Lesson 2

Timeframe

Three 50-minute class periods, depending on the class and how much students already know about water quality and macroinvertebrates

Materials

- Water quality sampling equipment —StreamWebs water quality and macroinvertebrate datasheets (http://streamwebs.org/resources/data-sheets)
- Containers and labels for water quality activity
- Lemon juice, vinegar, coffee, baking soda, antacid, etc. to demonstrate pH
- Mud or debris to demonstrate turbidity
- Macroinvertebrate pictures from "Macro Mayhem" (http://smile.oregonstate.edu/lesson/macro-mayhem)

Objectives

- Work together and collaborate in teams
- Learn how to properly collect and record data
- Be introduced to StreamWebs and equipment they will use in the field
- Learn how to create, log in to, and use the class StreamWebs account

Getting Ready for the Field

Teacher Background

For information on water quality and macroinvertebrates, refer to: A Citizen's Guide to Understanding and Monitoring Lakes and Streams, http://water.usgs.gov/edu/waterproperties.html

"Water Quality and Macroinvertebrate Field Studies," found in "Resources" section for individual Kits: http://seagrant.oregonstate.edu/education/streamwebs-educator-kits/streamwebs-kit-descriptions

For information on setting up an account and getting started using the StreamWebs database, refer to the sheet "Getting to know StreamWebs."

Description

In this lesson, students will learn about the research tools available to them for collecting data, how scientists monitor water quality health, and the online resource www.streamwebs.org for storing data. After students have a better understanding of the resources available to them, they will work on creating an investigative research question.

Preparation

Create a StreamWebs account ahead of time to share with your class. It is recommended that you share one account as a class.

1. Go to www.streamwebs.org; "Create New Account." It is recommended that you make one account that your class can login to so be sure to choose a user name and password that you will be comfortable sharing with students.
2. If there is an existing project site that you plan to work at you can locate it by selecting "Search Projects" from the menu. Sites are found by using the search bar and on the map by colored "pegs."

Preparation cont.

3. If you need to create a project site, select "Add Project" from the menu and enter in the information about your project site.
4. Obtain sampling tools for students to use as part of their investigation. Equipment may be available to borrow through your local watershed council, STEM hub, etc.
5. Make macroinvertebrate card packets for students to practice identification, using the pictures found in the "Macro Mayhem" lesson developed by Minnesota DNR (http://smile.oregonstate.edu/lesson/macro-mayhem). You will divide students into four or five groups and will need one packet per group. You will also need to set up "stations" with sample water that will allow students to practice collecting data with their equipment. You should label stations as different parts of the watershed, such as urban, rural, estuary, or upstream, downstream, etc. You could also provide each group of students with their own "set" of samples rather than rotating. If you are unable to collect a variety of water samples to show variation, you will want to adjust your water accordingly. In order to get a good variety of pH readings, you can add lemon at one station, baking soda to another, coffee to another, etc. Add mud or debris to demonstrate turbidity; hot and cold water for measuring temperature and dissolved oxygen; etc.

Activity Introduction

Explain to students that they will practice using sampling tools that help determine whether a stream is healthy. Specifically, they will be learning about the different water quality parameters and macroinvertebrate species commonly used to measure stream health.

Part 1: Understanding Water Chemistry

1. Ask students what we can learn by studying the water quality and macroinvertebrates in our watershed. *We can learn about the health of our watershed.*
2. What are some ways scientists determine whether a stream is healthy or unhealthy? *They do different tests to look at temp, oxygen in water, sediment in water, etc.*
3. Discuss stream temperature, dissolved oxygen, turbidity, and pH and what they measure and tell us about the water. Provide students with water quality parameters sheets (included in lesson).

