Nechako Roundtable

Progress Update on Large Lakes Monitoring and Sediment Core

Chelton van Geloven and Dan Selbie

Nechako Roundtable

Effort # 1 BCSRIF 2022

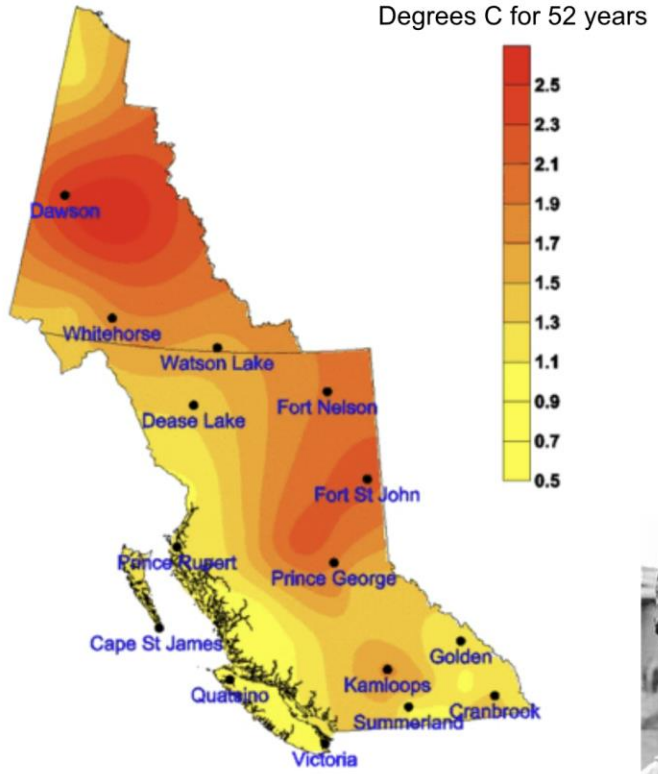
Effort #2 BCSRIF 2023

Effort #3 Collaboration with ECCC/UFFCA/NSERC

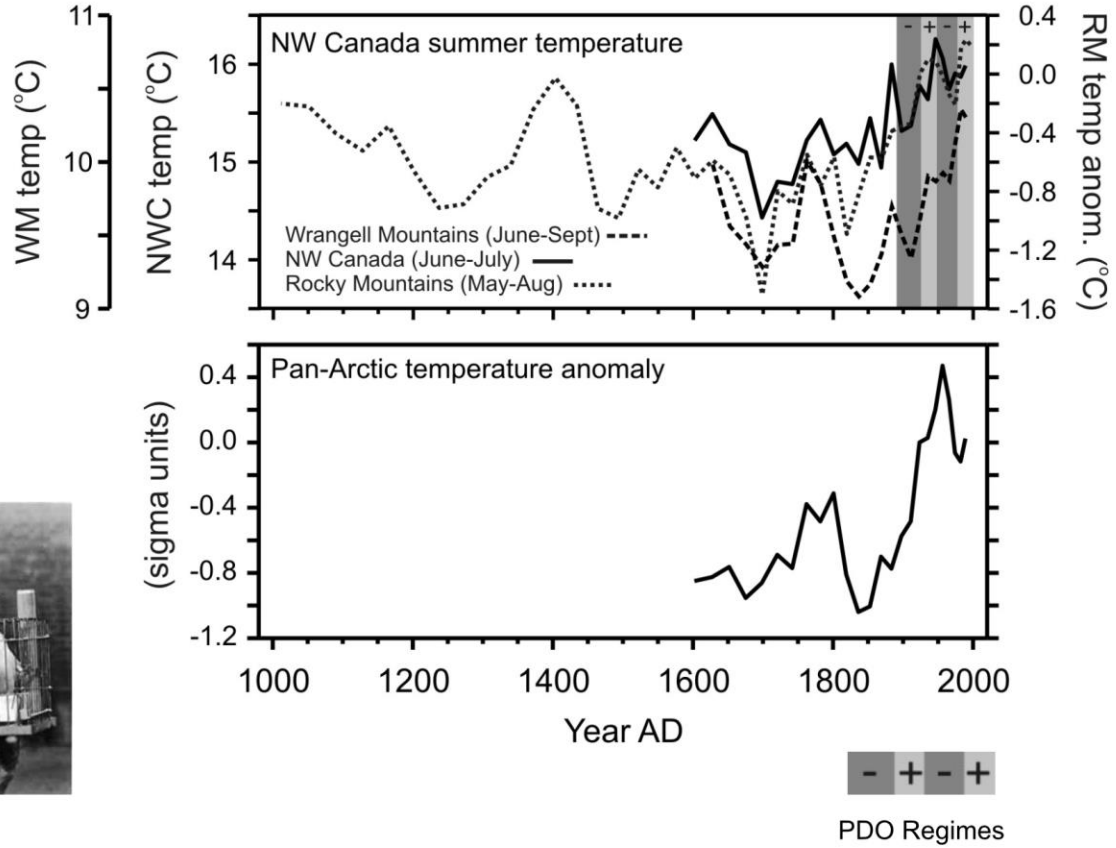
- Enough to start on Paleolimnology and build **LOCAL** monitoring capacity.
- Still need to increase the scope of monitoring

