LAB: Measuring Dissolved Oxygen Saturation

Objective: In this lab, students will determine how temperature and salinity affect dissolved oxygen (DO) levels in water samples.

Background: Read and highlight the following article excerpt:

Unlike terrestrial environments, oxygen is typically a limiting factor in aquatic ecosystems. Dissolved oxygen (DO) concentrations are expressed as milligrams of oxygen per liter of water (mg/L). The amount of DO affects what types of aquatic life are present in a stream, because many species of fish and invertebrates are sensitive to low DO levels. DO also regulates the availability of certain nutrients in the water. Many physical and biological factors affect the amount of dissolved oxygen in a stream.

The physical factors that influence DO are temperature, altitude, salinity, and stream structure. Temperature inversely controls the solubility of oxygen in water; as temperature increases, oxygen is less soluble. In contrast, there is a direct relationship between atmospheric pressure and DO; as the pressure increases due to weather or elevation changes, oxygen solubility increases. Salinity also reduces the solubility of oxygen in water.

Hypothesis: Make two hypotheses using the “if, then, because” format. In the first hypothesis predict how temperature will affect dissolved oxygen (DO) levels in water. In the second hypothesis, predict how salinity will affect dissolved oxygen levels. Identify the independent and dependent variables in each hypothesis.

Experimental Procedure:

1. Use a thermometer to measure the temperature of your water sample. Record this in Table 1.
2. Use a refractometer to measure the salinity of your water sample. Record this in Table 1.
3. Record the temperature and salinity data from each group’s sample in class in Table 1.
4. Use a ruler and the nomograph of oxygen solubility below to determine the expected DO levels of each sample assuming the sample is 100% saturated. Record these values in Table 1.
5. Use the DO probe or test kit to measure the DO levels of your sample. Record this value in Table 1.
6. Record the measured DO data from each group’s sample in class in Table 1.
7. Use the nomograph above to calculate the oxygen saturation of each sample. Record this in Table 1.
Data Analysis:

1. Table 1: Record your observations below.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Temperature (°C)</th>
<th>Salinity (ppt)</th>
<th>Expected DO at 100% Saturation (ppm)</th>
<th>Measured DO (ppm)</th>
<th>Oxygen Saturation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Create a bar graph that compares temperature to measured dissolved oxygen levels in the graph provided below.

3. Create a bar graph that compares salinity to measured dissolved oxygen levels in the graph provided below.

Conclusion: Explain why each hypothesis was either supported or rejected by the data.

Discussion Questions:

1. How did temperature affect dissolved oxygen levels in this lab?

2. How did salinity affect dissolved oxygen in this lab?

3. Why are thermal pollution and potential global warming of concern to dissolved oxygen levels in the ocean?