
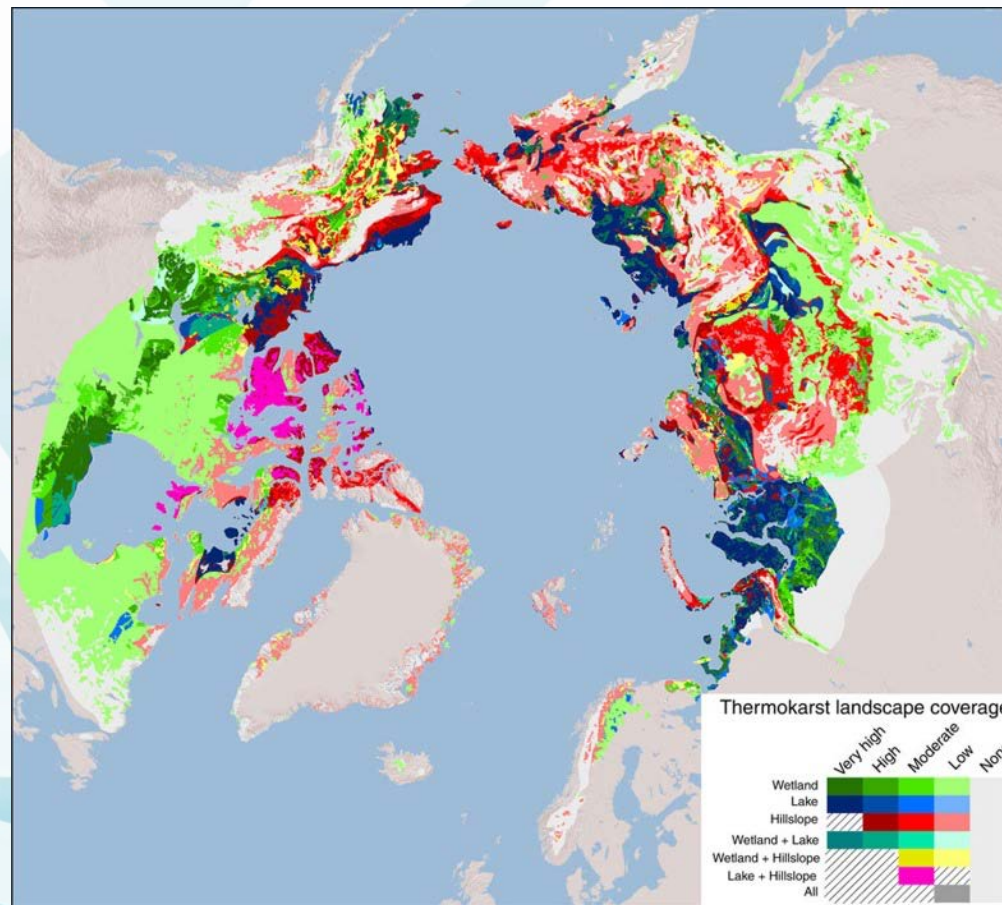
Permafrost thaw

- Rapid land cover changes
- Lake formation and/or drainage
- Biogeochemical changes
- Water quality impacts
- Impacts on infrastructure
- Altered on-the-land safety
- Major carbon source





Thermokarst vulnerability mapping



Odefeldt et al.
(2016)

What does warming mean for northerners?

Changing hydrology

- Patterns of precipitation and evapotranspiration
- Timing of snow and ice melt
- Permafrost thaw altering connectivity of surface and subsurface
- Altered run-off generation
- Energy and food security implications



<https://phys.org/news/2013-11-subarctic-lakes-years.html>

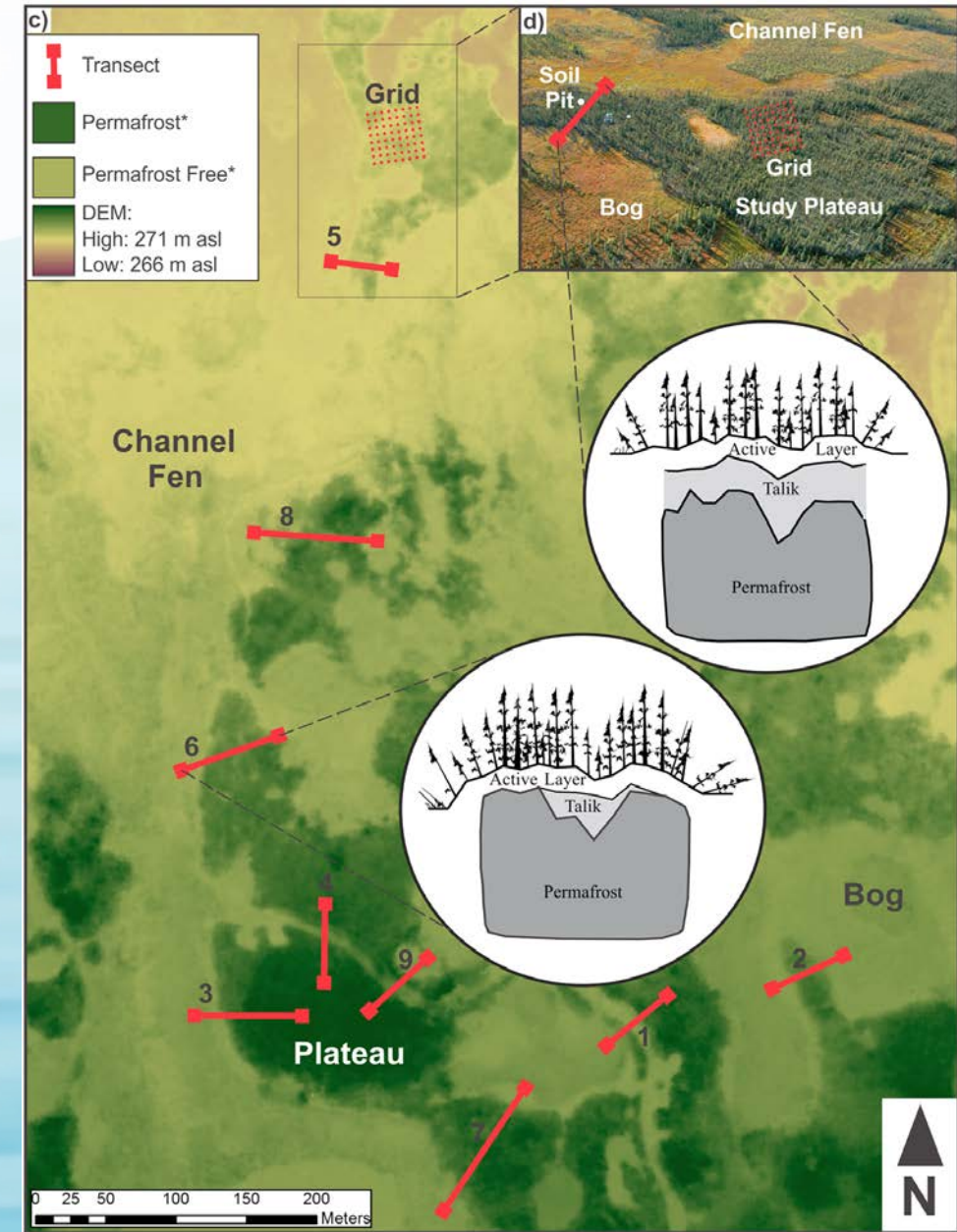
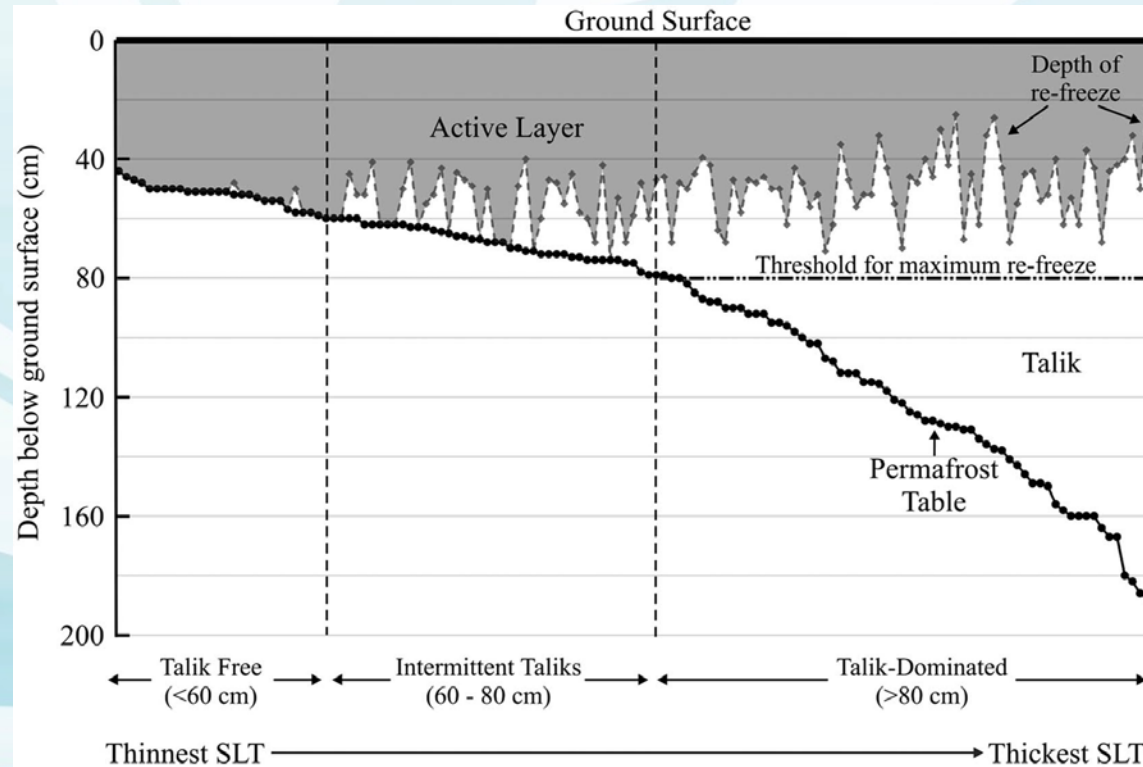
www.cbc.ca



