Introduction

Eutrophication is a large problem globally that results from excess nutrients (i.e. nitrogen and phosphorus) entering aquatic systems. In the case of phosphorus, it enters lakes by external (runoff) or internal loading (from lake-bottom sediments). Efforts to restore Clear Lake, a hyper-eutrophic lake located in Lake County, CA, have largely focused on external loading as the cause of excessive phosphorus concentrations.

In this study, we sought to quantify the internal load of phosphorus for the first time in Clear Lake by measuring phosphorus flux rates from lake-bottom sediments.

Results of this study will be incorporated into a whole-lake 3-D hydrodynamic model to aid in developing phosphorus management strategies for the lake.

Materials & Methods

- Collected 4 cores from each of the 6 sites across the lake
- We oxygenated 2 of the cores from each site by bubbling with air, the remaining 2 cores kept anoxic by bubbling with N₂ gas
- Incubated cores at 15.2°C for 30 days, sampling every 3 days
- Analyzed water in cores for pH, redox (Eh), SRP, D P, NO₃, and NH₄
- Incubated cores at 15.2°C for 30 days, sampling every 3 days
- Calculated maximum rate of flux of above analytes from linear portion of mass vs. time curves

Results

Phosphate Flux to Overlying Water of Cores

<table>
<thead>
<tr>
<th>Site</th>
<th>Treatment</th>
<th>Phosphate Flux (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA03</td>
<td>Anoxic</td>
<td>21.4</td>
</tr>
<tr>
<td>NR02</td>
<td>Anoxic</td>
<td>26.7</td>
</tr>
<tr>
<td>OA04</td>
<td>Anoxic</td>
<td>24.9</td>
</tr>
<tr>
<td>UA01</td>
<td>Oxic</td>
<td>11.6</td>
</tr>
<tr>
<td>UA06</td>
<td>Oxic</td>
<td>11</td>
</tr>
<tr>
<td>UA08</td>
<td>Oxic</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Site Description

- Historically eutrophic lake due to high phosphorus content in local volcanic parent material
- Likely the oldest lake in North America with sediments dating back to 450,000 years ago and beyond
- Lake is now hypereutrophic and suffers harmful algal blooms (HABs) that cause fish kills from anoxia and produce toxins

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References: