Simulating a Pond System Over 24 Hours

Jim Eckblad

Department of Biology, Luther College,
Decorah, IA 52101

This workshop describes the use of a computer program (Diurnal Pond Simulation*) that students can use to simulate changes in abiotic and biotic variables within pond habitats over a 24-hour period. The objectives in using this software are as follows:

To design sampling to best answer specific questions
To interpret data and look for patterns or differences
To look for relationships between variables
To suggest explanations for the observed relationships

Students must first select a sampling scheme. This will include choice of pond (there are six different ones available, but instructors can modify this), season of year, sampling depth (surface, mid-depth, or bottom), sampling frequency, and number of samples at each depth. They may also elect to take samples from each of the three depths.

As every biologist knows, even with the best of planning, you do not have control of the weather. There's a chance component to the weather during any sampling simulation, and the resulting data may reflect differences in weather. There's also a sampling error component such that repeated samples (under the same conditions) will not yield the exact same values. It will also be observed that different aquatic habitats may have different diurnal patterns displayed. For example, a hard-water versus soft-water habitat may respond differently to a day of rain. Or, eutrophic and oligotrophic basins may show different diurnal changes in response to different levels of primary production.

Students will obtain data to estimate nine abiotic parameters (temperature, dissolved oxygen, percent oxygen saturation, pH, alkalinity, dissolved carbon dioxide, conductivity, phosphate, and nitrate-nitrogen) and two biotic parameters (number per liter of phytoplankton and zooplankton). The resulting data can be displayed as either a table or a plot with time along the x-axis.

The questions below illustrate some of the concepts that can be addressed with this simulation.

1. What is the pattern of dissolved oxygen (DO) over a 24-hour period for surface water during the summer?
2. Is the DO profile with depth similar during different seasons of the year in Lindeman Pond?
3. Is the DO profile with depth similar for Lindeman Pond and Eagle Pond?
4. What is the pattern of pH over a 24-hour period for surface water during the summer? How does it compare to the DO pattern?
5. Is the DO profile correlated with any of the other abiotic variables?
6. We often characterize water as being "hard" or "soft". How does this apply to these six ponds?
7. We can also characterize bodies of water as ranging from oligotrophic to mesotrophic to eutrophic. How does this apply to these six ponds?

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* Program for the IBM-PC and compatibles and is distributed by Oakleaf Systems, (319) 382-4320

8. Do the nutrients (phosphorus and nitrate-nitrogen) appear to be equally abundant at all depths?
9. It has been reported that some species of zooplankton undergo a vertical migration during each 24-hour period. Do you see any evidence of that in these ponds?