Innovations I: Using Sediment Core Analyses to Attempt to Quantify the Historical Impact of Spawning Alewife

G. S. Nau  
*Acadia University*

N. McLellan  
*Ducks Unlimited Canada*

M. Mallory  
*Acadia University*

I. Spooner  
*Acadia University*

M.J.W. Stokesbury  
*Acadia University*

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Nau, G.S.\textsuperscript{a}, McLellan, N.\textsuperscript{b}, Mallory, M.\textsuperscript{a}, Spooner, I.\textsuperscript{a}, Stokesbury, M.J.W.\textsuperscript{a}

\textsuperscript{a} Biology Department, Acadia University, Wolfville, Nova Scotia, Canada, B4P 2R6
\textsuperscript{b} Ducks Unlimited Canada, Atlantic Region Office, Amherst, Nova Scotia, B4H 3Z5
Dams, Fishways and Fish

• Anadromous fish transport marine derived nutrients (MDN) into freshwater
• Provide obstacles for anadromous fish migration
  – Limit input of MDN
• Historical records of fish abundance can be severely lacking.
• Dams and fishways are too often unstudied, and impacts on freshwater productivity and fish migration are unknown.
Detecting a Historical Marine Signal

• Lake history in sediment
  – Record of historical lake ecosystems
  – Spawning grounds
• Is there an abiotic proxy for anadromous fish presence?
• Has the installation of dams, fishways and tidegates affected productivity?
  – Can a change in productivity be attributed to altered fish migration?
Study Sites: Cumberland Marsh Region, Nova Scotia and New Brunswick, Canada
Gaspereau River System, Nova Scotia, Canada
Study Sites

• Hackmatack Lake, Cumberland Marshes
  – Heavily modified, very little records
• Round Lake, Cumberland Marshes
  – Relatively undisturbed, very little records
• Gaspereau Lake, Gaspereau Valley
  – Heavily modified, well recorded, deep history
Sediment Coring

• Nova Scotia:
  – Round Lake
  – Gaspereau Lake
• New Brunswick:
  – Hackmatack Lake
  – Silver Lake
• Maine, USA:
  – Togus Pond
Sediment Cores

XRF:
- Dating: Pb
- Input of trace metals

Stable Isotopes:
- $\delta C + \delta N$
- Productivity
- $\delta S$: Marine influence

Recent couple of decades, mixed organic
- Older, many decades
- Much older, 100-200+ years, possibly pre-tide gate

Age increases with depth
Fish blending and analysis

• Whole alewife blended; subsample dried and analyzed
  – ICP-MS, SIA(δC + δN + δS)

• Results of fish analyses will help in identifying abiotic proxy, as well as in estimating historical nutrient inputs by fishes.
  – Can be compared to current knowledge of fish passage and population
Future steps

• Process results of SIA
  – Productivity changes
  – Marine signal

• Process and analyze Gaspereau Lake core
  – Identification of abiotic proxy for anadromous fish
Implications

• Dam and tide gate effects
  – Freshwater productivity
  – Fish access to spawning habitat

• Reliable assessment of historical anadromous fish abundance
  – Can be adapted for use in lakes in other regions and for different species.
Challenges (so far)

• Lack of historical records
  – Modifications and disturbance
  – Fish abundance

• Lack of controls
  – Pervasiveness of dams and fishways in maritime provinces
  – Unique habitat

• Time and resources
  – Limited in number of cores per lake
  – Limited in resolution
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Questions?
Comments?
Suggestions?
georgenau@acadiau.ca