



ECS Lunch and Learn

Supporting internal knowledge transfer within TRCA

June 9, 2021

Long-Term Monitoring of Lake Ontario Coastal Wetlands Reveals Distinct Water Quality Profiles Associated with Hydrogeomorphic Type

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1 Ontario Tech University

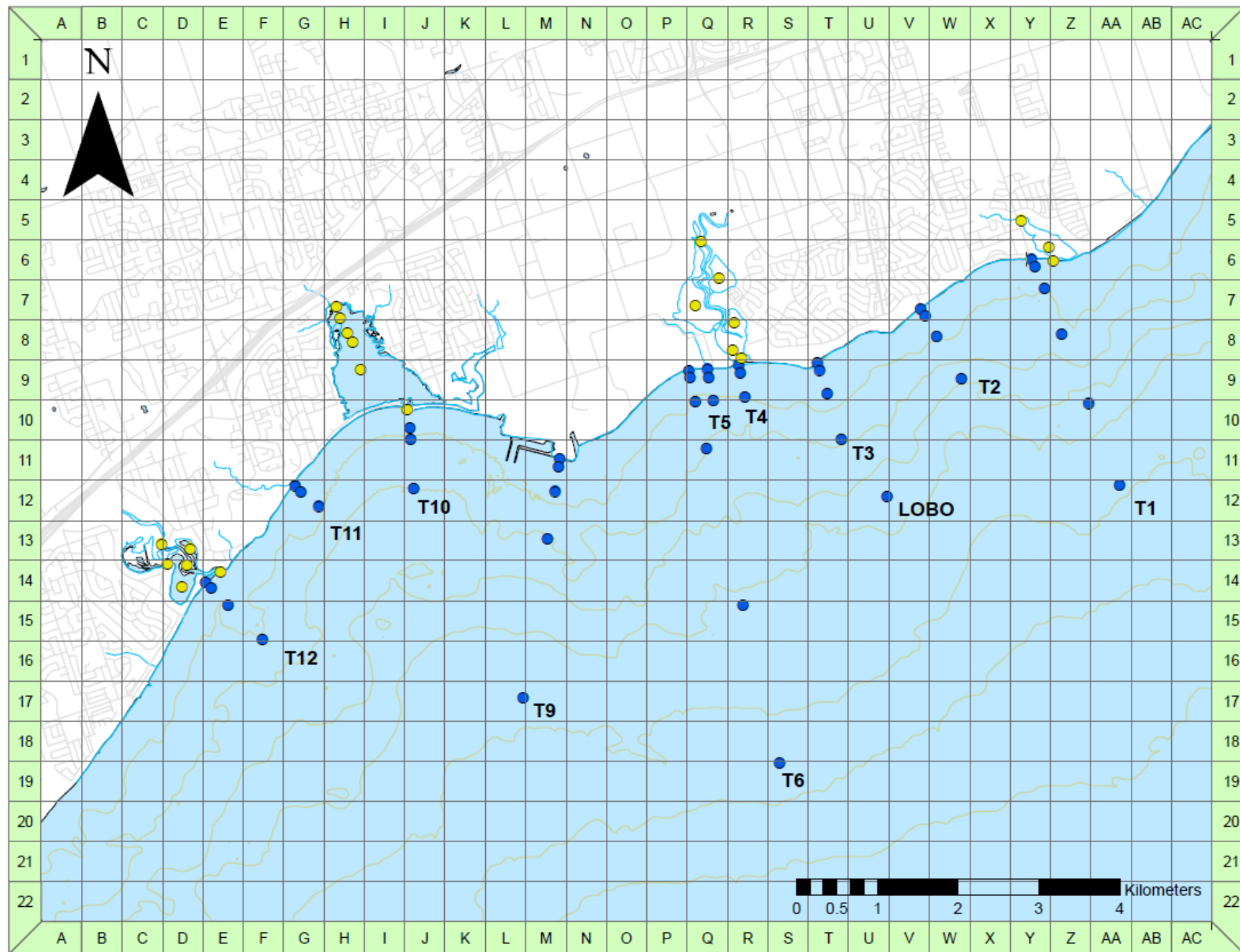
2 Toronto and Region Conservation Authority



Project Funding and Support

- Mitacs post-doctoral fellowship
 - Partners: Toronto and Region Conservation Authority and Ontario Tech University
 - Funding support: Regional Municipality of Durham and also York Region
- Project builds off the Western Durham Nearshore Monitoring Program





Project progress

- >10,000 data points
- Integrated Water Quality Monitoring Network (WQMN) data to expand dataset
- Presented at:
 - State of Lake Ontario – March 2021
 - Canadian Conference for Fisheries Research / Society of Canadian Limnology conferences – February 2021
- Duffin Creek Water Pollution Control Plant Advisory Committee Meeting in September
- Thomas et al, in preparation for the Journal of Great Lakes Research



Durham Region Coastal Wetlands

- Great Lakes Coastal Wetlands
 - Ecological transition zones
 - Provide habitat for local flora and fauna
 - Erosion control
 - Flood regulation
 - Water quality purification
- Impacted and degraded by human activities
- Internal cycling of nutrients, therefore a source or a sink of nutrient or ions