Canaries in the Coal Mine: Northern Lakes

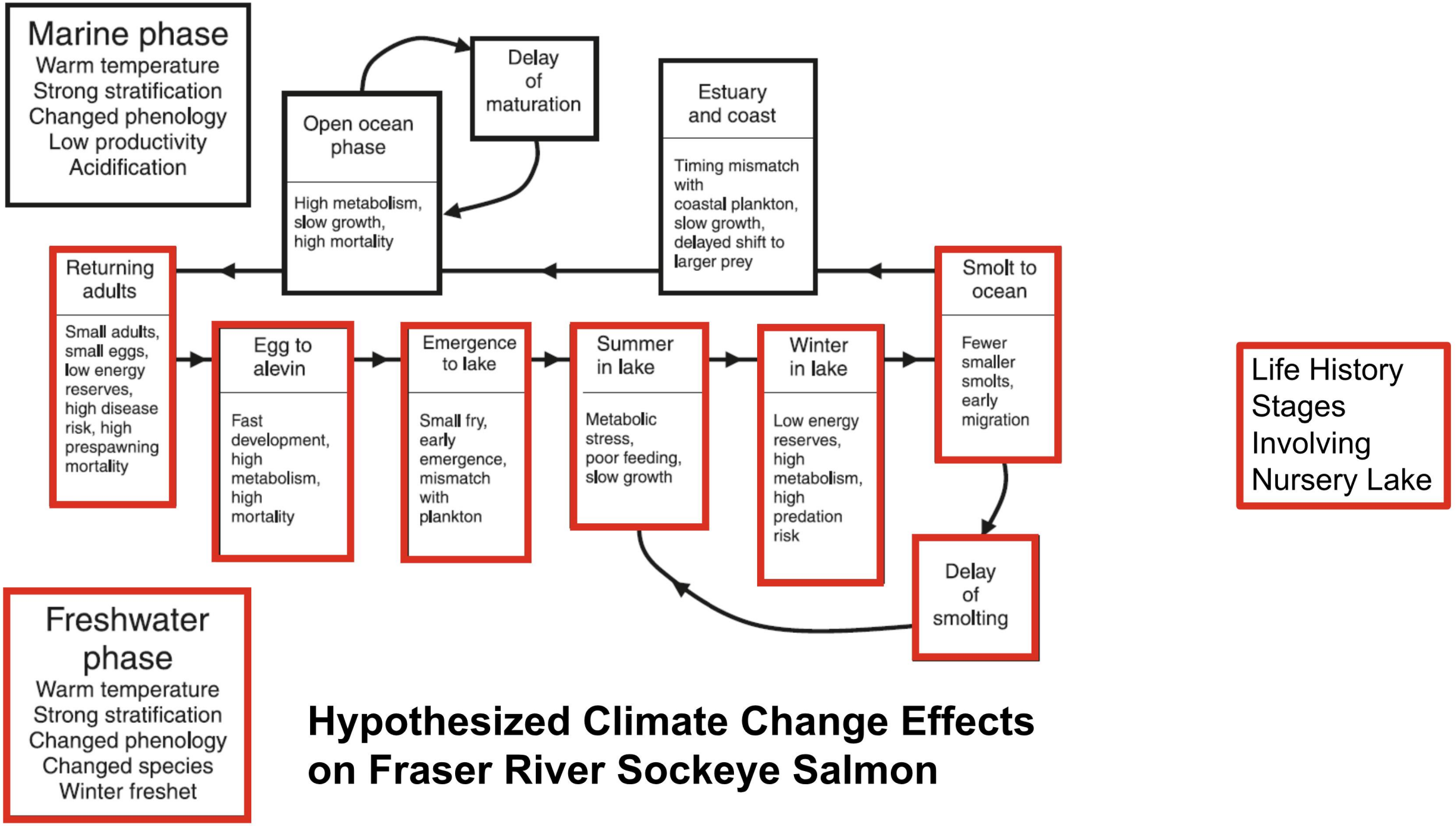
Trends in average temperatures
for BC & Yukon since 1950



Environment Canada



Selbie et al. 2011. Can. J. Fish. Aquat. Sci. 68: 675-692



Hypothesized Climate Change Effects on Fraser River Sockeye Salmon

Healey. 2011. *Can. J. Fish. Aquat. Sci. 68: 718-737*

“Lakes are Sentinels of Climate Change”