Northern
Water Futures

www.northernwaterfutures.ca

Warming, thaw and hydrological connectivity



What does warming mean for northerners?

Changing wildfire regime

- Land cover change
- Feedbacks to permafrost thaw
- Impacts for aquatic and terrestrial wildlife habitat = food security concerns
- Human health impacts
- Feedbacks to global climate

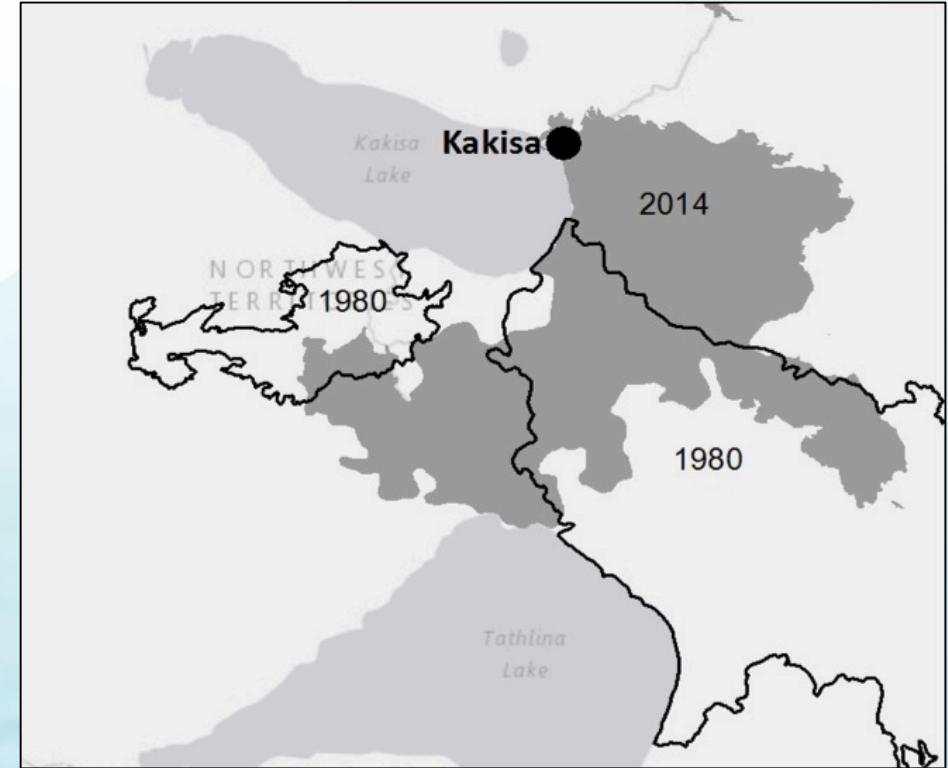


Photo credit: GNWT ENR

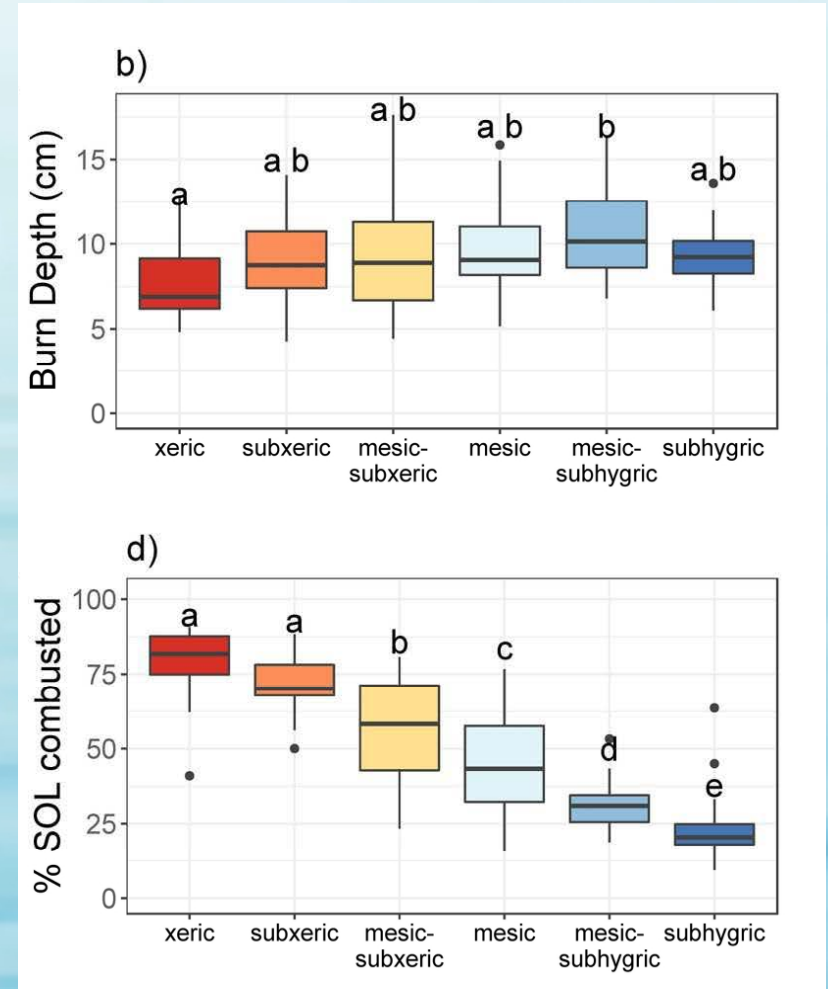


Northern
Water Futures

www.northernwaterfutures.ca

Landscape predictors of burn severity

- Drier parts of the landscape more susceptible to severe burning
- Mesic sites quite variable



What does warming mean for northerners?

Poleward shifting of species

- Biome shifts (e.g., tundra shrubbing)
- Altered ecosystem dynamics due to novel species
- Expansion of pests



Cumulative effects: development in a changing north

- Lack of baseline information to inform decision makers and regulators
- Impacts of warming alone poorly understood – how to assess development impacts?

NEB and GNWT study finds 200 billion barrels of oil in the Sahtu

Joint report evaluated the Canol and Bluefish shale fields near Norman Wells and Tulita

