



**NSERC
CRSNG**



University
of Windsor

Linking Regime Shifts to Carbon Dynamics in Lake Erie

A new NSERC-Strategic Project
(2013-16)



Environment
Canada



Fisheries and Oceans
Canada



Ontario

Ministry of the Environment

The team

| Co-Applicants | Affiliation | Role |
|--------------------------------------|---|---|
| Dr. M.A. Xenopoulos | Biology, Trent University | Project coordination (PI); Carbon balance, Biogeochemistry |
| Dr. Paul Frost | | Food web stoichiometry; zooplankton |
| Dr. Doug Haffner | GLIER, University of Windsor | Primary production/contaminant transfer |
| Collaborators | Affiliation | Role |
| Dr. Chris Marvin Dr. Susan Watson | Environment Canada* | Sediments/Contaminants Cyanobacteria, primary production, limnology |
| Dr. Marten Koops | Fisheries and Oceans Canada* | Invasion ecology, modeling |
| Dr. Todd Howell | Ontario Ministry of the Environment* | Benthic-Pelagic coupling |
| Dr. James Larson | U.S. Geological Survey (USA) | Lake-Rivers interaction (USA link) |
| Dr. Michael Twiss | Clarkson University (USA) | Winter limnology and primary productivity of Lake Erie (USA link) |

*supporting organization

Objectives

To determine the current carbon and material pathways in the foodwebs of Lake Erie.

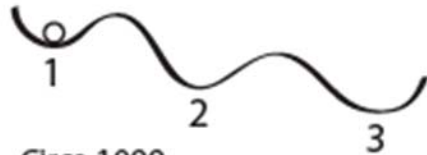
- short-term objectives:
 - 1) sample foodwebs and determine primary energy pathways and transfer efficiencies
 - 2) couple these data on foodwebs to lake metabolism measurements
 - 3) quantify contemporary surface CO_2 emissions and carbon burial rates measurements from the past.
- long-term objectives:
 - 1) construct a whole-lake carbon mass balance of Lake Erie to use in future management plans
 - 2) join regime shift projections with our current carbon cycling and foodweb data to better understand contaminant movement and trophic transfer
 - 3) develop a framework for understanding regime shifts in large aquatic systems that can be applied to other large Canadian lakes (e.g., Lake Winnipeg) or coastal waters experiencing regime shifts.

Construct a carbon balance

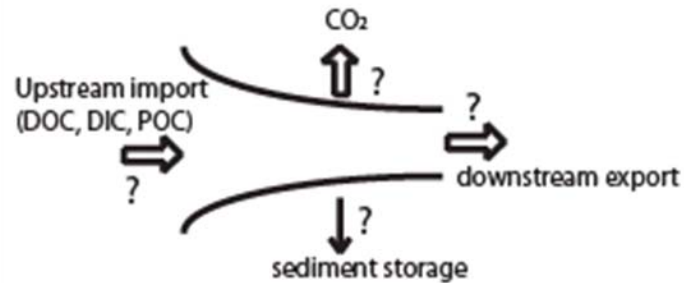
Focus on carbon: why?

- Carbon = energy
- A relatively understudied element for Lake Erie
- Carbon balance: WHERE is the carbon coming from, where is it going?
- How does it relate to N and P
- Linkages with contaminants
- YES- IT is an impossible task but preliminary numbers are needed

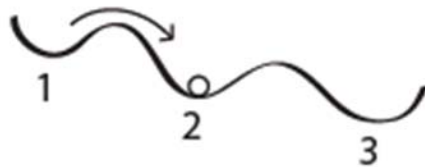
1. Pre-impact regime



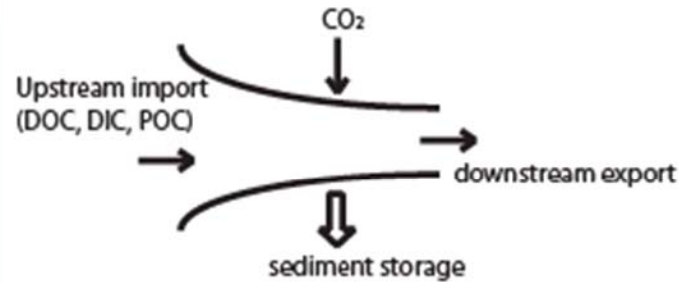
- Circa 1900
- Clear-water conditions
- Low nutrient concentrations



