Patterns of Eutrophication in Lake Matoaka
Williamsburg, VA

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*Thanks to Mindy Forsyth for being my photographer*
Introduction

- Eutrophic watersheds
  - High organic productivity
  - ‘Well-fed’ in phosphorus and nitrates
  - Murky water depleted in oxygen

- Chlorophyll
  - Energy fixation in photosynthesis
  - Assessment of algal biomass in lakes/ponds
  - Accurate measure of photosynthetic activity
  - Depends on availability of nutrients
Objectives

- Develop a technique for measuring algal chlorophyll concentration in Lake Matoaka
- Establish any patterns of anoxic zones
- Determine whether or not there are spatial/temporal/depth gradients of chlorophyll within the lake
  - Hypothesis: Eastern side of the lake would have greater amounts of algae (and therefore chlorophyll) due to the higher amounts of development-associated runoff
Materials & Methods

![Map of locations mentioned in the text](image)

Locations:
- College Creek
- Berkeley
- Pogonia
- Crim Dell
- Strawberry
- Lake Matoaka
Materials & Methods

• Field measurements
  – Temperature
  – DO₂
  – Conductivity

• Filtration

• Spectrophotometric methods
Results:

Depth Patterns

- no significant thermocline
- even mixing of water
Results:
Depth Patterns

• decomposition > photosynthesis
Results: Temporal Patterns

- Seasonal variation due to nutrient limitation
Results:
Spatial Patterns

Table 1. Runoff into Lake Matoaka

<table>
<thead>
<tr>
<th>Location</th>
<th>Runoff Rate (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Creek</td>
<td>0.030 m³/s</td>
</tr>
<tr>
<td>Crim Dell</td>
<td>0.012 m³/s</td>
</tr>
<tr>
<td>Strawberry</td>
<td>0.008 m³/s</td>
</tr>
<tr>
<td>Pogonia</td>
<td>0.006 m³/s</td>
</tr>
<tr>
<td>Berkeley</td>
<td>0.005 m³/s</td>
</tr>
</tbody>
</table>
Results:
Spatial Patterns

- correlation between conductivity and runoff volume
Results

- Warmer water near the surface receives more oxygen from atmosphere
- Colder water at bottom has more respiration and decomposition

- High chlorophyll and low DO₂ at cold temperatures
- Decomposition is occurring faster than photosynthesis
Conclusions

• Chlorophyll concentration and conductivity correlates directly with runoff volume

• Lake Matoaka as a large-scale BMP?

Table 2. Lake Matoaka as a eutrophic system

<table>
<thead>
<tr>
<th></th>
<th>Eutrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorophyll (µg/L)</td>
<td>&gt;15</td>
</tr>
<tr>
<td>Phosphorus (µg/L)</td>
<td>&gt;15</td>
</tr>
<tr>
<td>Depth (m) and sediment</td>
<td>&lt;10, organic</td>
</tr>
<tr>
<td></td>
<td>bottom high in N</td>
</tr>
</tbody>
</table>

References


