

Testing Hypotheses in the Winter World: A Semester-Long Temperature Monitoring Study for a Non-Majors Ecology Course

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Expanded Abstract

One challenge in teaching non-majors biology courses is fostering the development of students' ability to think critically with quantitative material. This mini-workshop described one such endeavor, utilizing temperature loggers to collect field data with which students performed hypothesis testing. The workshop additionally provided participants with some hands-on experience with temperature loggers, a relatively inexpensive technology with broad application in the laboratory setting. Participants had the opportunity to analyze both temperature logger data that they collected during the workshop and an actual data set collected as part of the field study.

In a non-science majors course on winter ecology, students embarked on a semester-long project, following an introduction to the physical aspects of the winter environment. During a field session, student teams each identified two microhabitats in close spatial proximity (e.g., opposite sides of a large tree trunk; above and beneath a fallen log). They next hypothesized whether or not the thermal environment would differ between the microhabitats and then planted a temperature logger [Hobo Pendant temp/light logger, 64K (UA-002-64); Onset Computer, Bourne, MA (www.onsetcomp.com)] in each microhabitat. The loggers recorded at 0.5-hour intervals for over 75 days, ranging from mid-winter into early spring. Temperature differences between microhabitats could have a substantial impact on the survival of overwintering organisms. Upon retrieving the temperature loggers, the students uploaded the data to test their original hypothesis.

When I taught this course for the first time, it was apparent that these non-science majors found this quantitative project rather daunting. Consequently, to prepare the students to analyze their actual temperature data, I developed two instructional modules that took place prior to data retrieval. These modules utilized datasets relevant to the course – population measurements for local overwintering bald eagles, Audubon Society Christmas Bird Count data, and long-term measurements of winter ice duration on Lake Mendota, Wisconsin. The first module focused on the basics of spreadsheet use and effective graphical representation of data, while the second dealt with a simple statistical approach to hypothesis testing employing confidence intervals. Primed by these modules, at the close of the semester, each team reported to the class the results of their hypothesis test based on their own field data.

At the start of the mini-workshop, each of five teams of participants received a pair of temperature loggers programmed to record at 30-second intervals. The teams were instructed to locate two “microhabitats” within 1 m of each other (Table 1) inside the computer lab setting of the workshop. The loggers recorded for over 20 minutes while the participants learned about the actual field project and the quantitative modules.

Table 1. Location of temperature loggers used by mini-workshop teams. (Note: there was no Team 3.)

Team #	Location Logger A	Location Logger B
1	by projector exhaust vent	1 m away from Logger A
2	desk top	CPU
4	CPU	bottle of chilled liquid
5	on floor near ice pack	on ice pack
6	Mike's left armpit	end of table in middle of room

The supplemental materials for this workshop include several resources: data collected by the workshop participants, an Excel spreadsheet providing a template for statistical calculations (means and 95% confidence intervals) for these temperature data, instructions for use of the spreadsheet, and actual field data (winter temperatures recorded from a streambed and adjacent bank). It is likely that an expanded version of this mini-workshop, offering more extensive hands-on experience will be submitted for consideration as a future major workshop.

Link to Supplemental Materials: www.ableweb.org/volumes/vol-32/smedley/supplement.htm

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