

# Can diatom community composition be used to evaluate water quality in southern Ontario streams?

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## Introduction

Diatoms are microscopic (2-200µm) unicellular algae that form a brown coating on stream substrates.

Diatoms are very sensitive to water quality changes because they acquire nutrients directly from the water they live in.

Changes in water quality (from storm runoff, pollution, erosion etc.) elicit changes in the composition of the diatom community, as sensitive species die off and are replaced by tolerant species

Diatoms have shown significant responses to changes in:  
-nutrient enrichment -pH  
-suspended sediments -pesticides  
-other contaminants

The response time to these changes are related to:  
1. the lifespan and tolerance of the diatom species in the community  
2. The normal fluctuation for each water quality variable

## Purpose

To evaluate the use of the diatom communities as indicators of water quality in southern Ontario

## Questions

Which water quality variables have the strongest influence on the composition of the diatom community?

Which time interval (1, 2, 3 months or seasonal) is correlated with the strongest response?

## Methods

1. Composite diatom sample collected from 5 rocks at each site using an algae biomonitoring protocol
2. 400+ diatom valves identified to lowest possible level (mostly species)

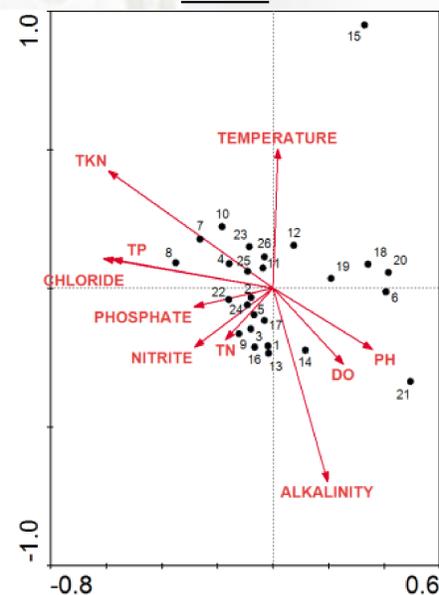
## Methods (Cont.)

3. Water quality data obtained from PWQMN and averaged over 1 month, 2 month, 3 month and seasonal (April 1 to November 30) intervals
4. Canonical Correspondence Analysis (CCA) was used to investigate the relationship between water quality and the diatom communities

## Results

The first CCA axis explained 24.2% of the relationship between water quality and diatom communities.

Canonical Correspondence Analysis (CCA) of diatom community and water quality data averaged over 2 months



All axes together explained 67.6 % of the variation in the diatom community as related to water quality.

Overall the CCA was significant (p=0.022).

Correlation between Environmental Axes and Water Quality Averaged over 2 months

Water Chemistry Variable	Axis 1	Axis 2
Alkalinity	0.20	-0.70
Dissolved Oxygen	0.25	-0.27
pH	0.36	-0.22
Temperature	0.02	0.50
Chloride	-0.61	0.11
Nitrite	-0.28	-0.21
TKN	-0.59	0.42
Total Nitrates	-0.17	-0.19
Phosphate	-0.28	-0.07
Total Phosphorus	-0.58	0.10

## Findings

- Chloride was strongly correlated with the variation in the diatom community (p= 0.61).
- Water quality averaged over the two months prior to sample collection was best correlated with the diatom community (p= 0.022).
- “General” water quality variables (like alkalinity, pH, temperature) was also well correlated with diatom community composition.
- The response of diatom communities to human alteration is not clear because it is confounded by the addition of pollutants (chloride and nutrients) and the natural flux of water quality in the streams.
- Further analysis is needed to partition out the variability due to normal water quality fluxes (in alkalinity, pH, temperature etc.) and better determine the influence of chloride and nutrient loading on the diatom community.

## Next Steps

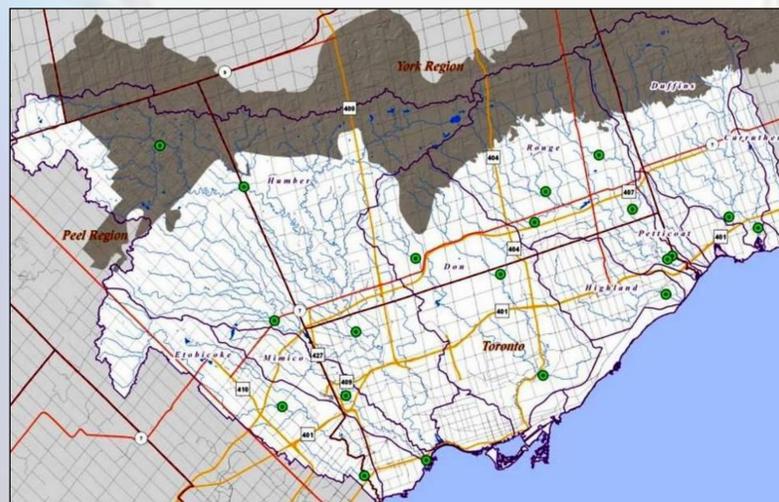
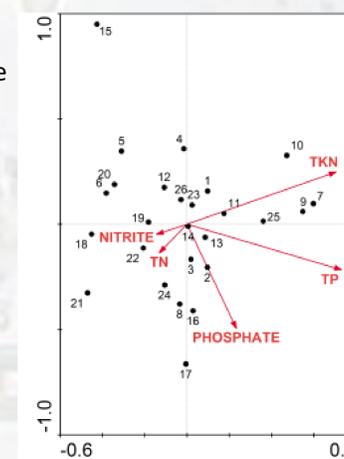
Use Variance Partitioning (Partial CCAs) to isolate the effects of chloride and nutrients on the diatom community composition.

## Initial Results

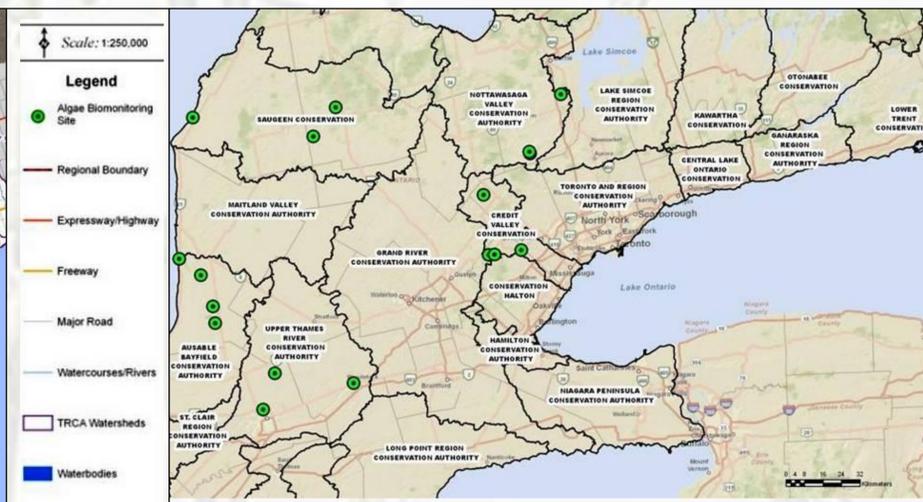
Diatom community variation explained by:

- all water quality: 47%
  - nutrients alone: 22%
  - general water quality and chloride together: 24.6%
  - Intersection: 0.3%
- Nutrients appear to have a unique effect on the diatom community!

Partial CCCA of diatom community and nutrients data averaged over 2 months



Algae Biomonitoring Sites sampled in year 1: Toronto Region



Algae Biomonitoring Sites sampled in year 2: Southern Ontario



Ontario

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