CBC News · Posted: May 25, 2015 6:00 AM CT | Last Updated: May 25, 2015

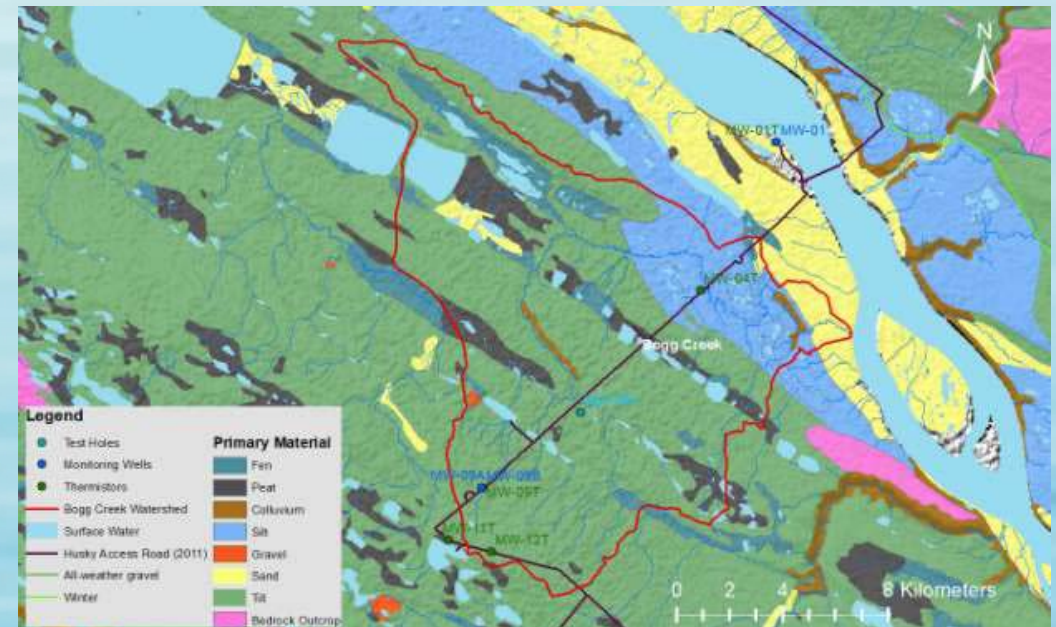


Northern
Water Futures

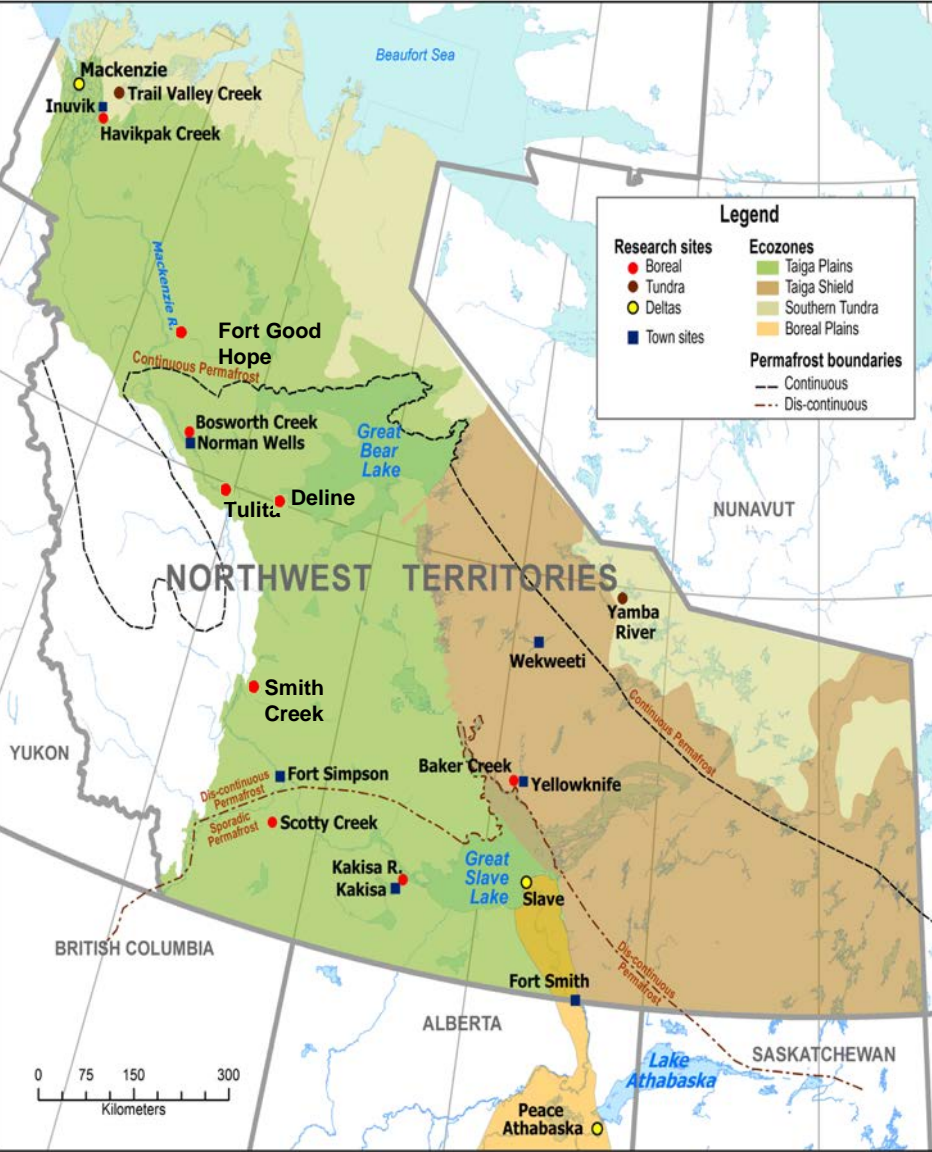
www.northernwaterfutures.ca

Groundwater baseline study

- Developing collaboration with Husky Energy, Ltd. to access datasets (measurement period 2012 – present) and site access
- Resampling of groundwater wells in summer 2018, geophysical measurements of site in winter 2019
- Development of remote sensing methods for detection of icings to inform less invasive methods of ground water measurements
- How will changing permafrost conditions impact ground water dynamics in these sensitive landscapes?



Northern Water Futures



Changing Biophysical Landscape

- Hydroclimatic changes
- Wildfire
- Permafrost thaw
- Habitat loss and fragmentation

Community health and wellbeing

- Food safety and security
- Drinking water safety
- Traditional livelihoods
- Harvester Safety