Adrian et al. 2009
Limnol. & Oceanogr. 54: 2283–2297

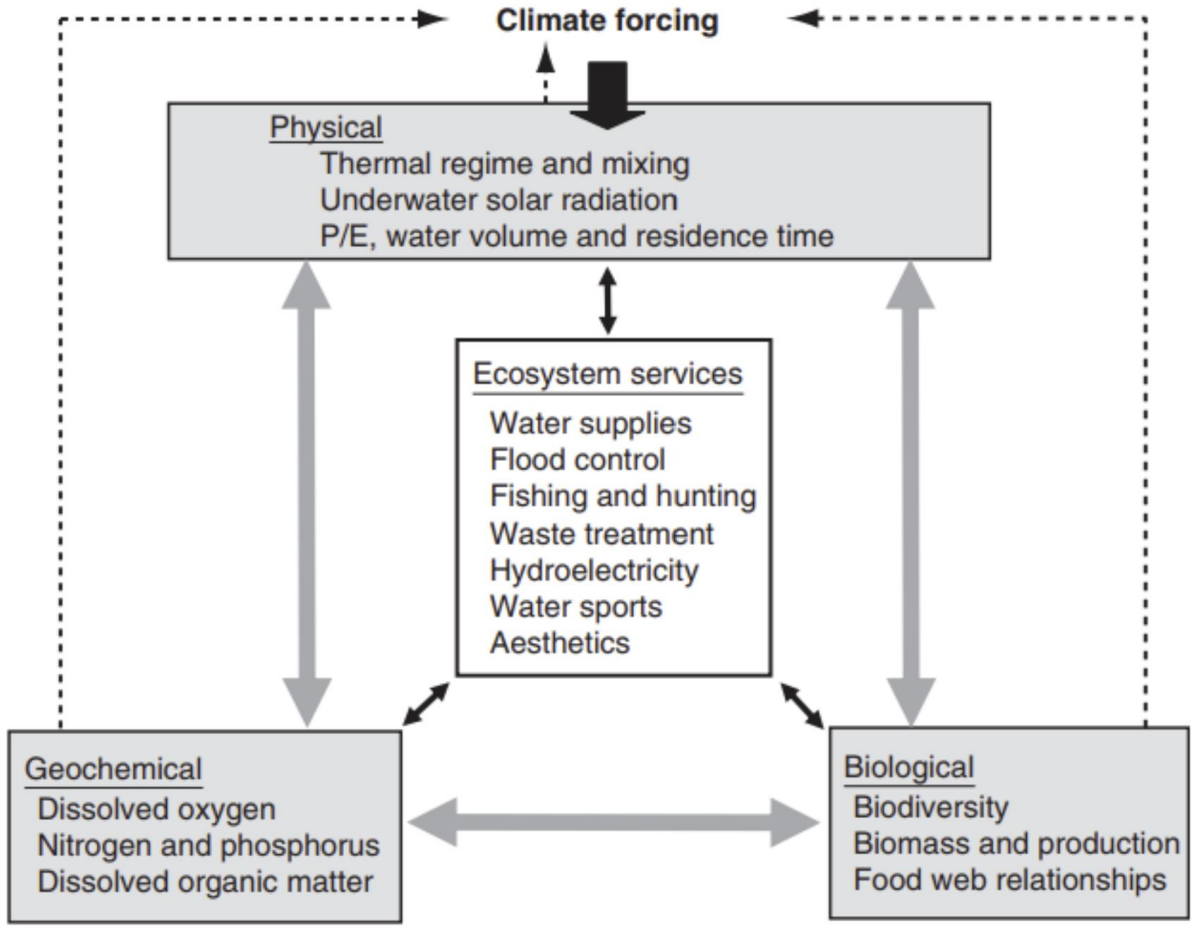
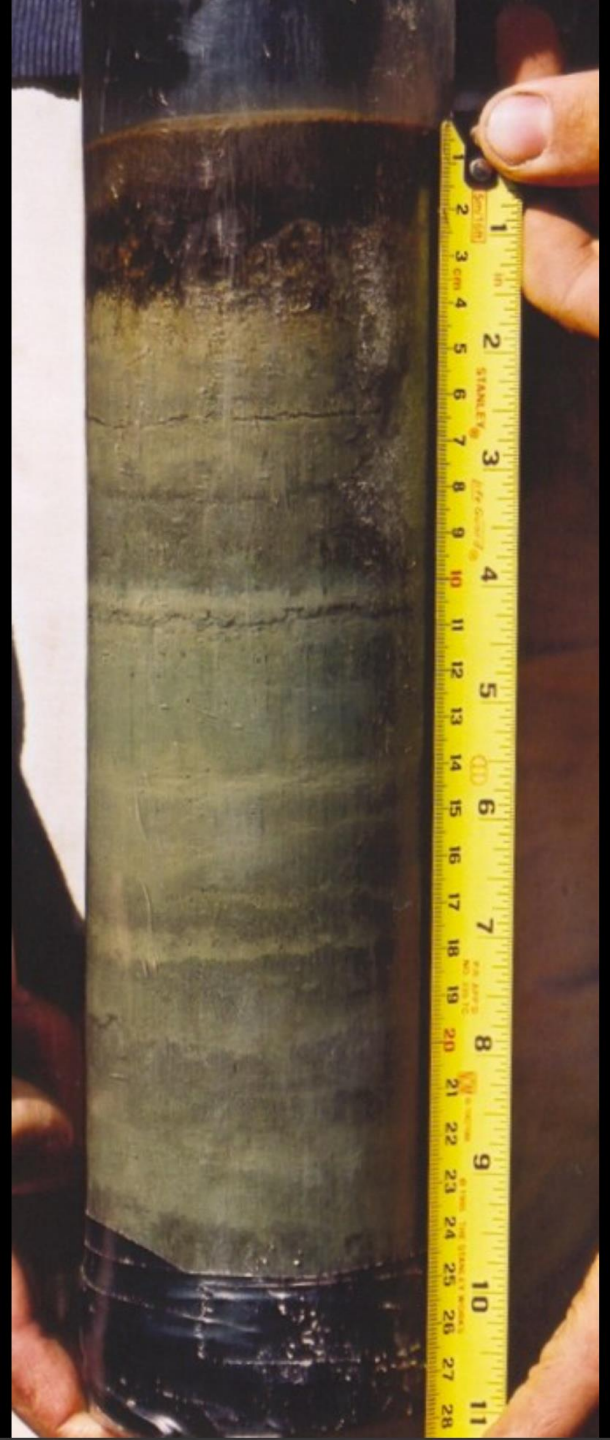


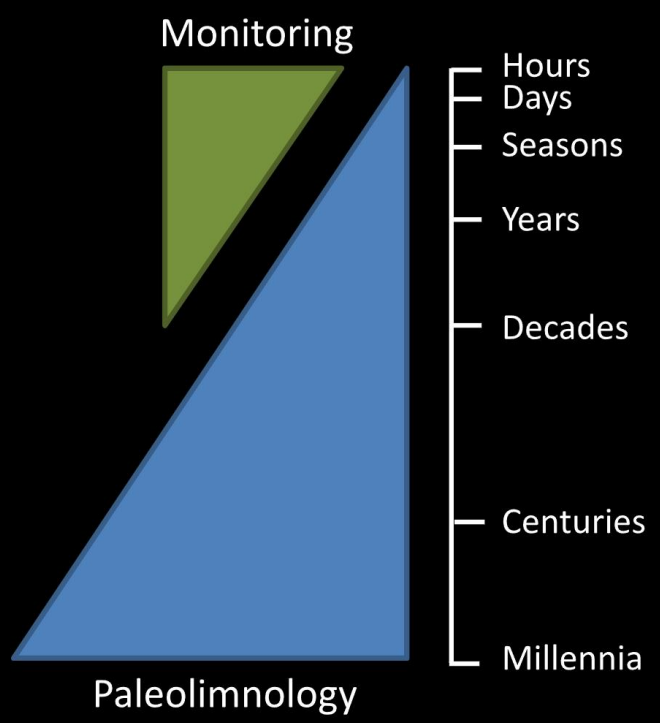
Figure 1 Changes in climate forcing affect the physical environment of lake ecosystems and thereby alter their chemical and biological properties. These changes affect the capacity of lakes to provide ecosystem services. P/E, precipitation to evaporation ratio. Dotted lines indicate positive feedback effects, e.g., via decreased ice cover or the release of greenhouse gases from lakes into the atmosphere.