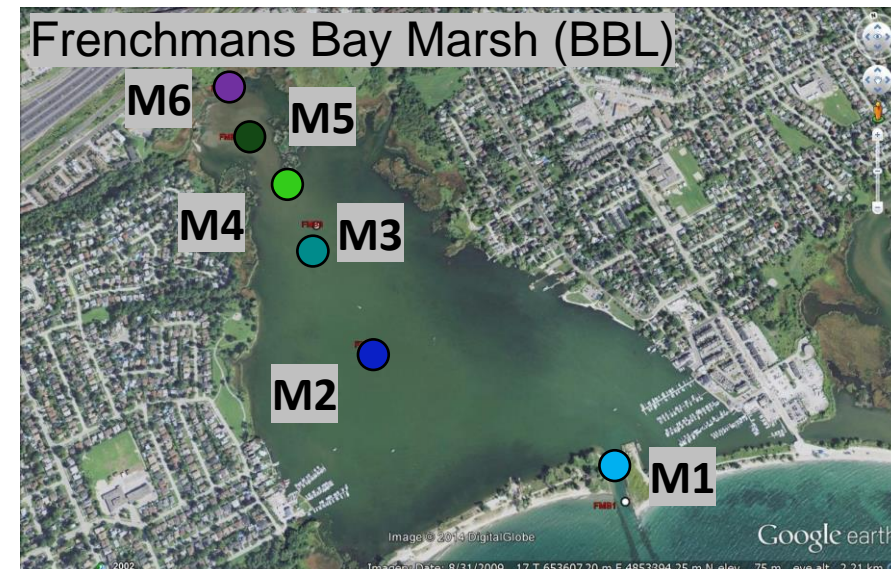
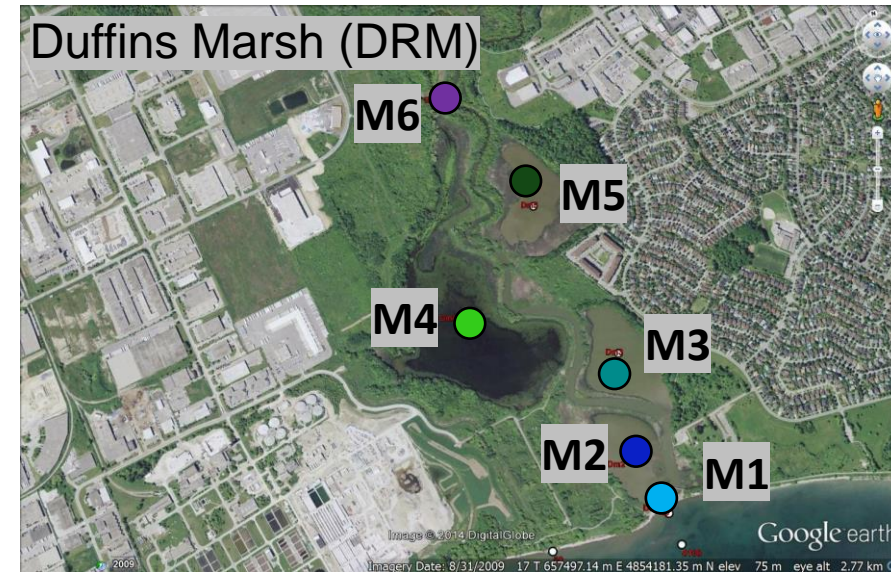
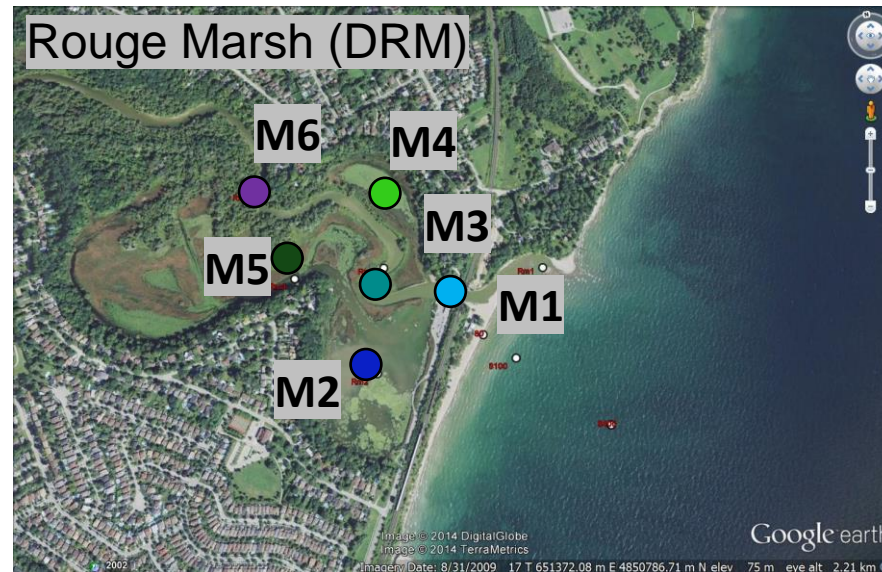
Marsh	Size (ha)	Watershed (ha)	Watershed :Size	Urban Land Cover	Water Quality	Trending
Drowned River Mouth						
Carruthers	116	3,690	335	41% urban	Poor	Mixed
Duffins	78	28,653	367	18% urban	Fair	Improving
Rouge	56	33,289	594	41% urban	Fair	Improving
Barrier Beach Lagoon						
Frenchmans Bay	39	1,652	42	>50% urban	Fair	Mixed

Each Wetland is Unique



How do we assess wetland function in the land to lake nexus?

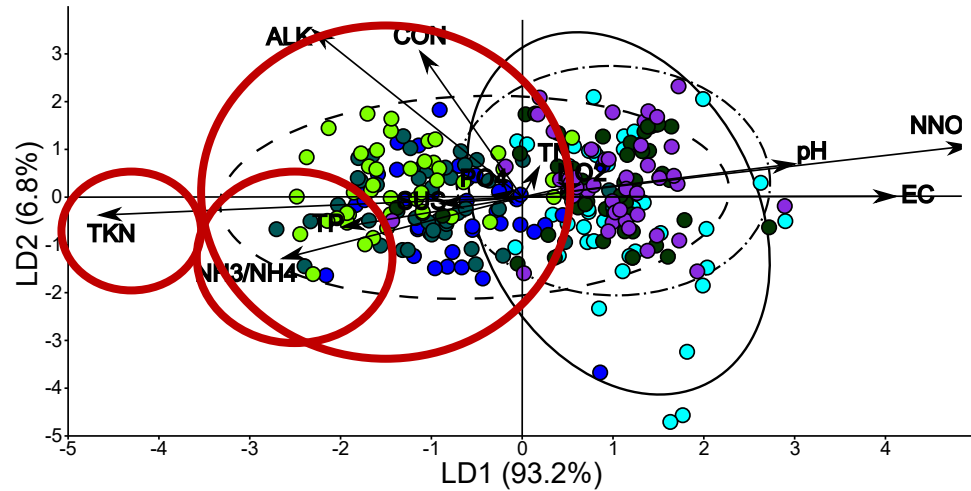
- TRCA long-term monitoring program
 - Sampling generally occurred between 2006 and present
 - FB not sampled in until 2008
 - No marsh sampling between 2011 and 2014
 - Monthly (May - November)
 - Water quality
 - Nutrients (TP, PO₄, TN, TKN, NO₂, NNO, NH₃/NH₄)
 - Environmental measures (pH, alkalinity, conductivity, suspended solids)
 - Biological (E.coli)



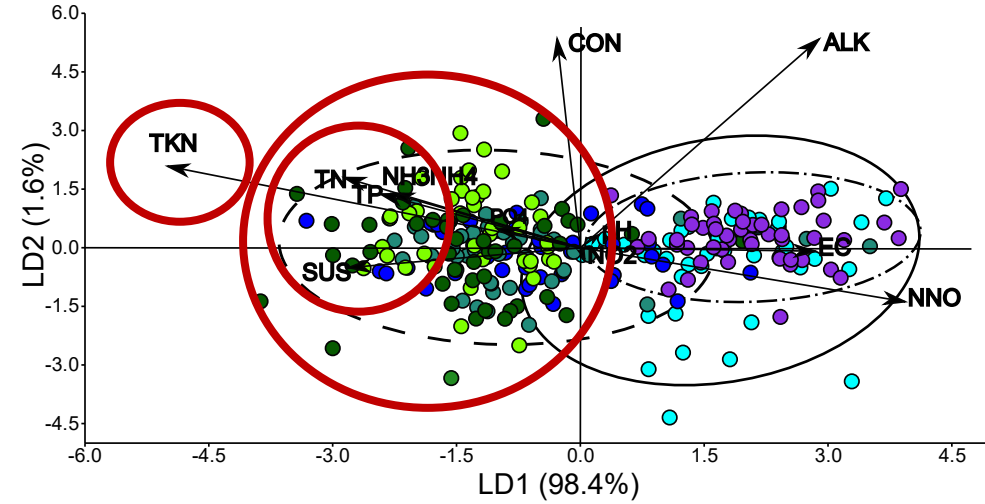
- Confluence of River and Marsh
- Internal Marsh Sites
- Marsh Site Closest to Lake