Sustainable development

- Infrastructure
- Reliable energy supply
- Responsible resource extraction



Northern
Water Futures

[www.northernwaterfutures.c](http://www.northernwaterfutures.ca)

a

Overarching impacts on community health and well-being

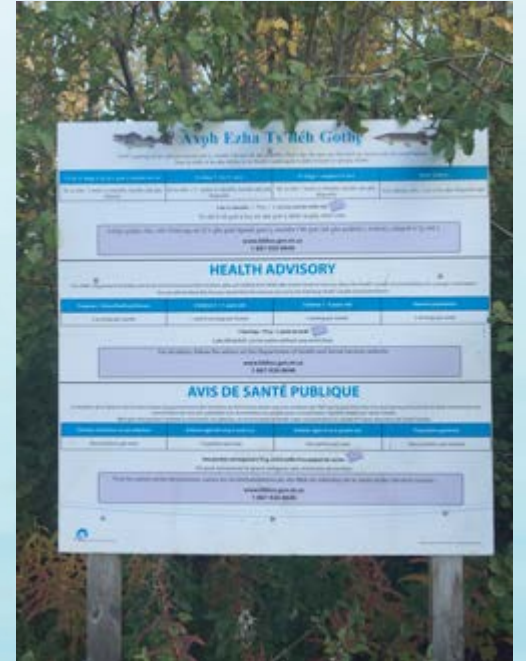
Case study: Fish [Hg] in the Dehcho region, NT

- Why do some lakes have high fish mercury and other lakes have low fish mercury?
- How will climate change and resource development affect fish mercury levels?



Fish [Hg] in the Dehcho region as a food security issue

Research on mercury in the NWT may have scared some Dene and Métis people off eating any kind of fish



Country food reassurances offered at Kakisa workshop

Second annual event focuses on issues surrounding fish and mercury

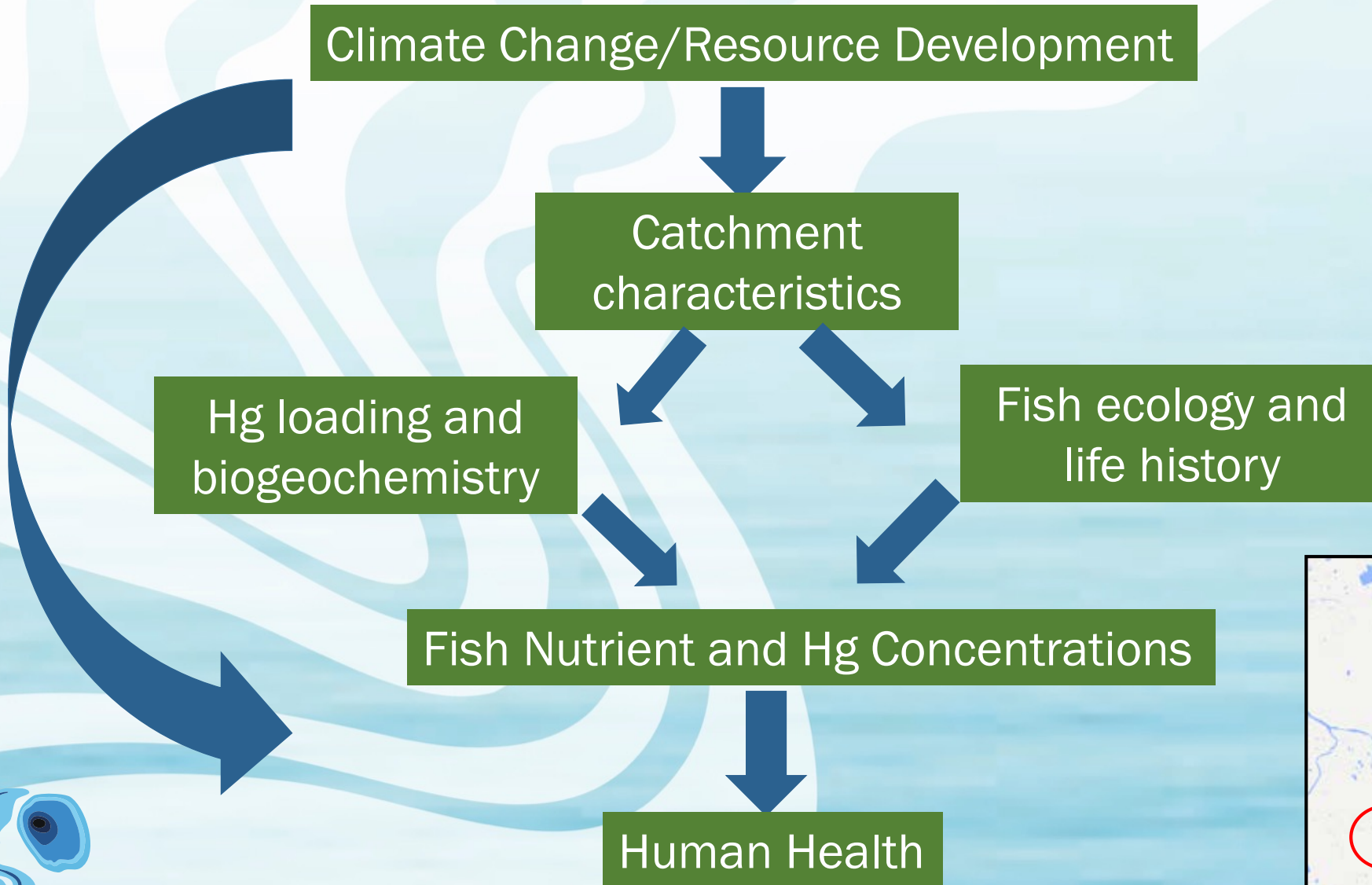
Roxanna Thompson
Northern News Services



Northern
Water Futures

[www.northernwaterfutures.c
a](http://www.northernwaterfutures.ca)