Modified from Vincent 2009



Paleolimnology:

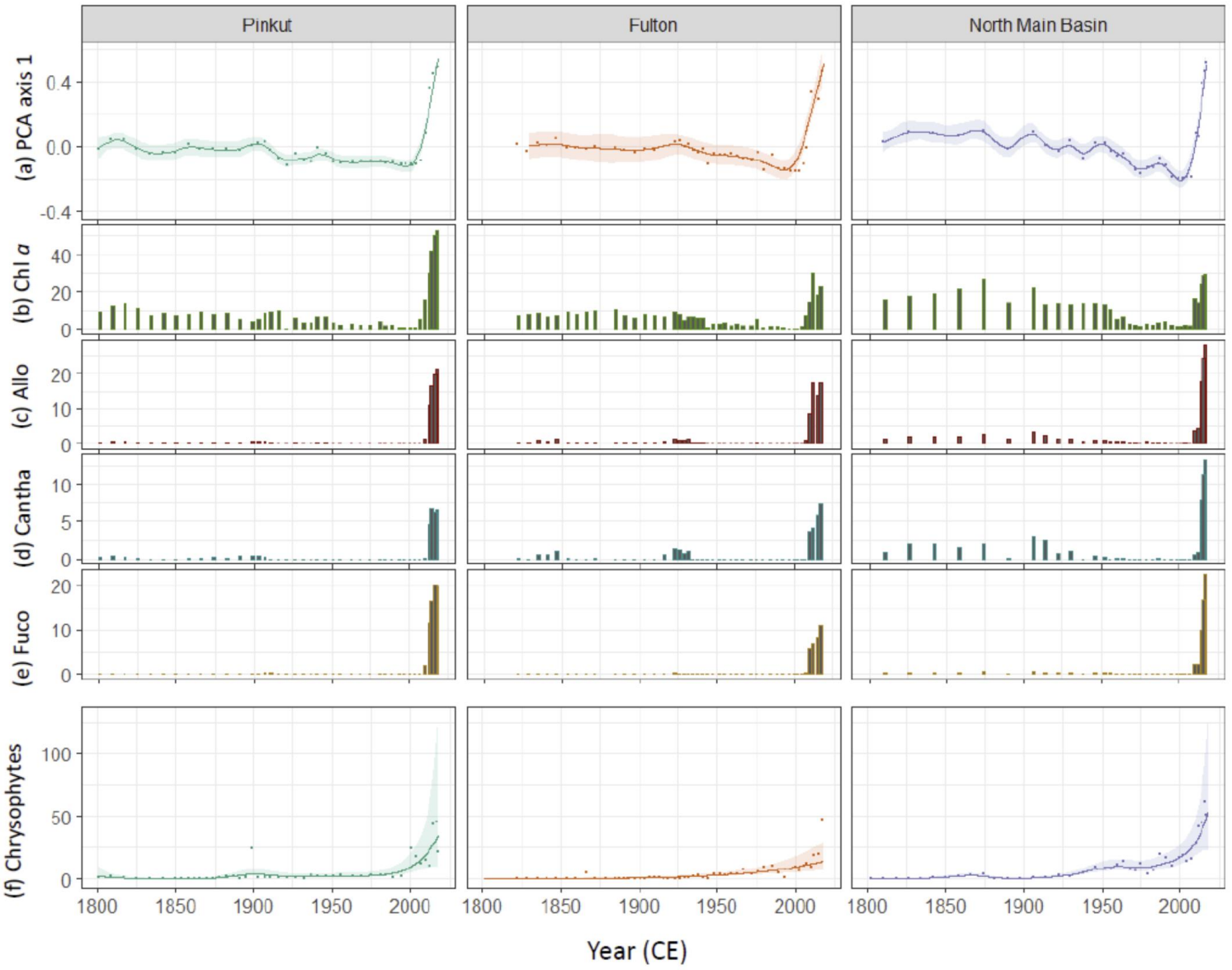
Reconstruction of lake, watershed & climatic histories using the physical, chemical, & biological information archived in lake sediments

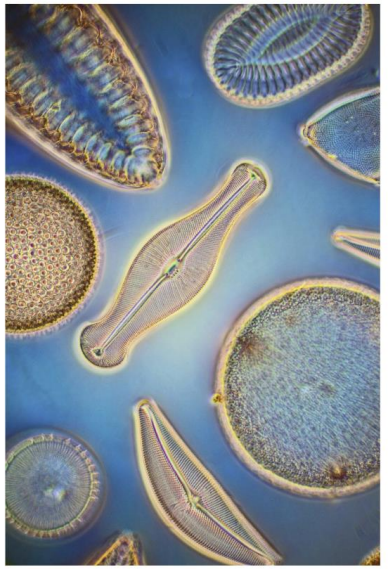


- Yields valuable data on environmental change in lakes, their watersheds, and the atmosphere
- Critical to address major environmental issues (e.g. acid rain, climate change, pollution)
- Reconstruct past Pacific salmon abundances, drivers, & FW habitat changes

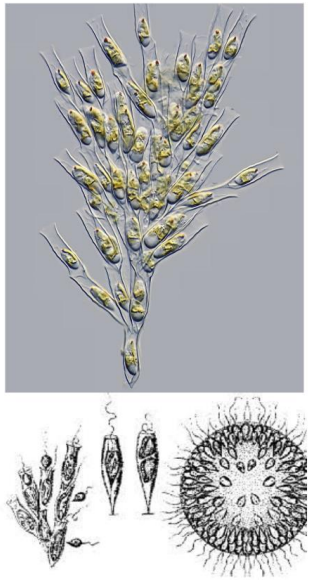
Fundamental Climate-Induced Ecological Change

