

Augusta Canal Benthic Macro Invertebrate Lesson Plan
Stage 1 – Desired Results

<p>Title: What lives in the Canal? Augusta Canal Water Quality</p>	<p>Subject/Course: Life Sciences</p> <p>Grade: 7</p>
<p>Big Ideas: What do benthic macro invertebrates living in the Augusta Canal indicate about the canal's water quality?</p>	
<p>Established Goals:</p> <p>Georgia Performance Standards</p> <p>S7CS2. Students will use standard safety practices for all classroom laboratory and field investigations.</p> <p>S7CS3. Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.</p> <p>S7CS9. Students will investigate the features of the process of scientific inquiry.</p> <p>S7L1. Students will investigate the diversity of living organisms and how they can be compared scientifically. A. Demonstrate the process for the development of a dichotomous key. B. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system (1archaeobacterial, eubacteria, protists, fungi, plants, and animals)</p> <p>South Carolina Standards-Ecology</p> <p>Standard 7.EC.5: The student will demonstrate an understanding of how organisms interact with and respond to the biotic and abiotic components of their environments.</p> <p>7.EC.5B.3 Analyze and interpret data to predict how changes in the number of organisms of one species affects the balance of an ecosystem.</p> <p>7.EC.5B.4 Define problems caused by the introduction of a new species in an environment and design devices or solutions to minimize the impact(s) to the balance of an ecosystem.</p>	
<p>Enduring Understandings: Students will understand...</p> <ul style="list-style-type: none"> • The difference between point source and non-point source pollution. • Different macro invertebrates tolerate different levels of pollution. • Water quality is a relative term. • Citizens share in the responsibility to test and monitor water quality in local waterways. 	<p>Essential Questions:</p> <ol style="list-style-type: none"> 1. What are some key measurable factors that affect animal and plant life in the Canal? 2. What is a macro invertebrate? 3. How many different types of invertebrates live in the Canal? 4. How dense is the bug population? 5. What percent of the invertebrates are crustaceans? 6. What conclusion can we draw about the water quality from the bug population? 7. How can citizens get involved in testing and monitoring local waterways?
<p>Knowledge Students will know...</p> <ul style="list-style-type: none"> • Accepted ways of measuring water quality of a stream or river is through looking at physical, biological and chemical indicators. • How the three indicators of water quality are measured. • What natural and human factors cause populations of macro invertebrates to change. 	<p>Skills Students will be able to...</p> <ol style="list-style-type: none"> 1. Explain the difference in physical, biological, and chemical water quality indicators. 2. Obtain water samples containing macro invertebrates. 3. Use a dichotomous key. 4. Find macro invertebrates in a water sample.

Stage 2 – Assessment Evidence

Performance Tasks/Projects:

1. Identify macro invertebrates by using a Dichotomous key.
2. Calculate water quality by the number of macro invertebrate found in water sample.
3. Combine findings of all groups and find the average water quality score for Augusta Canal.

Other Evidence:

- Calculations and verbal participation in National Parks Service web activity.
Accuracy in findings.
Completion of finding summary sheet.

Stage 3 – Learning Plan

Pre-visit Activities

1. “What do you see?” Anticipation writing activity.
2. Learn Benthic Macro Invertebrate Lesson Vocabulary.
3. Watch macro invertebrate PPT with quiz.

On-site Activities

1. Take 45 minute boat ride to make canal observations and listen to interpretation of the waterways history of naturalization, how water quality is measured, and influences human and natural of indicators of water quality.
2. Pull Hester Dendy from dock area and collect water sample of substrate. (20 min)
3. Test water temperature and clarity.
4. Watch and participate in National Parks Service web macro invertebrate activity. (10 min)
5. Identify macro invertebrate using a dichotomous key.(20 min)
6. Count different types of macro invertebrates and calculate water quality. (5 Min)
7. Discuss local community organizations dedicated to testing and monitoring waterways. (10 min).

Post-visit Activities

1. Read and report on local fish kill and causes: www.gpb.org/news/fishkill/related
2. Identify macro invertebrates on food web diagram from Augusta Canal website.

Materials:

Clip board and data sheet

Ruler

Sorting tray

Petri dish

Thermometer

Secchi disk

Macro Invertebrate dichotomous key

Stream Assessment form

Tweezers

Magnifiers

Internet connection to National Parks Service web page

<http://www.nps.gov/webrangers/activities/waterquality/>

Benthic Macro Invertebrate Lesson Terms	
Abiotic factor	of or characterized by the absence of life or living organisms.
Aquatic Organisms	Any organism that breeds, breathes, grows, lives, and eats in water.
Benthic	relating to, or occurring at the bottom of a body of water.
Bioassessment	a specific process required as part of an environmental assessment. An evaluation of potential effects of a proposed project on proposed, endangered, threatened, and sensitive animal and plant species and their habitats.
Biological Indicators (water quality)	macro invertebrates present- The abundance and diversity of macro invertebrates found is an indication of overall water quality.
Biotic factor	a living thing, as an animal or plant, that influences or affects an ecosystem: "How do humans affect other biotic factors?"
Chemical Indicators (water quality)	Dissolved Oxygen and pH (acid or basic)
Conductivity	The theoretical definition of conductivity is the "reciprocal of the resistance of a cube of a substance 1 cm on a side at a specified temperature". Typically the units of measure are microhms/cm (uohms/cm) or microsiemens/cm (uS/cm). Conductivity or specific conductance is a measure of the ability of a fluid to carry a charge which is directly related to the concentration of dissolved substances. As the total dissolved substances in the water increases, the conductivity of the water also increases.
Dichotomous Key	A reference tool where a series of choices between alternative characters leads progressively to the identification of the species.
Dissolved Oxygen	Or DO: Oxygen that is dissolved in water and available for aquatic plants and animals to breathe. Measured in parts per million.
Exoskeleton	a skeleton on the outside of the body. Arthropods produce a tough external covering called an exoskeleton
Hester Dendy	artificial substrates
Larva	the immature free-living form of most invertebrates and amphibians and fish which at hatching from the egg is fundamentally unlike its parent and must metamorphose
Macro invertebrates	animals without a backbone that can be seen with the naked eye.
Non-point source pollution	pollution discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff. Non-point source pollution is contamination that occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards. As this runoff moves across the land surface, it picks up soil particles and pollutants, such as nutrients and pesticides.
Nymph	an immature form of an insect that does not change greatly as it grows, e.g., a dragonfly, mayfly, or locust.
pH	pH—a measure of the relative acidity or alkalinity of water. Water with a pH of 7 is neutral; lower pH levels indicate increasing acidity, while pH levels higher than 7 indicate increasingly basic solutions.
Physical Indicators (water quality)	temperature, conductivity, and turbidity(water clarity)
Point source pollution	point-source pollution—water pollution coming from a single point, such as a sewage-outflow pipe.
Substrate	A surface on which an organism grows or is attached
Tolerant	inclined or disposed to tolerate; showing tolerance; forbearing:
Turbidity	the amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Thus, turbidity makes the water cloudy or even opaque in extreme cases. Turbidity is measured in nephelometric turbidity units (NTU).