Project View



Methods

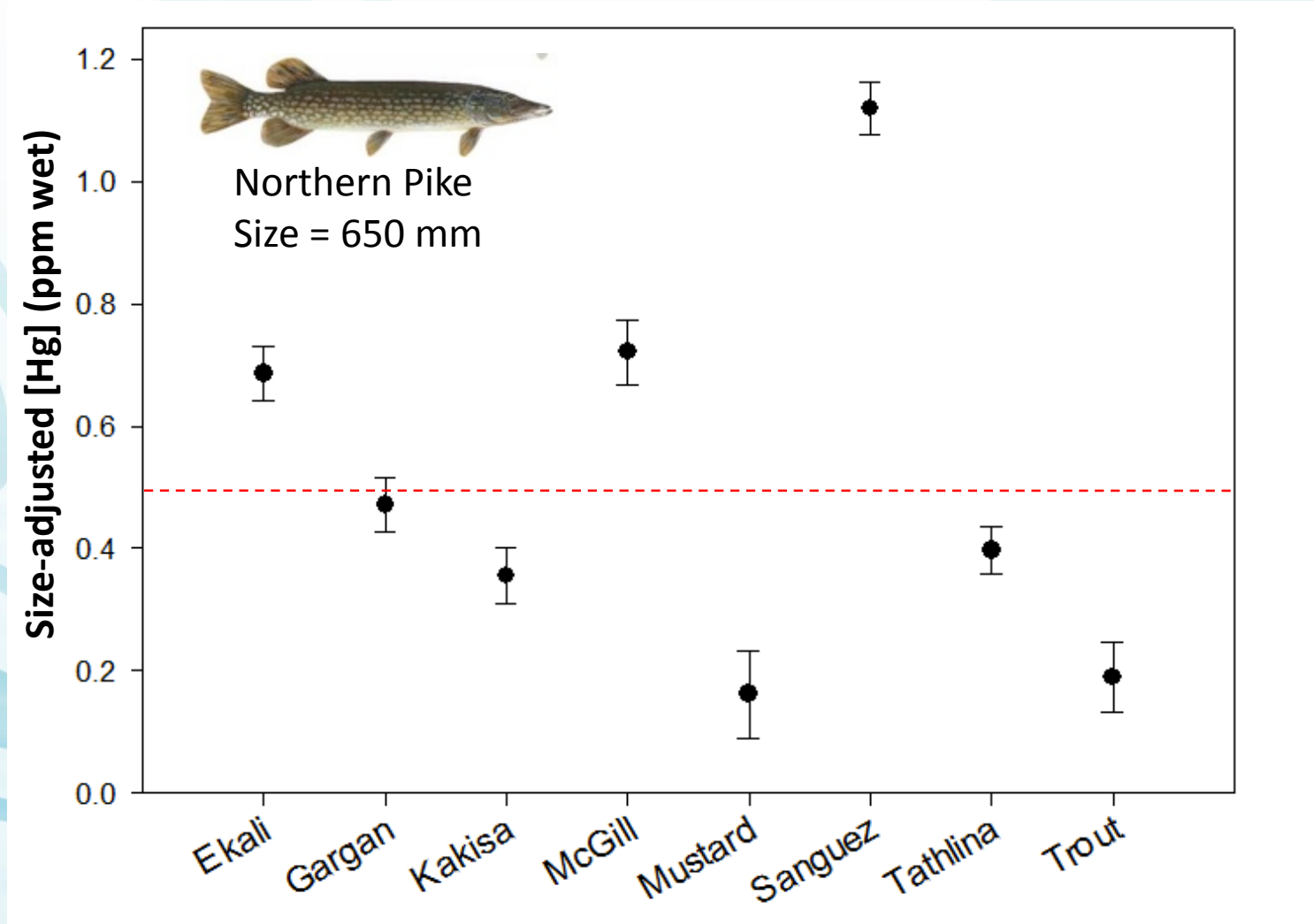
- Community-driven evolution
- Joint University-community sampling team
- Fish Hg levels
- Fish ecology: Stable isotope ratios, life history
- Lake: water chemistry, ultra-trace Hg and MeHg
- Sediment: THg, MeHg, LOI
- Catchment: Area, composition
- Invertebrate and food web: MeHg, community comp, biomagnification



