



**Bureau of Water Quality
Division of Environmental Assessment
Biomonitoring Program**

Protocols for Measuring Continuous Water Temperature Using an Onset Data Logger

Appendix A: Protocols for Testing Temperature Logger Precision

1. Equipment List

- A. Temperature loggers
- B. Plastic trays
- C. Sturdy objects to keep trays off work surface

2. Procedure

A. Preparing Data Loggers

- (1) Enter test information (date, person performing test, equilibration time start, start and end time of test) and logger numbers in precision test form (see App. Ai for template and link to working form). Use a new worksheet for each year.
- (2) Launch loggers as described in *Protocols for Measuring Continuous Water Temperature Using an Onset Data Logger*. Set the delay start time of each data logger so they will all begin recording temperature at the same time (e.g., 11:00 a.m.) and at the same interval (i.e., every 3 minutes). Set the start time to include the equilibration time – generally 30 minutes prior to the test start time. Launch all loggers to be tested prior to setting up the test, as describe below.

B. Logger Precision Test

- (1) Place prepared loggers on plastic trays. Mix loggers of different age cohorts (year purchased) in trays, and also mix cohorts within each tray.
- (2) To allow for temperature equilibration, place trays into fume hood (ventilation and lights turned off) 30 minutes before they are to begin recording temperatures for precision testing purposes. Put trays side by side on sturdy objects (cardboard boxes, glass sample jars without metal lids) to keep trays away from metal work surface and airstreams at bottom of fume hood.
- (3) Close fume hood (there will be a ~1 inch space at the bottom). Stick note on hood to indicate that precision testing is in progress (from ... to ...) and a contact name and phone number.
- (4) Leave loggers in the fume hood for 2 hours.
- (5) Remove loggers from fume hood and download the temperature information. Transfer the time and temperature recorded by each logger into the precision test form (App. Ai), Augusta H:\L&W\WATERSHED\Monitoring &



Assessment\Program\Biomonitoring\SOPs-Instructions\BIOMON TRACKING
LISTS\Tracking temp loggers precision.xls.

- (6) Calculate the mean temperature recorded by each logger during the 2-h test period, and the grand mean (GM, the mean of all loggers means). Next, calculate the $GM + 0.5\text{ }^{\circ}\text{C}$ and $GM - 0.5\text{ }^{\circ}\text{C}$.
- (7) Graph logger means, GM, and $GM \pm 0.5\text{ }^{\circ}\text{C}$ as shown in App. Ai. Add lines to graph to indicate $GM \pm 0.5\text{ }^{\circ}\text{C}$.
- (8) Any logger whose mean falls between the $GM \pm 0.5\text{ }^{\circ}\text{C}$ lines is considered acceptable and can be marked 'Y' in the row 'Acceptable?' in App. Ai.
- (9) Any logger whose mean falls below or above the $GM \pm 0.5\text{ }^{\circ}\text{C}$ lines is considered problematic and must be marked 'N' in the row 'Acceptable?' in App. Ai. Repeat the test procedure for all out of bounds loggers and four loggers considered acceptable. Enter data from re-run in precision test form (App. Ai) under 'Sample run 2', and proceed with calculations as for run 1 [i.e., 2. B. (5) – (7)]. If the mean of a re-run logger falls within the $GM \pm 0.5\text{ }^{\circ}\text{C}$ lines, the logger is considered acceptable and can be marked 'Y' in the row 'Acceptable?' in App. Ai (Sample run 2). If the mean of a re-run logger again falls below or above the $GM \pm 0.5\text{ }^{\circ}\text{C}$ lines, the logger must be either repaired or removed from use.
- (10) NOTE: Temperatures in the fume hood are not stable. Expect to see an increase of approximately 1 degree Celsius over a 2-hour testing period.

3. References

Idaho Division of Environmental Quality, 1999. Protocol for placement and retrieval of temperature data loggers in Idaho Streams. Water Quality Monitoring Protocols-Report No. 10