2. Phytoplankton (offshore turbid)



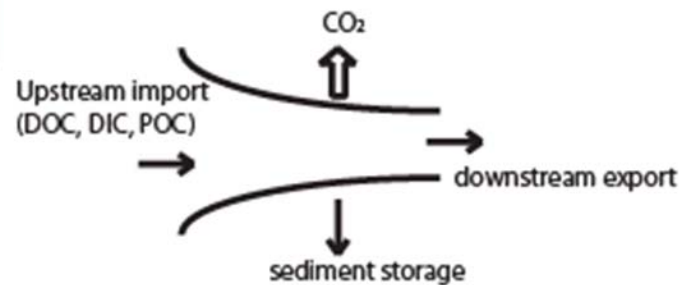
- ~1950 to 1980
- High nutrient concentrations
- Phytoplankton dominance
- Reduced C loading



3. Benthification (offshore clear)



- 1990 to present
- Relatively high nutrients
- Invasive mussels
- Nearshore shunt



WHY
REGIME
SHIFTS?

Immediate opportunities

- PDF position
- Four graduate positions (1 MSc, 3 PhD)



Graduate Positions

Aquatic Ecosystems- Carbon Budget – Lake Erie

We are seeking highly motivated graduate students to participate in a NSERC-funded strategic grant **linking regime shifts to carbon dynamics in Lake Erie**. Three graduate positions will be based at Trent University in Peterborough, ON, Canada as part of the Environmental and Life Sciences Graduate Program (<http://www.trentu.ca/els>). One graduate position will be based at the University of Windsor, Windsor, ON, Canada as part of the Environmental Science Graduate Program (<http://www1.uwindsor.ca/glier/>). This is a collaborative and interdisciplinary project and interested candidates should have a background in one or several of the fields of ecology, limnology, environmental science, biogeochemistry, analytical chemistry or environmental chemistry. Candidates should be able to work as a member of a large interdisciplinary team and be willing to conduct research in both the field and laboratory. The projects will be highly integrated and will include:

Carbon balance, nutrients and biogeochemistry

Food web stoichiometry, zooplankton

Primary production and contaminant transfer

Positions would ideally begin between Jan 1, 2014 and May 1, 2014. The graduate positions are intended to be funded at the Ph.D. level but we will consider exceptional Master's students. For consideration, please send to one of the contacts below by e-mail: a letter of interest, a statement of interests, unofficial transcripts, a c.v. and the contact information for references.

Contacts:

- Dr. Marguerite Xenopoulos (m Xenopoulos@trentu.ca), Department of Biology, Trent University
- Dr. Paul Frost (paulfrost@trentu.ca), Department of Biology, Trent University
- Dr. Doug Haffner (haffner@uwindsor.ca) Great Lakes Institute of Environmental Resources, University of Windsor

Postdoctoral Position in Limnology and Ecosystem Ecology: Linking Regime Shifts to Carbon Dynamics in Lake Erie

Applications are now being accepted for a postdoctoral position to participate in a multidisciplinary and highly collaborative project funded by NSERC's Strategic Grant Program. The position will be based in the Department of Biology, Trent University, Peterborough, Ontario, Canada. The primary objectives of the research are to determine the current carbon and material pathways in the foodwebs of Lake Erie and quantify current and contemporary carbon emission and burial rates.

The candidate must have experience in and an excellent understanding of aquatic ecology as demonstrated by a good publication record in international journals. Strong leadership skills are also required as the postdoctoral fellow will be expected to provide some guidance and assistance to junior members of the project as well as some aspects of project coordination with collaborators and supporting organizations. A PhD in ecology, limnology, environmental chemistry and/or environmental sciences is required.

The position is available for a total of 3 years. The initial appointment will be for 1 year with the possibility for renewal depending on performance. Preferred start date is before January 1st 2014 or soon thereafter.

To apply, send a cover letter, curriculum vitae, examples of publications, and the names of three academic references to the address below (e-mail is preferred). Review of applications will begin on November 5, 2013 and will continue until position is filled.