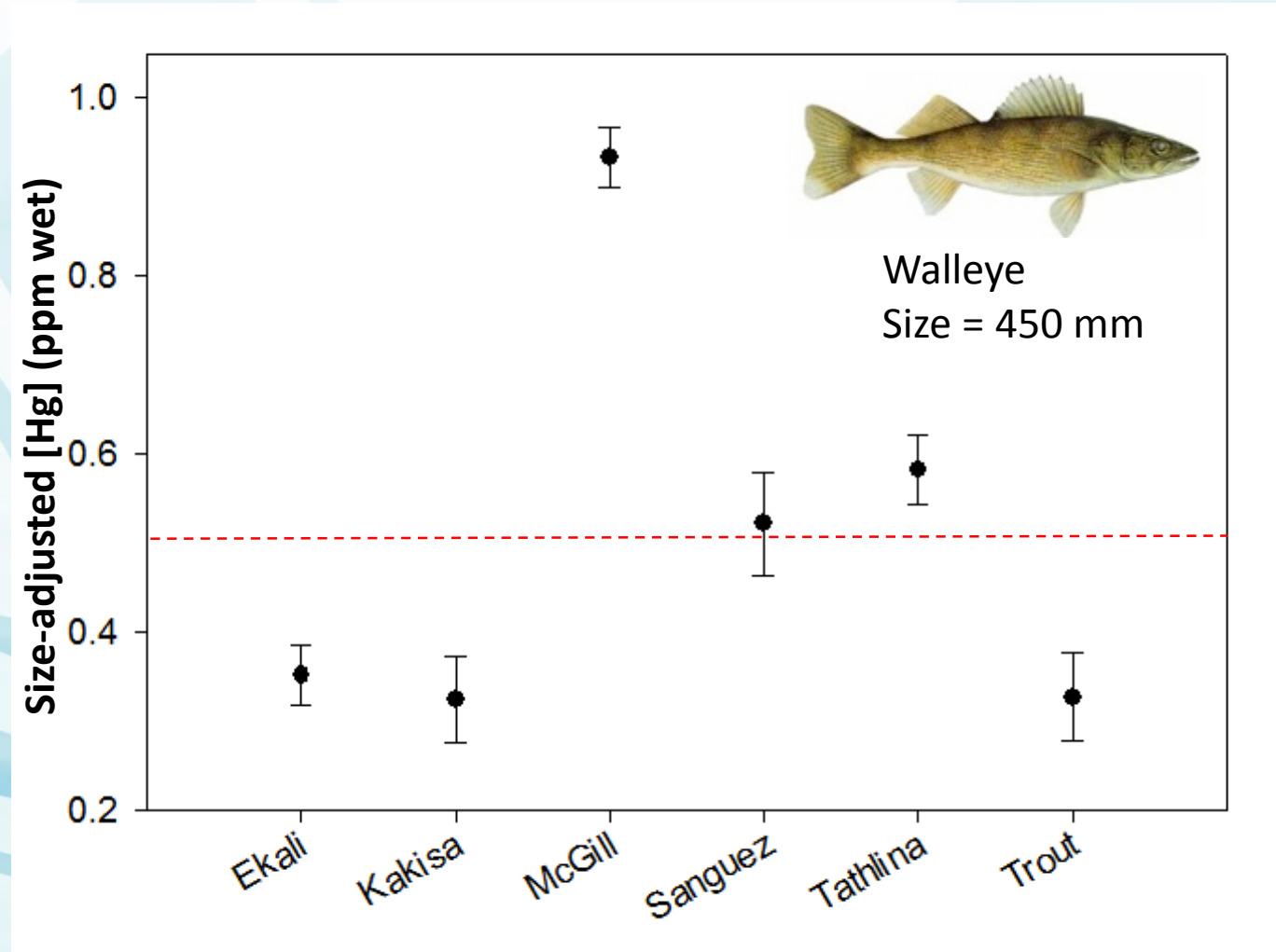




Priority 1: Fish [Hg] - Are They Safe To Eat?



Priority 1: Fish [Hg] - Are They Safe To Eat?

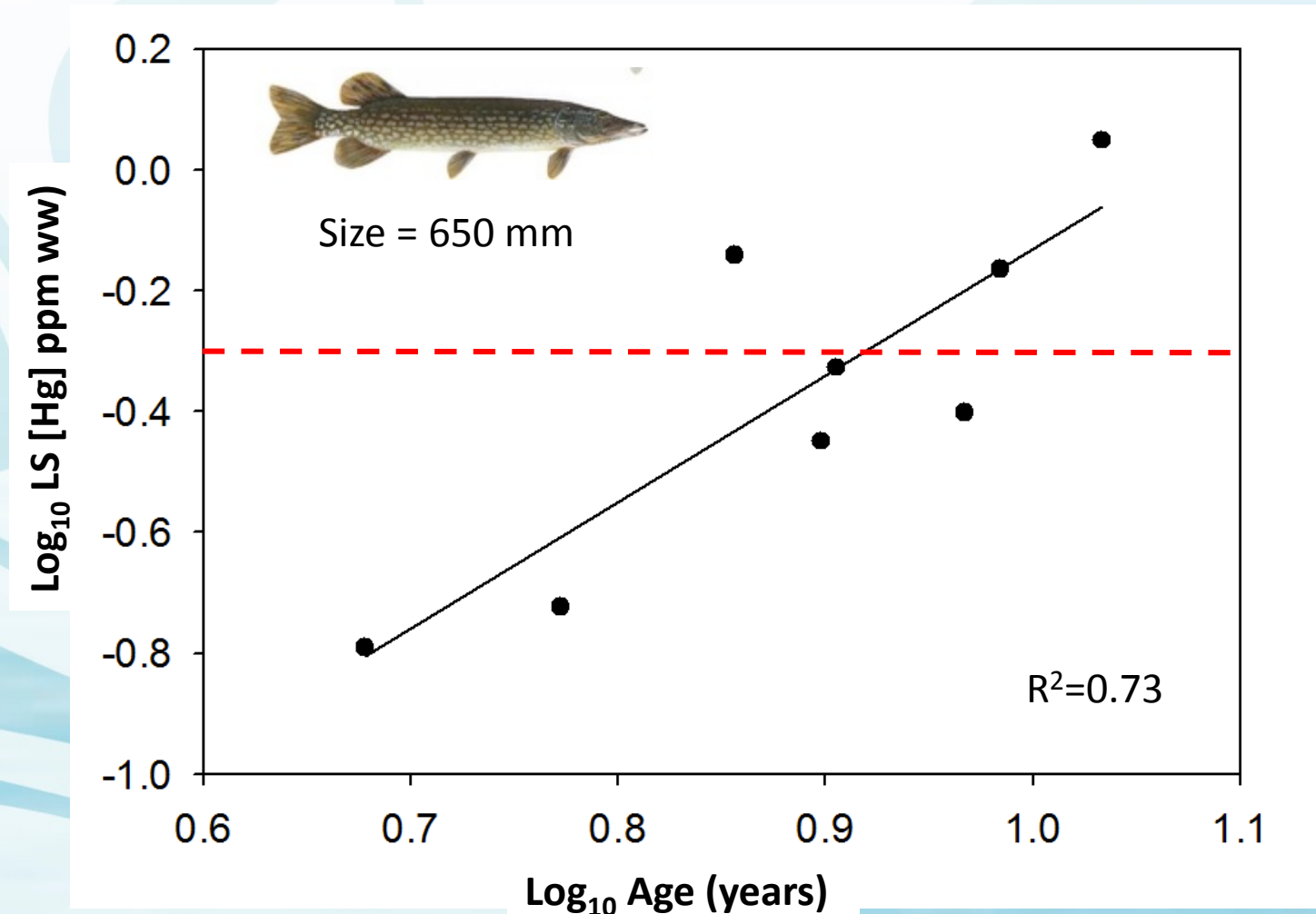


Priority 2: Why are Fish [Hg] so Different?