Next Generation Science Standards

DISCIPLINARY CORE IDEAS:

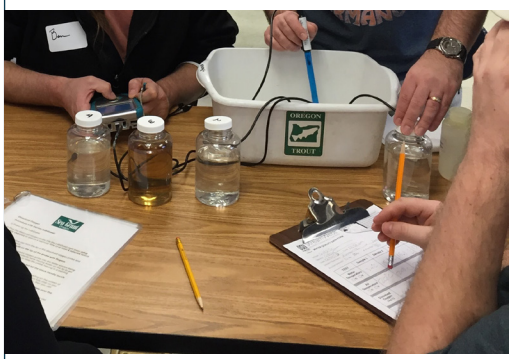
LS2.A: Interdependent Relationships in Ecosystems
ESS3.C: Human impacts on Earth Systems

PERFORMANCE EXPECTATIONS:

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

PRACTICES:

Practice 1: Asking Questions and Defining Problems
Practice 3: Planning and Carrying out Investigations



Preparation cont.

4. Ask students to break into pairs or small groups. Tell them they are going to do an inquiry activity to get to know the tools they will work with in the field.
5. Pass out field equipment to students and have them discuss: What is it? What is it used for? How does it work? What might this tool tell you about a water sample? How do you know? What is your *evidence?*
6. Pass out StreamWebs water quality datasheets to student teams, and use the Guiding Questions to help students understand the importance of data collection.
7. Have students rotate through the water quality sample stations and use their equipment to collect water quality data. Remind them to record all the required information on the datasheet.
8. When students have finished collecting their data, have them report out their findings.

Part 2: Understanding Macroinvertebrates

1. Tell students that scientists also use macroinvertebrates that live in the water to determine how healthy it is.
2. Define to the class what the word *macroinvertebrate* means. Break it up into *macro* (large enough for us to see with our naked eye) and *invertebrate* (without a backbone).
3. Explain how macroinvertebrates living in a stream can be an indicator for water quality.
4. Hand out to each group a packet of macroinvertebrate cards. Ask students what they notice about their macroinvertebrates that might help us tell them apart.
5. Explain that macroinvertebrates are grouped by characteristics similar to the ideas students just discussed. Among these characteristics are size and shape of their body, legs, eyes and mouth if visible, and where they are found in the stream. Now have them sort their macroinvertebrates based on some of the things they notice about them.

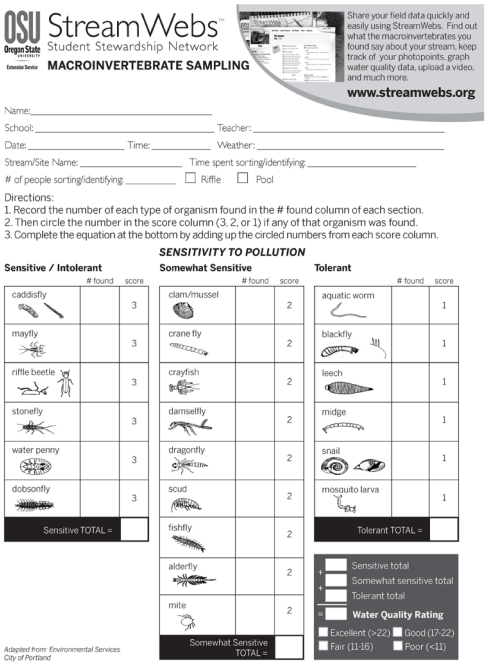
Guiding Questions

- **What are data?** *Facts and information gathered from observation. Data can be numbers, words, sketches, and drawings—all of the things we just collected with our tools.*
- **Why is it important to collect data?** *Data are part of the scientific method (explain, if a new idea to students). Data help scientists gain understanding about the natural world, identify patterns and correlations, answer questions, and make conclusions.*
- **Why is it important to record data accurately and neatly?** *Once collected, data are often input into a database, such as StreamWebs, or a spreadsheet. It is important to be able to read what you have recorded so that it can be input later. Common errors such as bad handwriting, no recorded date, or blank spots on datasheets can make it difficult to use the data.*
- **What will we do if we do not have information to record in a certain spot on our datasheets?** *Instruct students to record the number 0, mark N/A, or note other reasons for no data collected.*

Macroinvertebrates cont.

