

Activities for undergraduate classrooms using BBZ Data

Incorporate Bugs Below Zero Community Science data into lab and class activities for freshwater biology or ecology courses.

Activities are appropriate for course sections focused on invertebrate biology, aquatic insects, phenology, and science communication and data synthesis and presentation.

Activity 1.

- Students Investigate phenology and emergence patterns in aquatic insects.
 - **Learning objectives:** Relate emergence patterns to weather and other environmental variables, relate work to larger climate change trends, and make predictions about emergence patterns and phenology of cold-adapted chironomids.
 - **Activity using raw data from Anecdata:**
 - Find a stream location nearest your school in the dataset.
 - Analyze emergence timing in relation to environmental conditions such as water temperature, air temperature, time of year, stream substrate, ice cover etc.
 - Compare this to another local stream with different temperature/habitat/etc. characteristics.
 - **Questions to consider:** How does emergence change with water temperature? Stream habitat types and substrate? How could warming temperatures affect emergence patterns? What effect might this have on other organisms that feed or rely on chironomids?
 - **Make predictions:** Look at the climate data and make some predictions about future changes to emergence patterns and phenology. Predict how changes to phenology might affect food webs and ecosystem functions in streams

Activity 2.

- Behavior study: Students investigate patterns in insect behavior under different conditions.
 - **Learning objectives:** Investigate insect behaviors under different environmental conditions, relate behaviors to literature on what is known about freeze avoidance in chironomids and other insects, predict behavior changes under different weather and climate conditions.
 - **Activity using raw data from Anecdota:**
 - Analyze data collected on the behavior of insects on the snow and/or mating pairs by summing up the total number of individuals exhibiting each behavior and investigating when these behaviors occur.
 - **Questions to consider:** How does insect behavior change with regard to temperatures, weather, etc. Are there different behaviors exhibited on sunny days vs. snowy days? Does the activity change based on air temperature or other variables? Are insects walking on the snow below or above freezing? Which insects?
 - **Make predictions:** Based on the observations, what group of insects would be most active under the coldest temperatures? Warmest? When would mating be most likely to occur? How could climate change affect this?

Activity 3.

- Students create a communication piece on use of the data to communicate their work to a younger audience (k-12) or any community member unfamiliar with freshwater science.
 - **Learning objectives:** Create a science communication and education piece to relate your work to the public or younger audiences.
 - **Activity can use multiple formats to communicate the work effectively**
 - Create a presentation, flier, or infographic to communicate:
 1. The background for and significance of studying aquatic insects
 2. Key results from one of the 2 projects above
 3. Conclusions and takeaways relating work to broader topics like climate change, ecosystem functioning, or food webs easy for a non-scientific audience to understand
 - **Questions to consider:** Why should anyone care about aquatic insects and chironomids? Why is winter important to study? Who is my audience and what background do they have in science? Is my work easy to follow and understand? Am I using colors and shapes in helpful ways especially for visually impaired folks?