Water quality trends at internal marsh sites show distinct differences in function between marsh types

Rouge Marsh - DRM

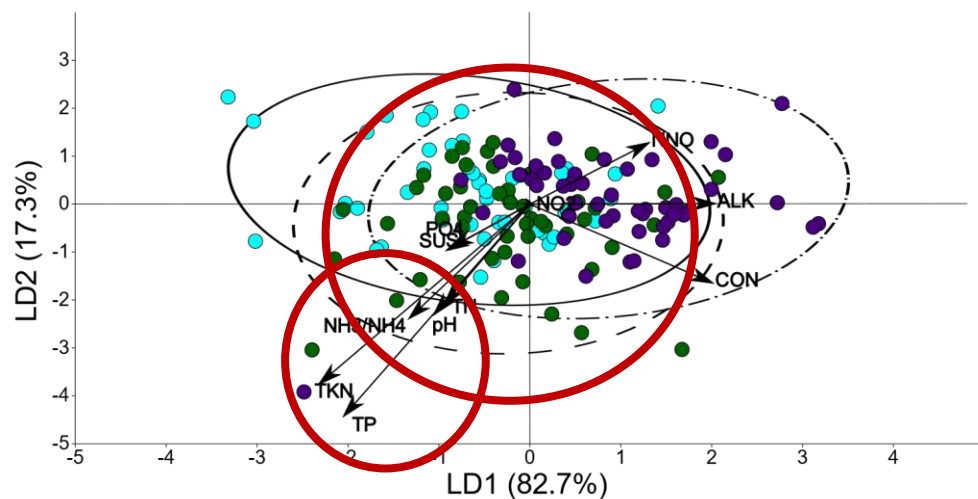


Duffins Creek Marsh - DRM

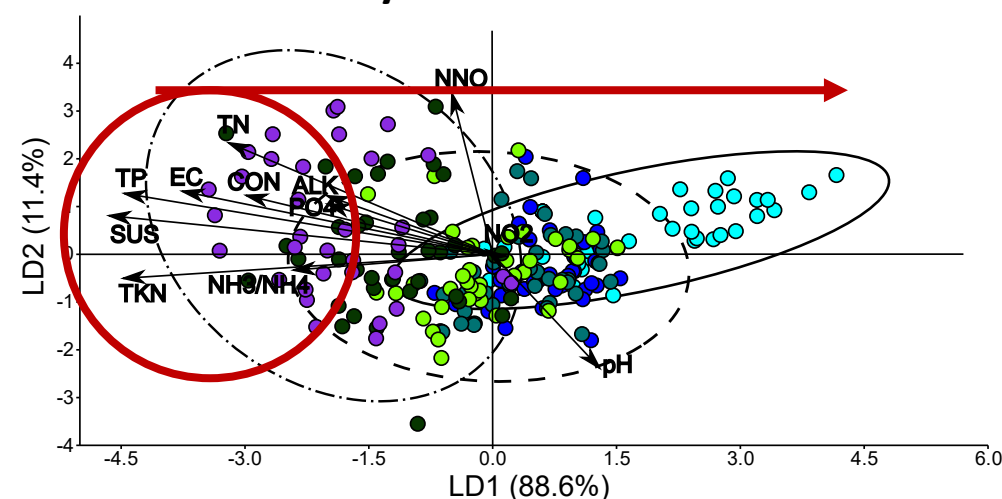


- Confluence of marsh and river
- Internal marsh sites
- Marsh site closest to lake

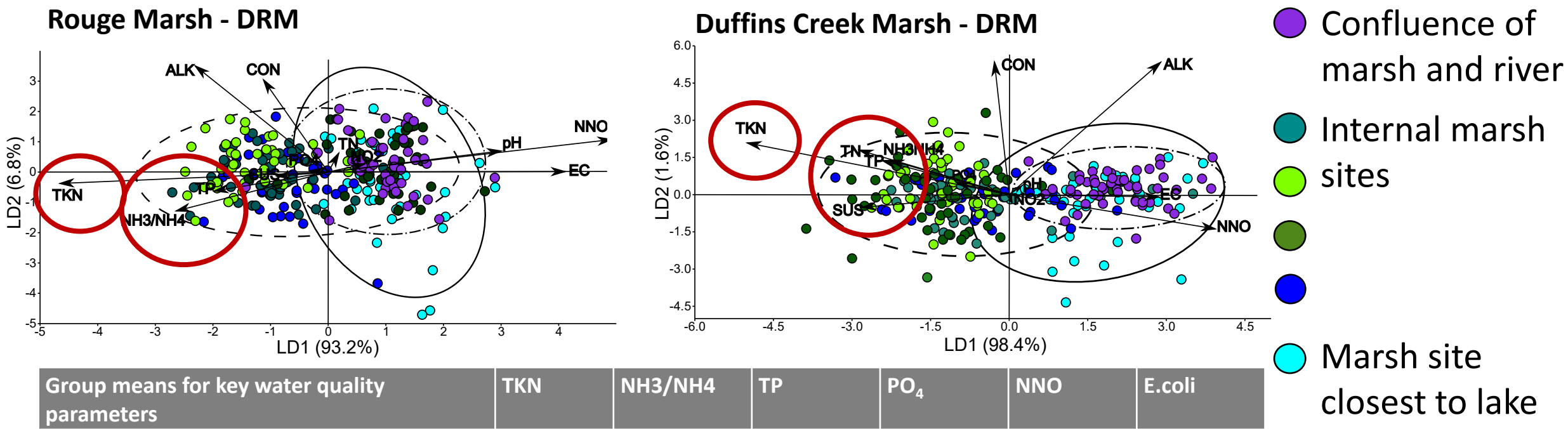
Carruthers Marsh - DRM



Frenchmans Bay Marsh - BB



Water quality trends at internal marsh sites show distinct differences in function between marsh types