Contact: Dr. Marguerite A. Xenopoulos, Trent University, Department of Biology, Peterborough, ON, Canada K9J 7B8 [m Xenopoulos@trentu.ca]
For more information visit: <http://people.trentu.ca/m Xenopoulos>

Isolating factors can get us in trouble

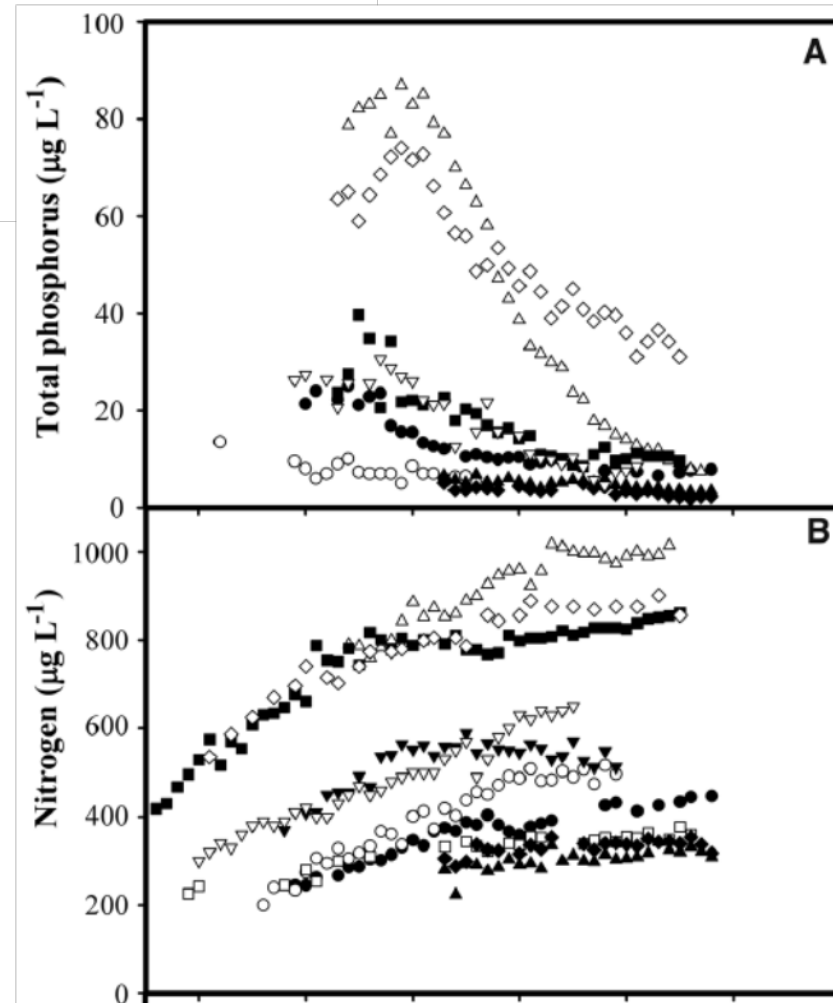
Human Influences on Nitrogen Removal in Lakes

Jacques C. Finlay,* Gaston E. Small,† Robert W. Sterner

SCIENCE VOL 342 11 OCTOBER 2013

Focus on reducing P

But increasing N



Other opportunities

- Proposal weakness
 - Biological/food web measurements
 - Temporal resolution
 - Spatial resolution
 - offshore vs nearshore
 - Mussel biomass/ fish (will have to rely on collaborators)
 - Storm events?
 - Input/output of C

Short-term Timeline

- Now-May 2014: Complete recruitment of HQP
- Winter 2014: Winter Carbon Budgets on CCGS Griffin
- May 2014, August 2014 and October 2014: Field work on CCGS Limnos

Advisory Committee

| Project Advisory Committee | Affiliation | Role |
|-----------------------------------|--|--|
| Dr. William D. Taylor | University of Waterloo and Canadian co-chair, Great Lakes Science Advisory Board, International Joint Commission | Advice on project priorities and approaches International liaison |
| Dr. Noel Urban | Michigan Tech University | |
| Dr. Don Scavia | University of Michigan | |
| Dr. Craig Stow | NOAA | |
| Dr. Rick Bourbonniere | Environment Canada | |

Contact us

- Maggie Xenopoulos (mxenopoulos@trentu.ca)
- Andrew Scott (andrewscott@trentu.ca)