Babine Lake, BC - Main Basin

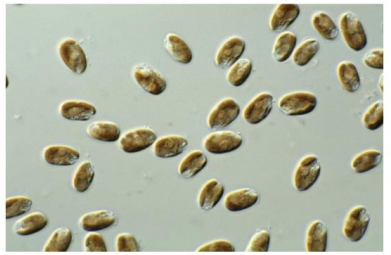


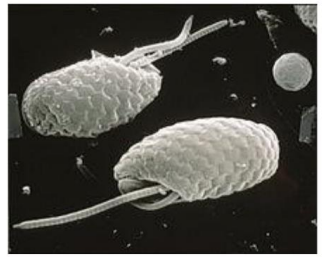


Diatoms



Chrysophytes





Cryptophytes

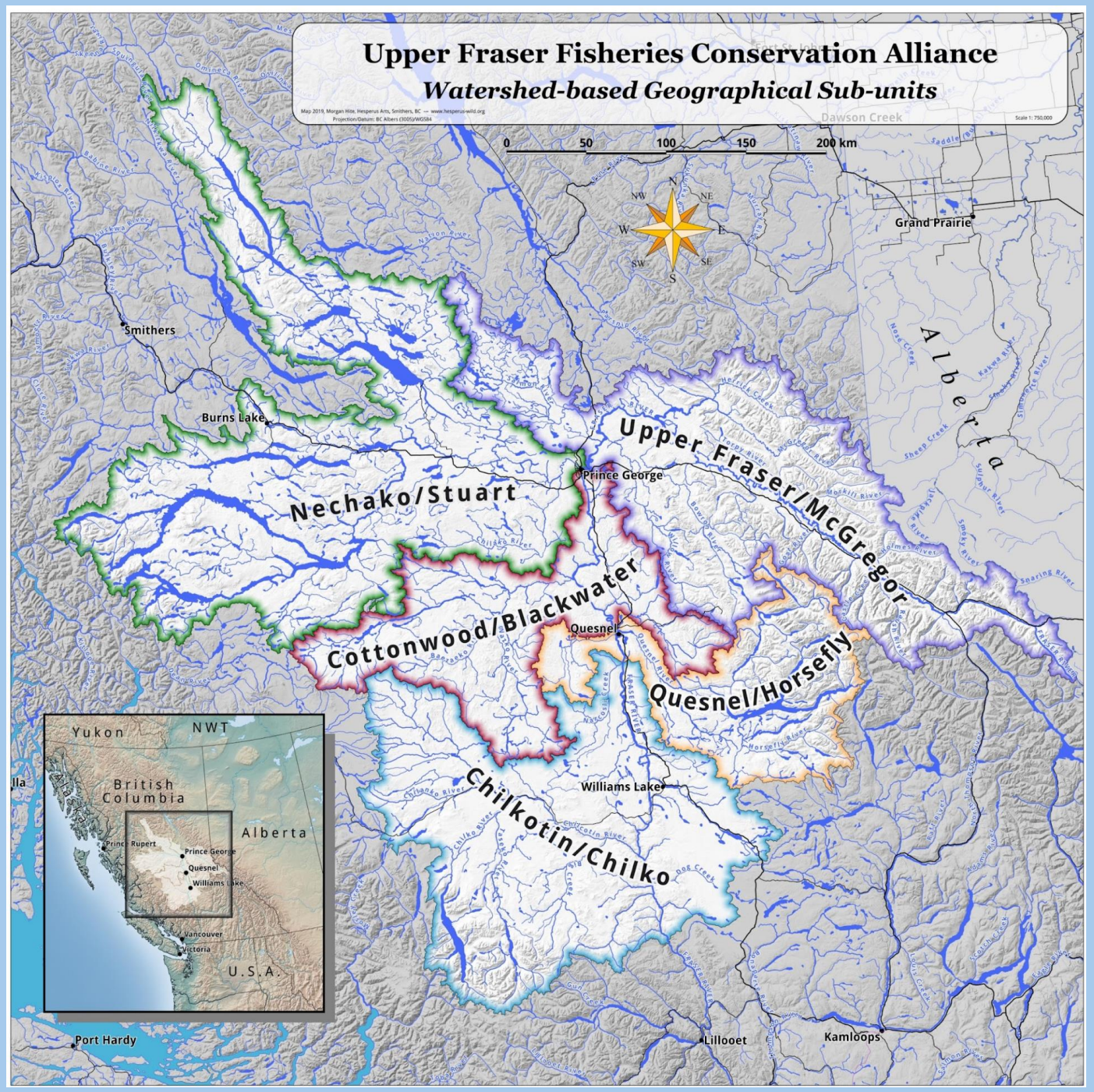
Barouillet et al. *in revision* J. Great Lakes Res.