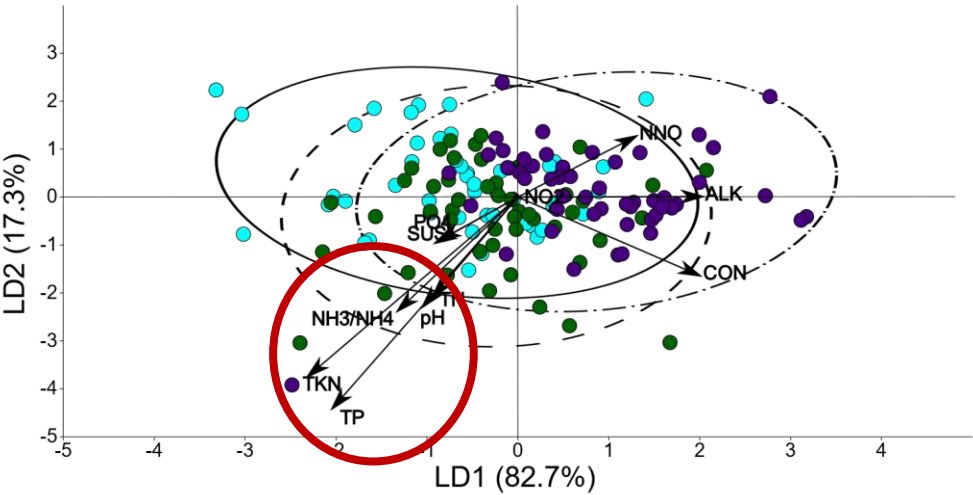
Group means for key water quality parameters	TKN	NH3/NH4	TP	PO ₄	NNO	E.coli
Rouge Marsh						
Confluence of river and marsh	0.61	0.06	0.05	0.010	0.49	204
Internal marsh	0.88	0.09	0.08	0.015	0.16	60
Closest to lake	0.61	0.06	0.06	0.010	0.46	213
Duffins Creek Marsh						
Confluence of river and marsh	0.61	0.04	0.04	0.006	0.42	166
Internal marsh	1.05	0.09	0.13	0.016	0.12	42
Closest to lake	0.46	0.04	0.04	0.006	0.40	140

Water quality trends at internal marsh sites show distinct differences in function between marsh types

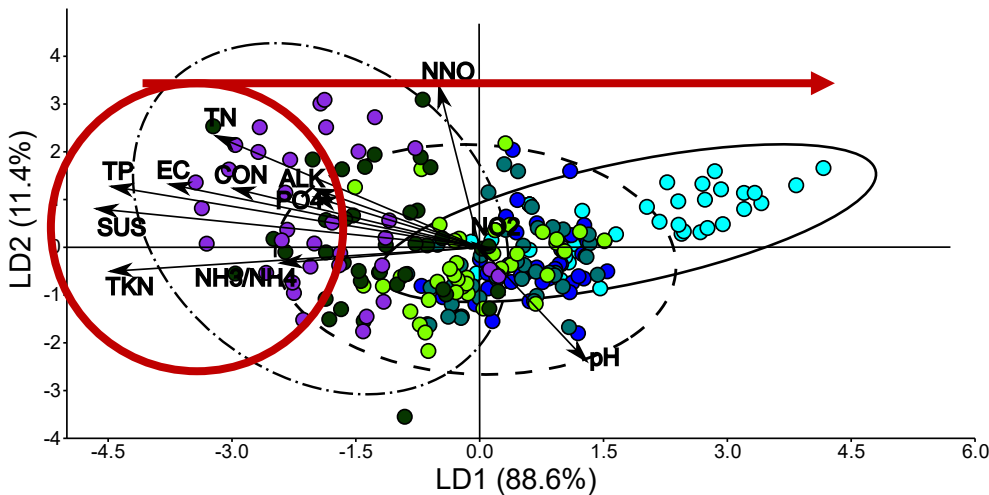
Group means for key water quality parameters	TKN	NH3/NH4	TP	PO ₄	NNO	E.coli
Carruthers Marsh						
Confluence of river and marsh	0.75	0.07	0.07	0.014	0.31	228
Internal marsh	1.00	0.10	0.11	0.018	0.21	117
Closest to lake	0.90	0.09	0.09	0.017	0.23	102
Frenchmans Bay Marsh						
Confluence of river and marsh	1.10	0.12	0.12	0.011	0.36	304
Internal marsh	0.75	0.08	0.07	0.006	0.18	35
Closest to lake	0.42	0.04	0.03	0.003	0.24	7

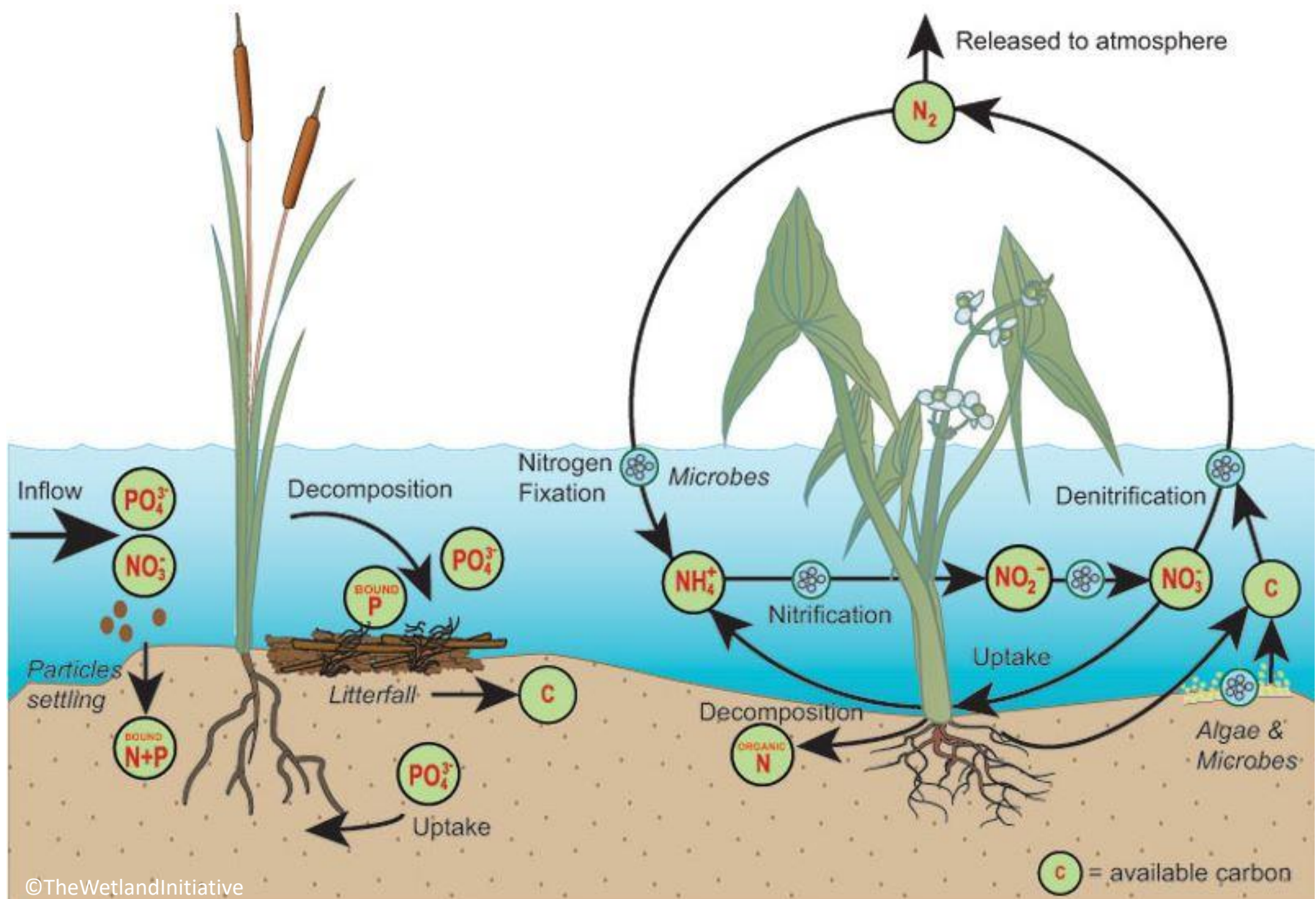
- Confluence of marsh and river
- Internal marsh sites
- Marsh site closest to lake