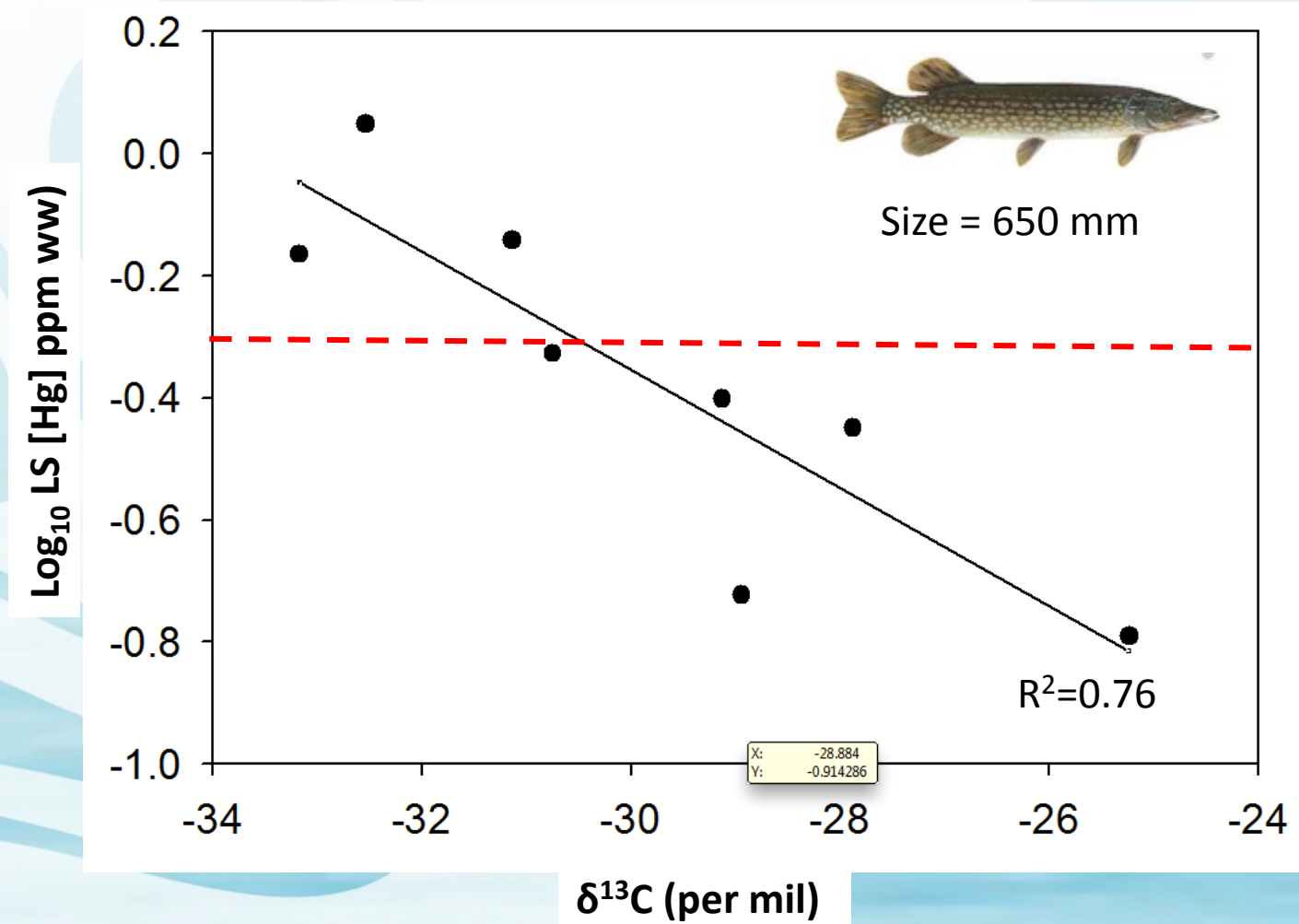
- Related size-standardized Hg to:
 - Biotic variables
 - Abiotic variables
- Related biotic variables to:
 - Catchment char's
 - Water chemistry
- Objective: variables for monitoring



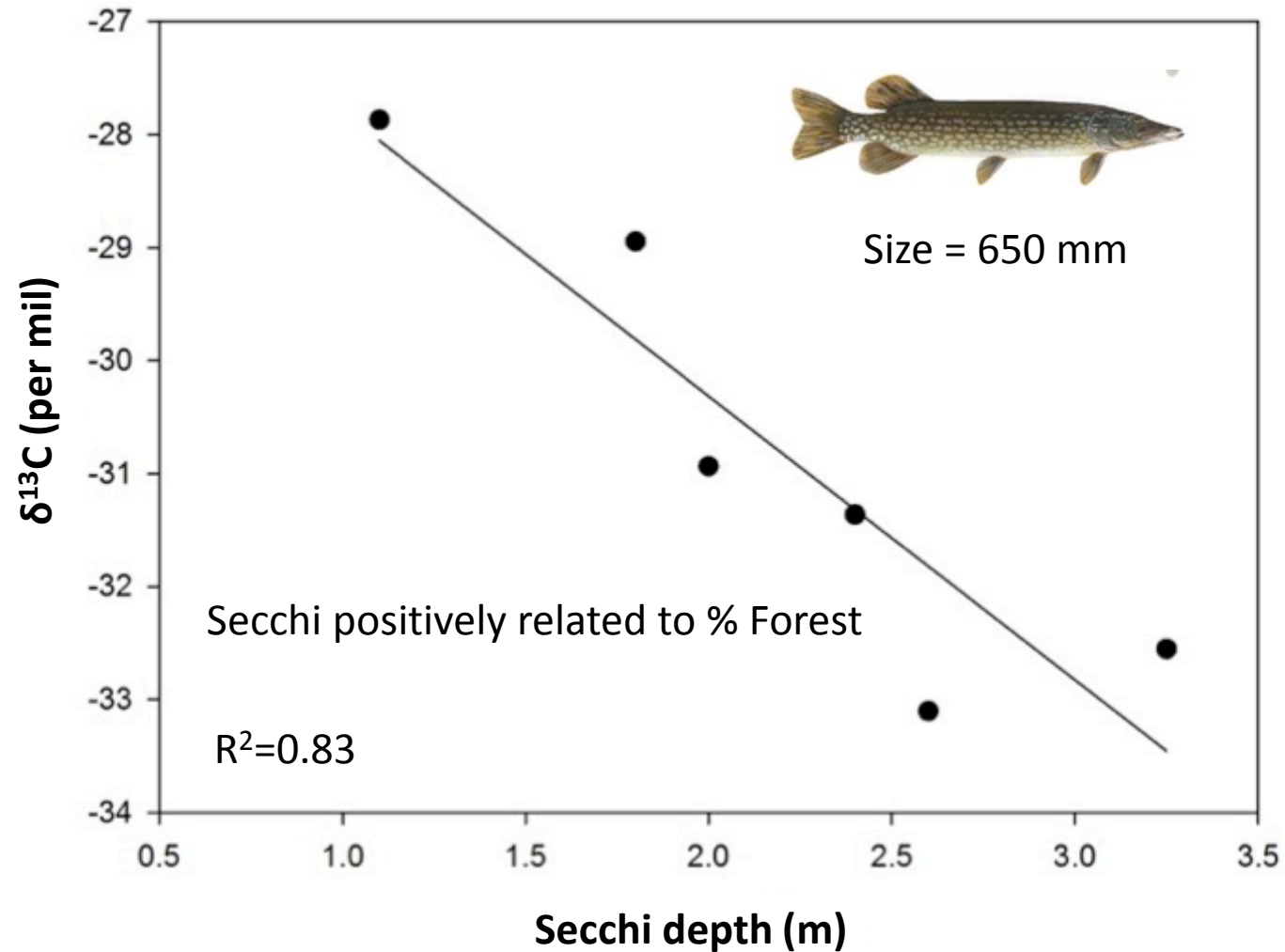
Explaining Patterns in Fish [Hg]



