

## 1.7) INSTRUCTOR’S GUIDE TO DIURNAL AND SEASONAL POND DYNAMICS

**Overview:** A 60-gallon fish tank or plastic tub (available at most plant nurseries) filled with fertilized pond water can serve as an acceptable substitute for a pond. Fertilization of the pond water can be done with plant food. Follow the instructions on the container for the correct dose of plant food for watering plants (usually between 0.5 to 1 teaspoon per gallon). It also is helpful to “seed” the tank with a 1-2 gallon sample of water from a living pond to encourage a faster algae bloom. The sample should preferably come from a pond that is already hypereutrophic.

Try to maintain turbidity readings between 25 and 35 cm. Pond water that is too clear usually does not exhibit the large oxygen flux that is needed to demonstrate the role of photosynthesis. Do not use aeration because this will minimize differences between morning and afternoon dissolved oxygen. Turbidity readings below 25 cm often result in algae crashes whereby oxygen readings remain low for several days. If you do get an algae crash, use it as a “teachable moment” to discuss how dead zones are generated.

**Answers to Questions:** 1) Dissolved oxygen levels are low at dawn and higher in the afternoon due to photosynthesis. This difference is minimal on cloudy days. 2) High temperatures increase BOD and decrease gas solubility. This negative correlation between dissolved oxygen and temperature is more evident for the morning readings because only respiration takes place during the night. Afternoon readings are poorly correlated with temperature because photosynthetic activity adds more oxygen to the water, despite higher water temperatures that are less conducive to dissolved gases. 3) Phytoplankton. 4) Afternoon. 5) Oxygen levels became dangerously low, possible due to an algae crash or massive release of oxygen-consuming wastes like raw sewage. 6) Carbon dioxide. 7) Respiration. It adds CO<sub>2</sub> to the water. 8) Photosynthesis. It removes CO<sub>2</sub> from the water.

**Logistics:** Since this lab involves only one data set that is shared by all the students, only one oxygen meter is needed. This is best organized as a group project done over a period of 2-3 months, whereby each student signs up to take all measurements on a given day. It is important for the same student to take the morning and afternoon reading on the same day in order for him or her to see the difference first-hand. Measurements during warmer months result in more interesting data, so do not delay this project if your semester begins in the fall. Students will share the same data set, but there is absolutely no reason each student cannot answer the questions on their own, so be wary of plagiarism.

**Degree of Difficulty:** 1—Even though the collection of data is prolonged, the only planning necessary is the preparation of the pond and the data sheet in which students write their readings.

**Product Guidelines:** See the “Instructor’s Guide” for Lab 1.2.

**Materials:** An outdoor pond; a dissolved-oxygen meter; a thermometer; a Secchi disk; and a pH testing kit.