Sockeye Creek, Babine Lake, Sept 2, 2023


Mitchell Harborne, Fulton River Project

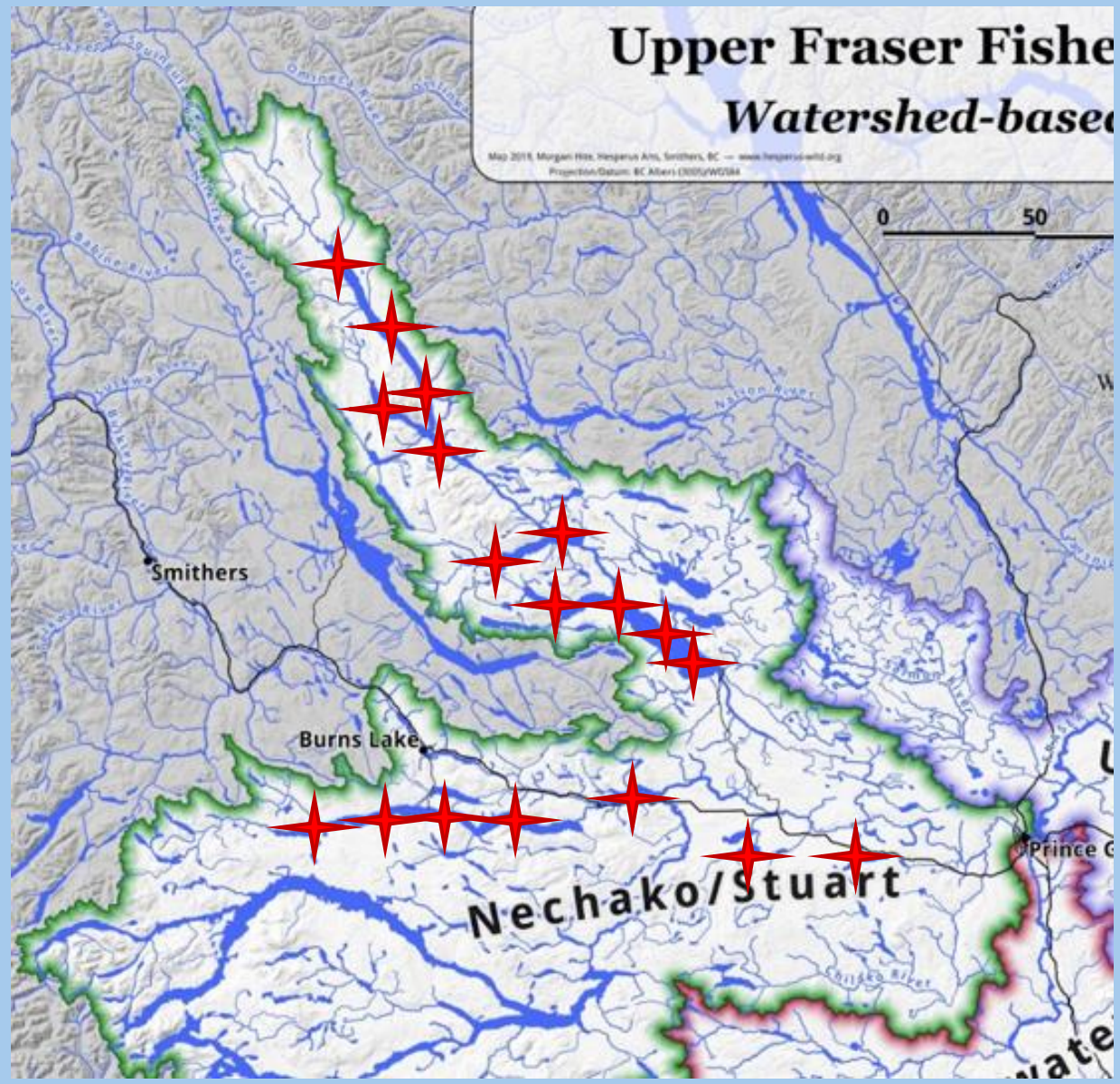
Environmental Sampling

- Water quality from shallow to deep
  - Already started in Takla and Trembleur Lakes
  - Second Set of Equipment purchased
- Moorings (continuous temperature at various depths)
- Zooplankton (what are juvenile sockeye eating)
- Paleolimnology



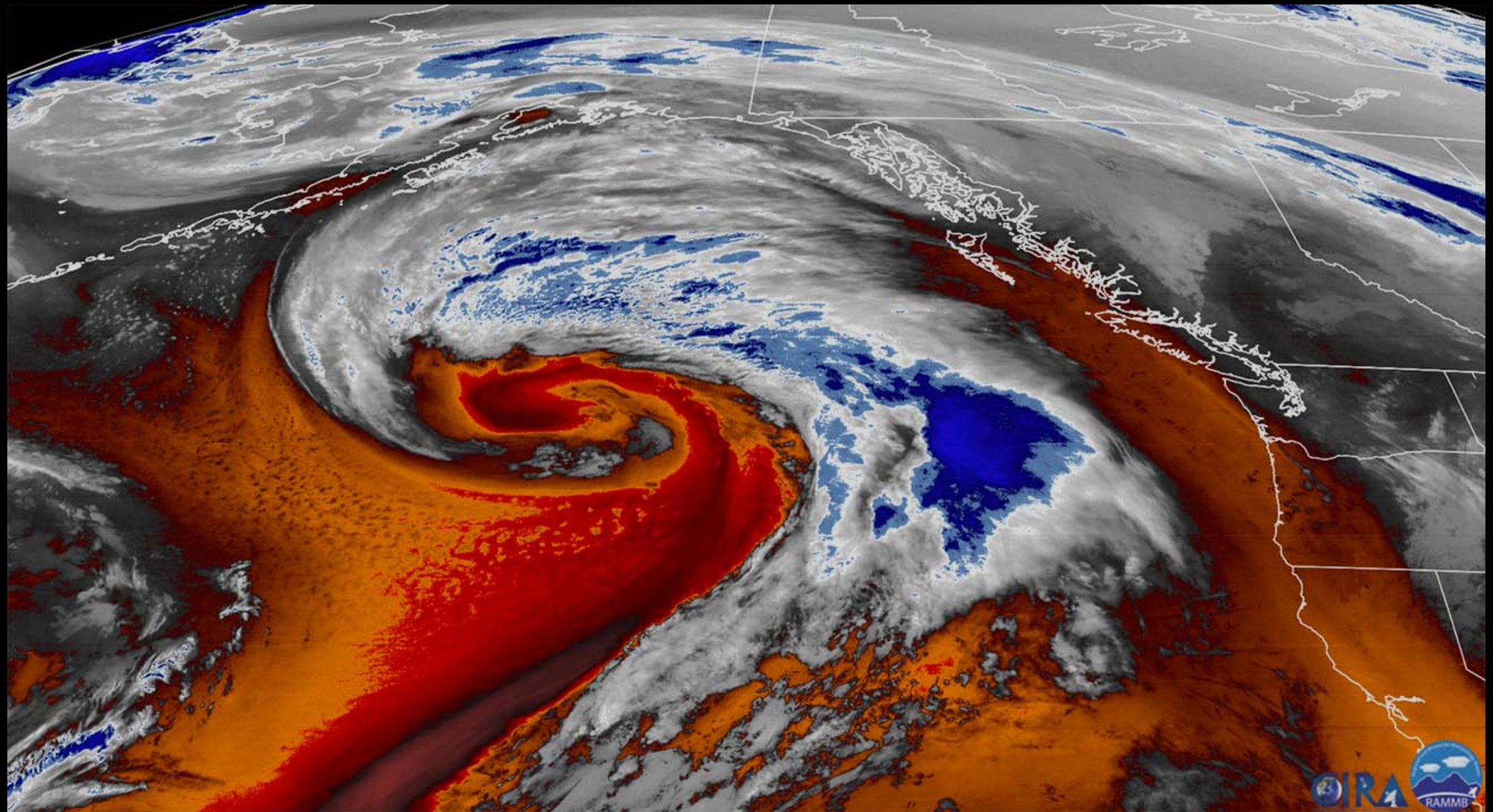
Proposed Sampling Year 1

Takla x 5
Trembleur x 2
Stuart x 4
Fraser x 2 (2023)
Bowrun x 2
Francois x 3
Finger/Tatuk x 1
Quesnel x ?
Nulki/Tachick x 1



NSERC Alliance Goal:

Establish the salmon-climate relationship at ecologically-relevant spatial & time scales