Carruthers Marsh - DRM



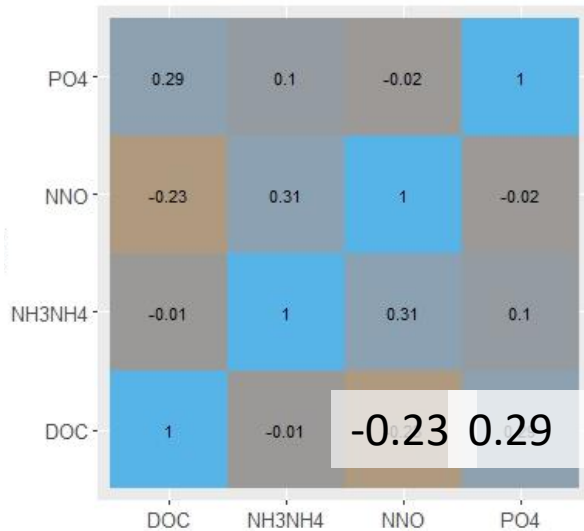
Frenchmans Bay Marsh - BB



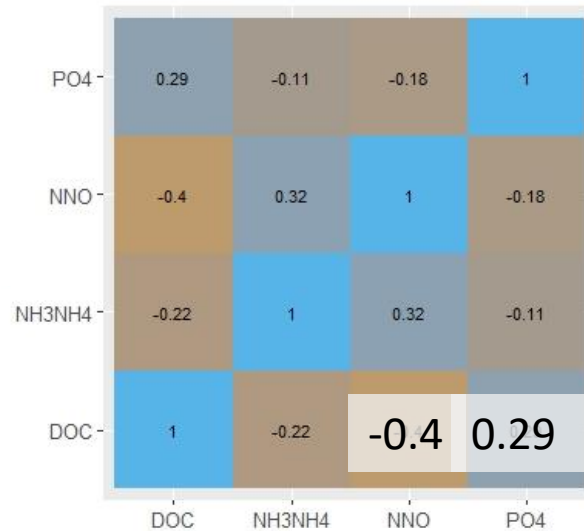


What are the relationships between nutrients?

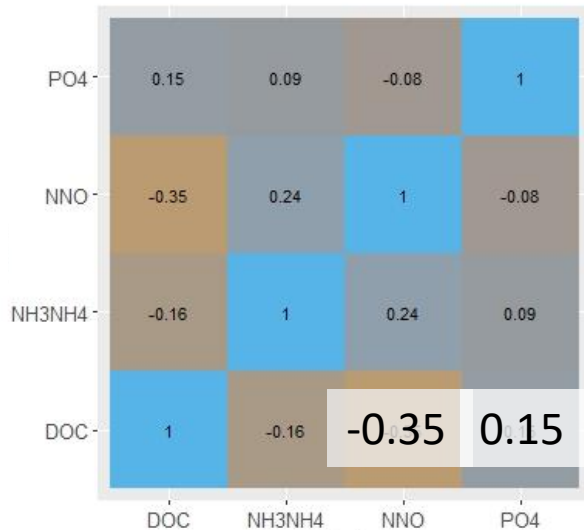
Rouge Marsh - DRM



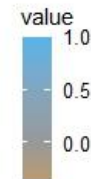
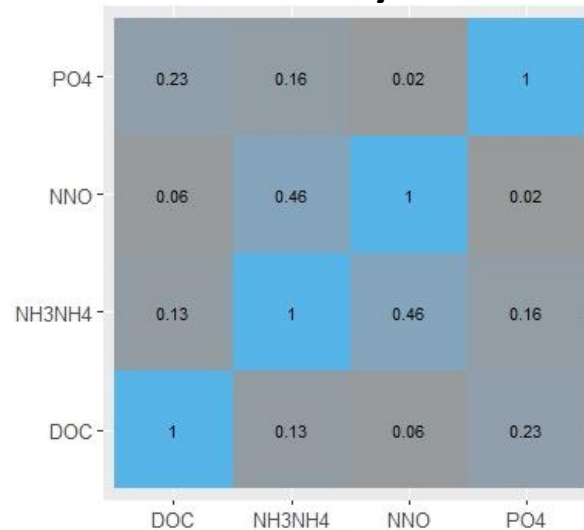
Duffins Creek Marsh - DRM