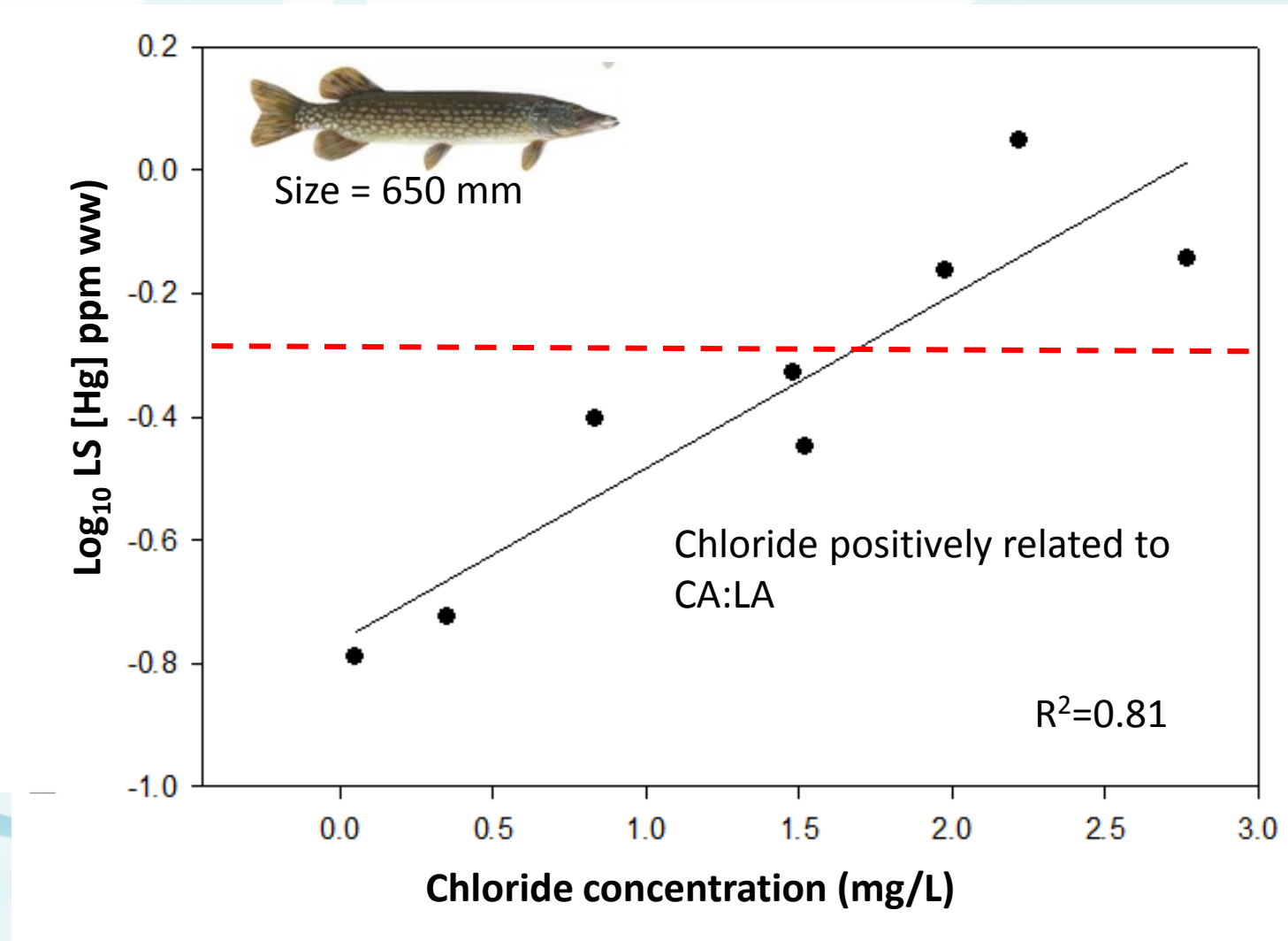
Explaining Patterns in Fish [Hg]



Explaining Patterns in Fish [Hg]



Explaining Patterns in Fish [Hg]



Summary to date

- Variation in size-standardized [Hg] among lakes explained by different variables for each species
- Northern Pike: more forest, clearer lakes, feed more offshore, grow slower, more [Hg]



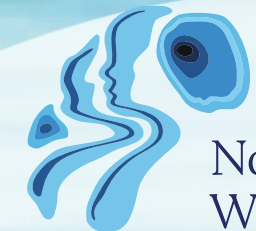
Food Security, TK, and Management

What about the benefits of eating fish?

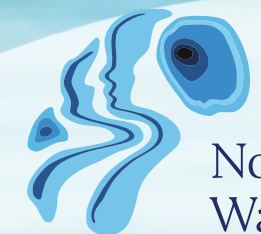
- Probabilistic risk modeling
- Understanding variation in fish nutrient: Hg ratios

Management and TK

- Fish growth could have slowed recently (still finishing age and growth analysis)
- Fish-down to reduce Hg levels – pilot project in Sanguéz Lake



Youth Engagement



Northern
Water Futures

[www.northernwaterfutures.c](http://www.northernwaterfutures.ca)
a

EKALI 2017

Mercury Concentrations in Fish



Ekali Lake is a small lake located approx. 25 km south of Jean Marie River, NT.

WHAT DID WE DO

- Lake Whitefish, Northern Pike, and Walleye were caught in Ekali Lake in 2017.
- Fish were measured, weighed, and measured for mercury content.
- Data were submitted to GNWT Health and Social Services.



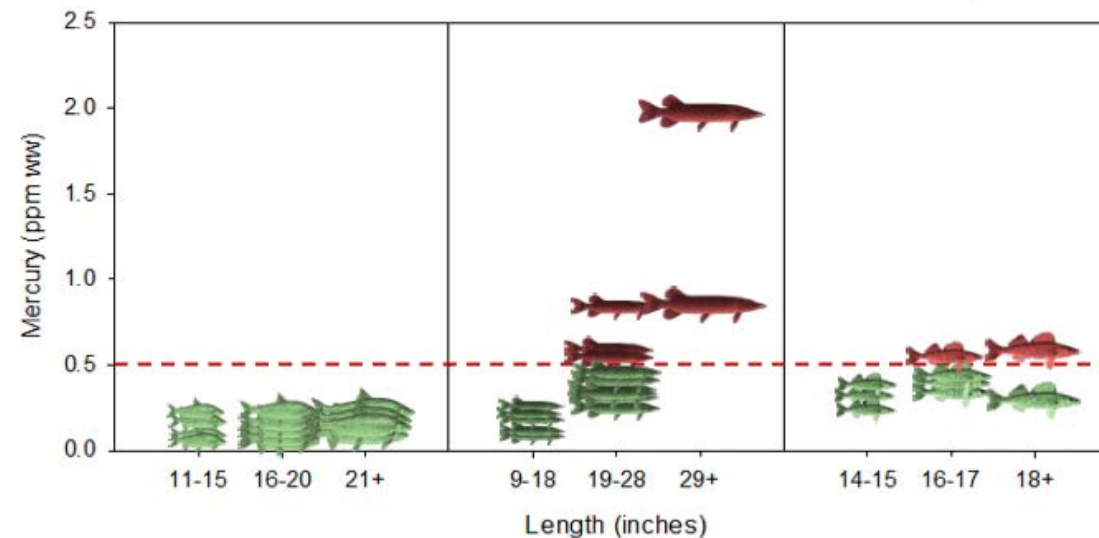
Lake Whitefish



Northern Pike



Walleye



Northern
Water Futures

Thank you!



GLOBAL WATER FUTURES
SOLUTIONS TO WATER THREATS
IN AN ERA OF GLOBAL CHANGE



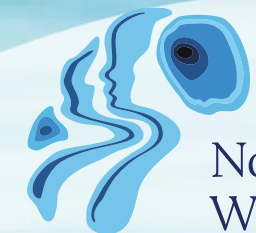
You can learn more about Northern Water Futures in lots of ways –

Email: info@northernwaterfutures.ca

Website: www.northernwaterfutures.ca

Twitter: @NWF_Research

Facebook: @NorthernWaterFutures



Northern
Water Futures

www.northernwaterfutures.ca