NSERC Alliance:
A New Pathway to Partnership

- **NSERC Alliance Grants**
  - Federal funding for academic-based partnered research
  - Partnership fund with defined goals
    - Generate knowledge to address complex challenges
    - Create economic, social & environmental benefits
    - Support public policy
    - Diverse perspectives & skills accelerate translation & application of research

Fraser Sockeye Salmon In Trouble

Stock	Run Timing Group	COSEWIC Listing Status
CULTUS	LATE	ENDANGERED
BOWRON	EARLY-SUMMER	ENDANGERED
HARRISON (U/S)	LATE	ENDANGERED
QUESNEL	SUMMER	ENDANGERED
SETON	LATE	ENDANGERED
TAKLA-TREMBLEUR	EARLY STUART	ENDANGERED
TAKLA-TREMBLEUR-STUART	SUMMER	ENDANGERED
TASEKO	EARLY SUMMER	ENDANGERED
NORTH BARRIERE	EARLY SUMMER	THREATENED
WIDGEON	RIVER TYPE*	THREATENED
KAMLOOPS	EARLY SUMMER	SPECIAL CONCERN
LILLOOET-HARRISON	LATE	SPECIAL CONCERN
NAHATLATCH	EARLY SUMMER	SPECIAL CONCERN
FRASER-FRANCOIS	SUMMER	SPECIAL CONCERN
HARRISON (D/S)	LATE	SPECIAL CONCERN
NADINA-FRANCOIS	SUMMER	NOT AT RISK
CHILLIWACK	EARLY SUMMER	NOT AT RISK
SHUSWAP COMPLEX	EARLY SUMMER	NOT AT RISK
ANDERSON-SETON	EARLY SUMMER	NOT AT RISK
PITT	EARLY SUMMER	NOT AT RISK
HARRISON RIVER	RIVER TYPE*	NOT AT RISK
CHILKO	EARLY SUMMER	NOT AT RISK
CHILKO	SUMMER	NOT AT RISK

Academic Partners

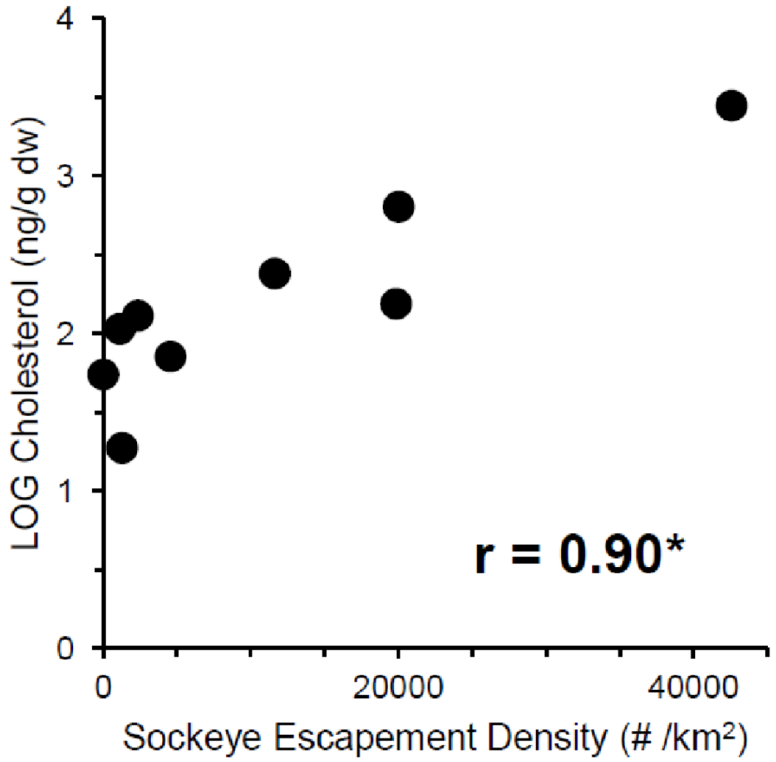
Jules M. Blais, PhD
Professor,
Department of Biology, University of Ottawa

Editor in Chief, *FACETS*

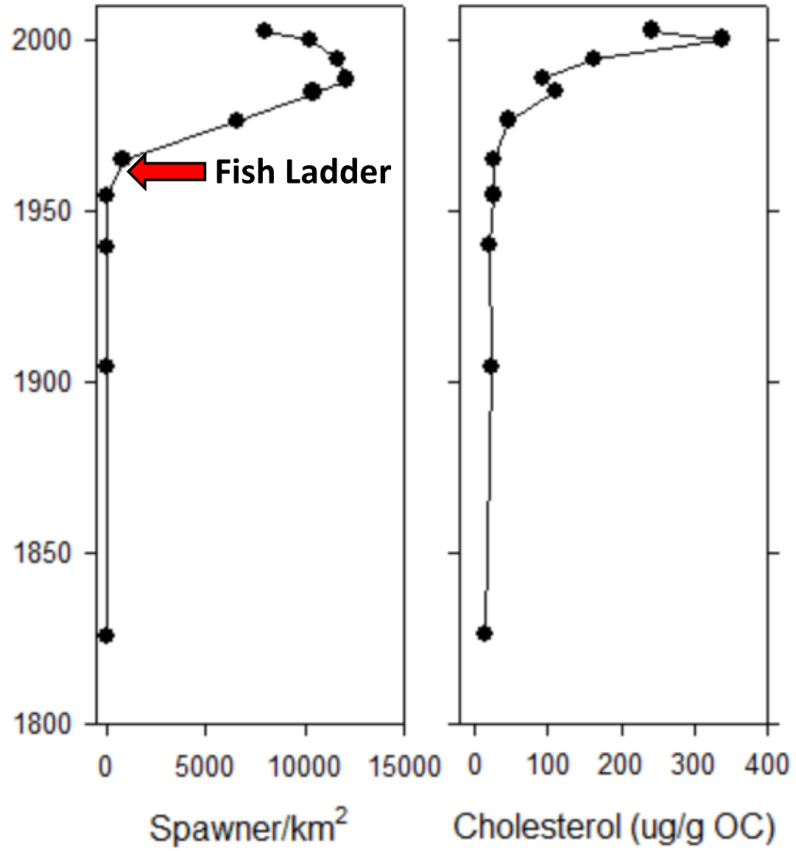
John P. Smol, OC, PhD, FRSC, FRS
Distinguished University Professor &
Canada Research Chair in Environmental Change
Department of Biology, Queen's University