Carruthers Marsh - DRM

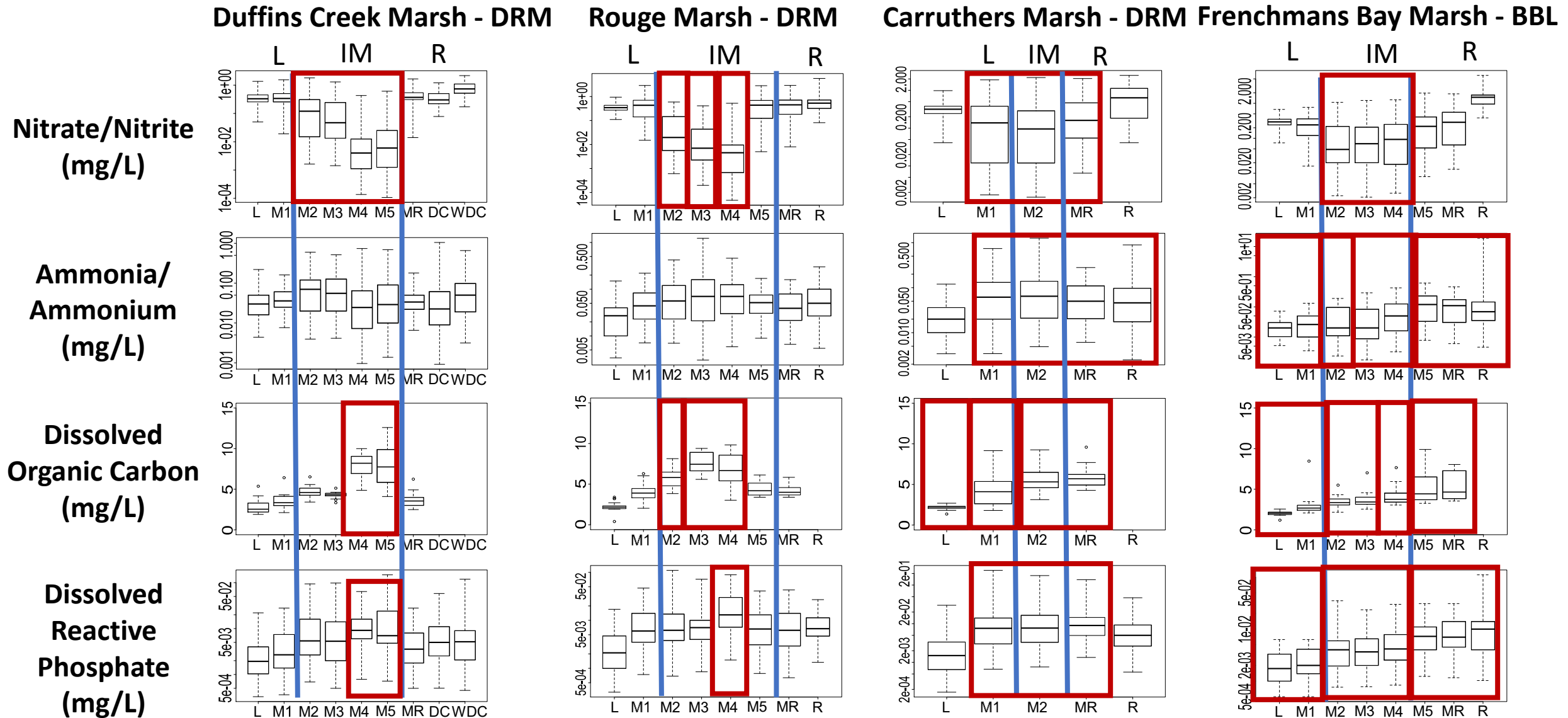


Frenchmans Bay Marsh - BBL



- Similar relationships between nutrient species at DRM marshes
- At DRM marshes 2 important relationships:
 1. Negative correlations between Nitrate+Nitrite (NNO) and Dissolved Organic Carbon (DOC)
 2. Positive correlations between Dissolved Reactive Phosphate (PO4) and Dissolved Organic Carbon (DOC)

Celled drowned river mouth marshes show evidence of internal nutrient cycling



Are coastal wetlands sources or sinks of nutrients?



- Celled marshes
 - Cycling at internal marsh sites (decreased NNO , increased NH_3)
 - Potential evidence of anoxia or additional source of PO_4 at internal sites
 - Marshes could be source of nutrients (e.g., NH_3/NH_4 , PO_4) to Lake Ontario,
 - Timing of sampling
 - Seasonality
 - Uptake
 - Dilution

Are coastal wetlands sources or sinks of nutrients?

- Non-celled marsh
 - Evidence of nutrient cycling within internal wetland sites
 - No evidence of anoxia or additional sources of PO_4 at internal sites



- Barrier beach lagoon
 - Gradient of nutrients from high (river) to low (lake) concentrations (vise-versa for WQI)
 - Evidence of nutrient cycling within upper sites in wetland
 - No evidence of anoxia or additional sources of PO_4 at internal sites

Take Home Messages

- Wetlands have the ability to improve water quality, but can also act as sources of nutrients.
 - When are these nutrients being delivered to the lake?
 - What happens once they are delivered?
- Drowned River Mouth wetlands with cells could be a source of dissolved P
 - Potential anoxic events within cells
 - Additional sources of P



Do carp gates and stormwater outflows play a role in water quality within the cells?



Do carp gates and stormwater outflows play a role in water quality within the cells?

Duffins Marsh Case Study



Corner Marsh



2004
High turbidity

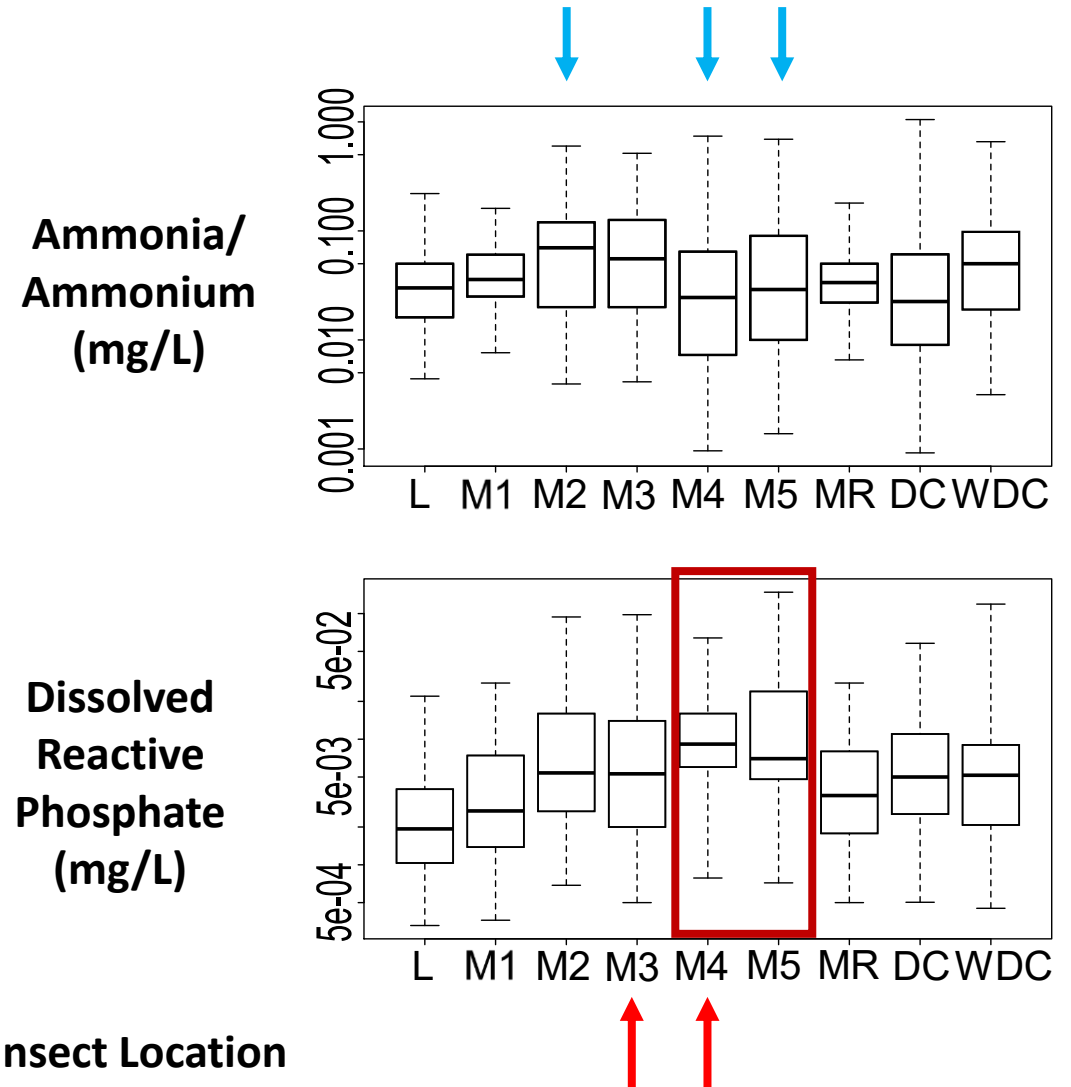
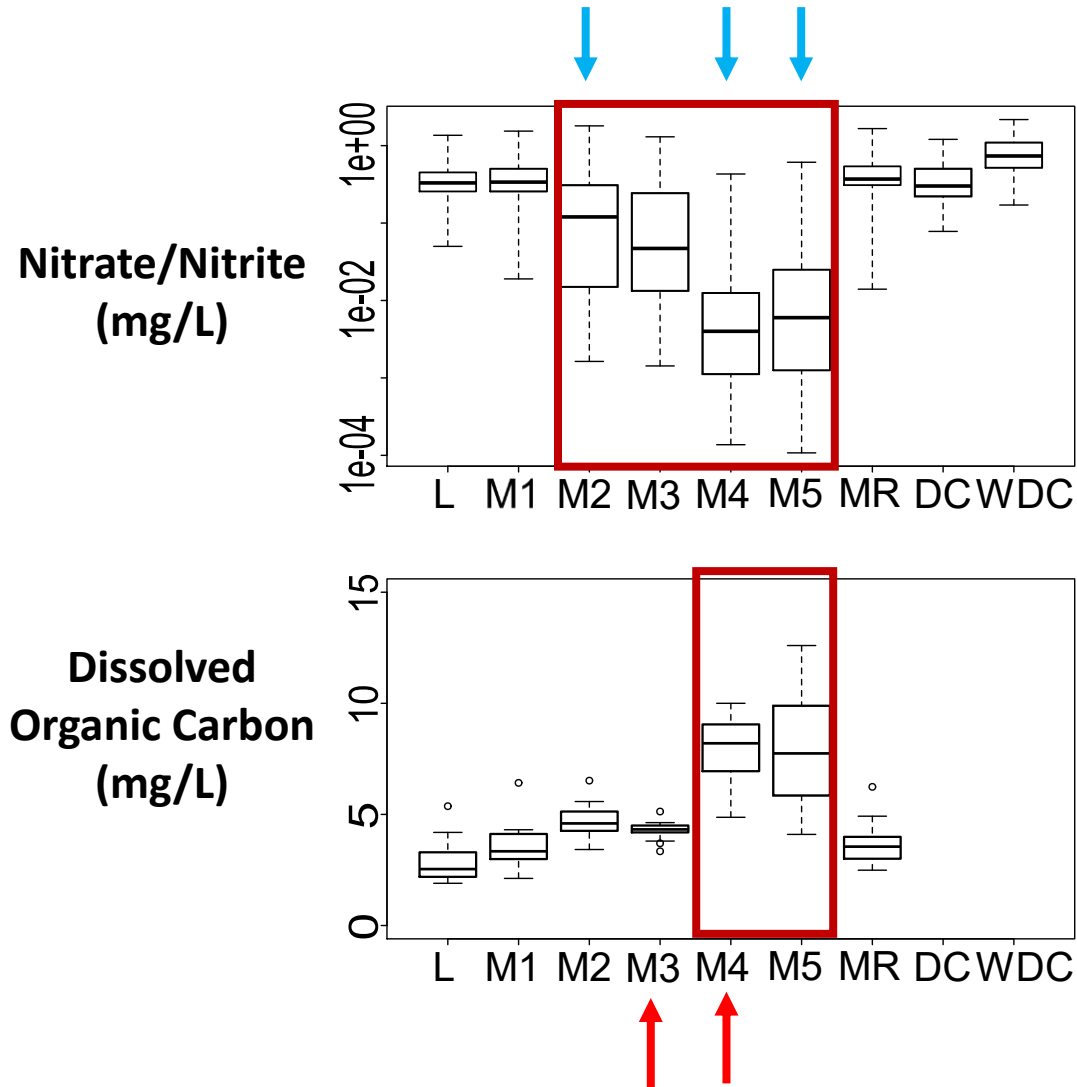


2008
**Improved water clarity
Emergent vegetation present**



2010
**Sustained water clarity
Emergent and floating vegetation present**

Do carp gates and stormwater outflows play a role in water quality within the cells?



Take Home Messages

- 2 of 3 cells with carp gates show evidence of anoxia and release of PO₄
 - Is this a result of less perturbation of sediments, increased biomass, a combination of factors?
- Are we trading one water quality measure for another?
- More work needed to help flesh this out
 - Temporal examination of data
 - Measures of oxygen levels within the cells
 - Comparison to other cells (e.g., Rouge)



Next Steps

- Explore whether these marshes could be sources of dissolved reactive phosphate to the nearshore
 - What is the role of nearshore currents, temperature and water level on water quality within the marshes and delivery to the lake
- Expand work on interaction of marshes and the watershed and lake
 - Examining the relationship between land-use within delineated watersheds and biogeochemistry to coastal wetlands



Acknowledgements

- Toronto and Region Conservation Authority
- Regional Municipality of Durham
- MITACS Accelerate Fellowship program



Upcoming ECS Lunch and Learns!

Wednesday, June 23
11:00am-12:00pm

**Demo of the Recently
Launched Watershed and
Ecosystems Reporting Hub**

By Shari Dahmer

Wednesday, July 14
11:00am-12:00pm

**TRCA's Water Resource
System**

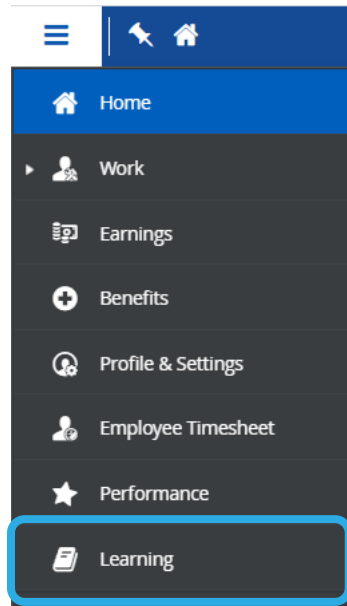
By Jonathan Ruppert


Wednesday, August 4
11:00am-12:00pm

**Broadview and Eastern EA
and Port Lands Flood
Protection Implementation**

By Meg St John and
Maryam Iler

Learning Management System



 Course Catalog

CATEGORIES


FILTERS

Lunch and Learn

X

Q

4 items




New

Lunch and Learn: Teams, OneDrive and SharePoint

EN

Webinar




New

Lunch and Learn: Hobbies for Mental and Physical Health (Please read...