President, Academy of Science, Royal Society of Canada
Editor, *Environmental Reviews*

NSERC Alliance Goal:
Development & Application of a New Paleo-Salmon Indicator



Sockeye Nursery Lake
Surface Sediments

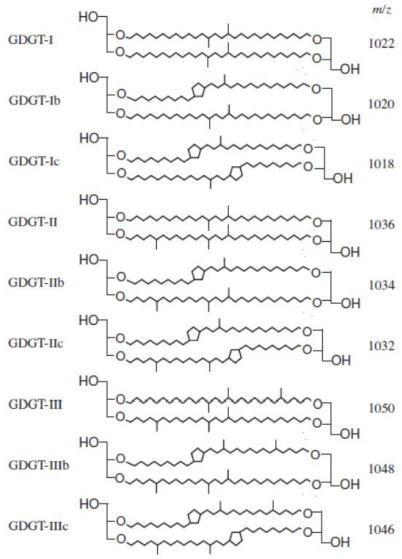


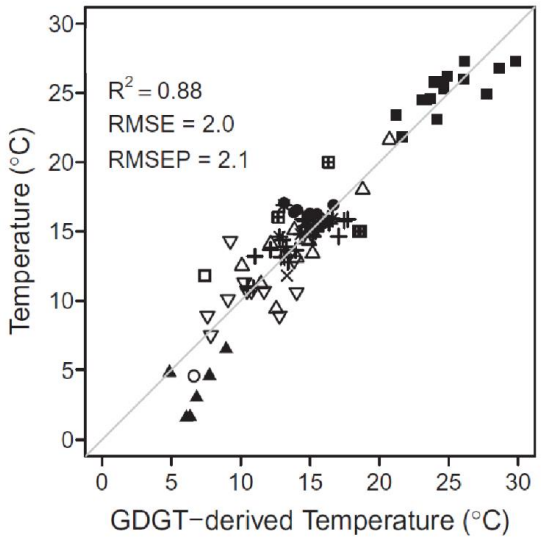
Downcore Application
Frazer Lake, AK

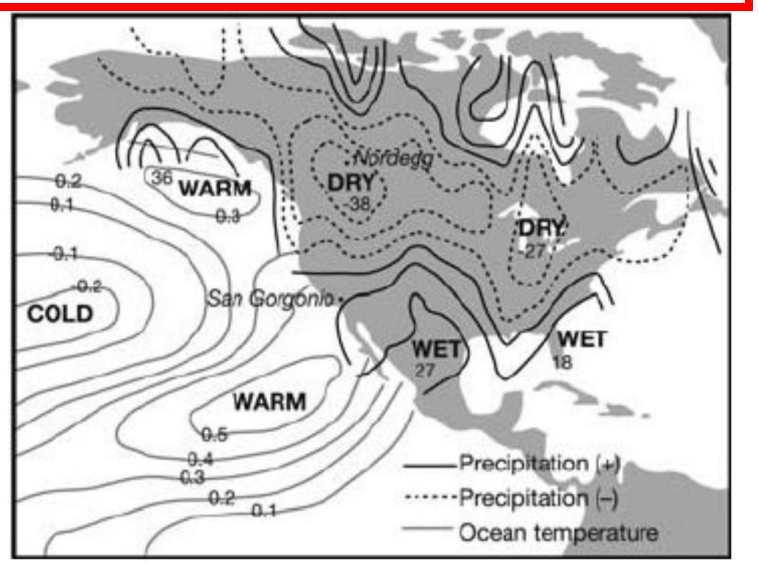
Sedimentary salmon-derived sterols show promising application in salmon reconstruction

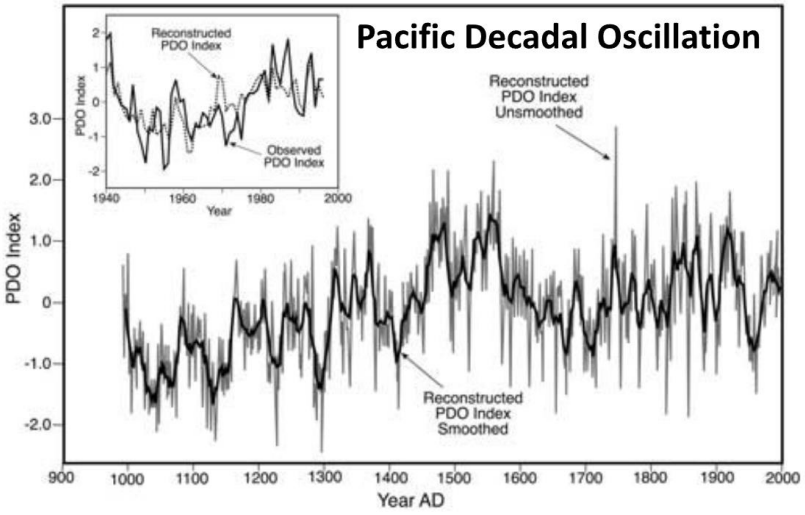
NSERC Alliance Goal:
Calibration & Application of a New FW Paleo-thermometer

Glycerol Dialkyl Glycerol Tetraethers (GDGT's)









- Molecules in membranes of bacteria & archaea
- Molecular branching α temperature
- Calibration yields accurate & precise paleo-thermometer applicable across nursery lakes
- Reconstruct major climate variations in relation to salmon production around North Pacific (e.g. ENSO, PDO)

Pearson et al. 2011. *Geochim. Cosmochim. Acta*. 75: 6225-6238

MacDonald & Case. 2005. *Geophys. Res. Lett.* 32: L08703

Where can enhanced monitoring Knowledge Lead?

Traditional Knowledge

- How can proposed monitoring complement existing knowledge and Experience

Tools

- Lake Fertilization
- Engineering solutions (coldwater releases)

What is affecting Fish

- Nutrient availability was proven to be significant in the Babine River

Habitat Restoration

- Work on impaired streams
- Partner with Beaver

Hatchery Production

- Advanced conservation and Cultural/food security fisheries

Working Together