EN

ILT (Instructor-Led Training)




New

Lunch and Learn: Thermal Imaging for Restoration and Conservation

ENROLLED

EN

Webinar



New

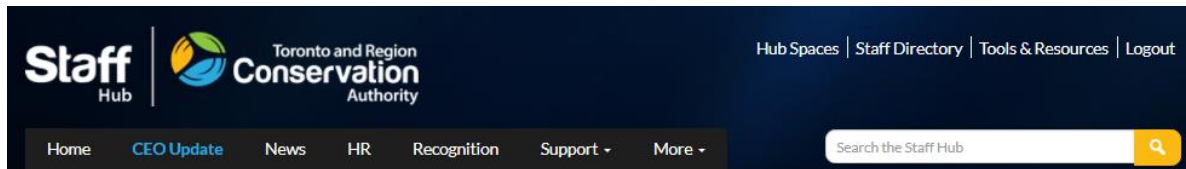
Lunch and Learn: Natural Heritage System Update

ENROLLED

EN

Webinar

New! Scientific Knowledge Sharing Hub



[Home](#) > [Scientific Knowledge Sharing](#)

Scientific Knowledge Sharing

Evidence-based decision making is at the core of what TRCA does. Several of our Business Units engage in generating new scientific knowledge to support watershed management actions and decisions.

It is critical that the knowledge generated is effectively shared.

The Scientific Knowledge Sharing platform is dedicated to sharing the latest scientific knowledge generated by TRCA and our partners. It is a place where staff can learn about and engage in the scientific work TRCA is undertaking.

PLEASE NOTE: There are several TRCA teams engaged in generating new scientific knowledge. Currently the content on the platform is specific to the Watershed Planning and Ecosystem Science business unit. Additional content from other TRCA teams will be added as the platform develops.



Knowledge Sharing: Learn More

- [Watershed and Ecosystems Reporting Hub](#)
- [Environmental Monitoring](#)
- [Research and Science Working Group](#)
- [TRCA Research Agenda](#)
- [Development and Engineering Services Hub Space](#)

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Knowledge Sharing: Latest Updates

[Knowledge Sharing - Climate Change Analysis at the Local Scale](#)

April 19, 2021 by Hub Admin [Featured](#)

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Past Recordings

<p>Watersheds and Ecosystems Reporting Draft Web Application</p> <p>Laura Del Giudice, Senior Manager, Watershed Planning & Reporting Kristina Dokoska, Project Coordinator, Ontario Climate Consortium</p> <p>September 21, 2020</p> 	<p>Introduction to the LID Treatment Train Tool</p> <p><i>Presented by – Steve Auger, Sahila Abbasi and Yusef David</i></p> <p>November 5, 2020</p> 	<p>TRCA's Recent Floodplain Mapping Updates</p> <p>Wilfred Ho*, Christina Bright*, Mike Todd**</p> <p>* Flood Risk Management, Development & Engineering Services ** Information Technology & Records Management</p> <p>November 10, 2020</p> 	<p>Working with Indigenous Communities</p> <p>Lunch and Learn</p> <p>November 17, 2020</p> 
<p>Green Infrastructure in Asset Management Planning</p> <p>Presented by: Michelle Sawka, Senior Research Scientist Tracy Timmins, Research Analyst</p> <p>Ecosystem and Climate Science</p> <p>December 8, 2020</p> 	<p>Explore TRCA's Biodiversity</p> <p>How to get the most from our enormous natural heritage data set.</p> <p>Presented by: Gavin Miller, Flora Biologist, Paul Prior, Fauna Biologist, and Parth Sheth, GIS Technician.</p>  <p>December 17, 2020</p>	<p>Evaluating the effectiveness of fish habitat restoration across the Toronto waterfront</p> <p>Kaylin Barnes¹, Lyndsay Cartwright¹, Rick Porttiss¹, Jon Midwood², Christine Boston², Monica Granados³, Thomas Sciscione¹, Colleen Gibson¹, Olusola Obembe¹</p> <p>ECS Lunch and Learn January 14, 2021</p> <p>¹ Toronto and Region Conservation Authority ² Fisheries and Oceans Canada ³ PRERiver.org</p> 	<p>Erosion Risk Management Program</p> <p>Lunch and Learn Presentation</p> <p>Presented by: Matt Johnston, Associate Director Ashour Rehana, Manager David Gingerich, Analyst</p> <p>January 27, 2021</p> 
<p>The Meadoway Research Overview</p> <p>The Meadoway COMMUNITY POWERED GREEN SPACES</p> <p>Presented by: TRCA</p>  	<p>TRCA's Natural Heritage System Update</p> <p>Presented by: Namrata Shrestha, Senior Research Scientist Andrew Chin, Research Analyst</p> <p>Ecosystem and Climate Science Watershed Planning and Ecosystem Science Development and Engineering Services</p> <p>24 Mar 2021</p> 	<p>Thermal imaging for ecosystem conservation and restoration</p> <p>Jonas Hamberg Mitsun Postdoctoral Fellow TRCA (ECS) & University of Toronto Advisors: Jonathan Ruppert & Patrick James (UofT)</p>  	<p>Lake Ontario Fish and Aquatic Ecosystem Health</p> <ul style="list-style-type: none"> Eat Safe Fish: A Collaborative Engagement with the Mississaugas of the Credit First Nation – by Valerie Francella Don River Mouth Naturalization Project: Restoration of Fish Habitat in Toronto – The First Piece in a Very Large Puzzle – by Angela Wallace From Rivers Downstream to Lake Ontario: 20 years of aquatic sampling through The Regional Watershed Monitoring and Toronto Waterfront Monitoring Programs – by Jan Moryk and Angela Wallace 
<p>Lake Ontario Restoration Initiatives</p> <ul style="list-style-type: none"> Determining Practical Key Performance Measures for Wetland Restoration Practitioners: Challenges and considerations – by John Stille RAP Delisting and the Adoption of the Integrated Restoration Prioritization Tool: Compiling TRCA data on waterfront and inland restoration planning and projects within the Toronto Area of Concern – by Andrew Ramesbottom and Colleen Gibson Winning the War One Battle at a Time: Managing phragmites and DSV at a Toronto waterfront park – by Jennifer Smith 	<p>Precision Biomonitoring Webinar Series:</p> <p>PRECISION BIOMONITORING —Intelligent DNA Solutions—</p> <p>eDNA: Applications, Advantages and Implications!</p> 	<p>Lunch and Learn</p> <p>Wetlands, Warehouses or Both? – The Story of Project Lonestar and the Lower Duffins Wetland Complex.</p> <p>Presented by: Steve Heuchert, Development Planning and Permits Shauna Fernandes Chagani, Planning Ecology</p> <p>May 12, 2021</p> 	

An aerial photograph of a large body of water, likely a lake or reservoir, with a dark blue surface. The shoreline is irregular, with a mix of green trees and sandy or rocky patches. To the right of the water, there is a residential neighborhood with many houses and streets. A road curves along the edge of the water. The overall scene is a mix of natural and urban environments.

Thank you

For questions about the ECS Lunch and Learn Series, please contact:

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