Discuss what it means to be a tolerant versus an intolerant macroinvertebrate species. *Some macroinvertebrates are able to handle pollution better than others.*

7. Hand out macroinvertebrate datasheets. Ask students to sort their macroinvertebrate cards by tolerance level and record them on their datasheets. What does the water quality rating tell you about the health of the stream?
8. Discuss the importance of recording readable data. Have students review their sheets and see how they did.


OSU Oregon State University Extension Service StreamWebs Student Stewardship Network

MACROINVERTEBRATE SAMPLING

Share your field data quickly and easily using StreamWebs. Find out what the macroinvertebrates you found say about your stream, keep track of your photopoints, graph water quality data, upload a video, and much more.

www.streamwebs.org

Name: _____

School: _____ Teacher: _____

Date: _____ Time: _____ Weather: _____

Stream/Site Name: _____ Time spent sorting/identifying: _____

# of people sorting/identifying: _____ ☐ Riffle ☐ Pool

Directions:
1. Record the number of each type of organism found in the # found column of each section.
2. Then circle the number in the score column (3, 2, or 1) if any of that organism was found.
3. Complete the equation at the bottom by adding up the circled numbers from each score column.

SENSITIVITY TO POLLUTION

Sensitive / Intolerant	# found	score
caddisfly		3
mayfly		3
riffle beetle		3
stonefly		3
water penny		3
dobsonfly		3
Sensitive TOTAL =		

Somewhat Sensitive	# found	score
clam/mussel		2
crane fly		2
crayfish		2
damselfly		2
dragonfly		2
scud		2
fishfly		2
alderfly		2
mite		2
Somewhat Sensitive TOTAL =		

Tolerant	# found	score
aquatic worm		1
blackfly		1
leech		1
midge		1
snail		1
mosquito larva		1
Tolerant TOTAL =		

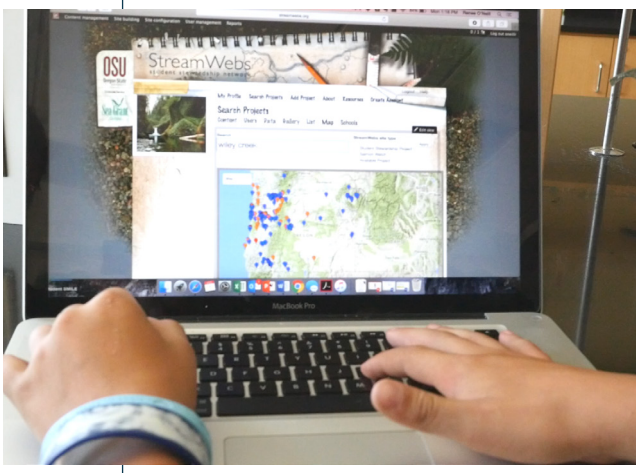
Sensitive total
+ Somewhat sensitive total
+ Tolerant total
= **Water Quality Rating**

☐ Excellent (>22) ☐ Good (17-22)
☐ Fair (11-16) ☐ Poor (<11)

Adapted from: Environmental Services City of Portland

Part 3: Getting Comfortable with the StreamWebs Website

1. Show students how to log in to StreamWebs, and share the username and password with students. *We recommend one class account that students share, as it is easier to manage.*
2. Have students visit the site page where they will be collecting data during your class field trip(s).
3. Show students how they will go about entering water quality and macroinvertebrate data into the website after their field trip. Have them make note of the importance of having complete datasheets. Are their datasheets missing any important information?
4. Give students time to explore the website and look at what other schools are doing and the data they have collected.



Activity Wrap Up

Review with students what tools they are going to use to investigate their watershed. Now that they have practiced using sampling equipment and datasheets and learned more about what data they will be collecting, they are ready for the field! Go over any need-to-know information for your upcoming field day, such as what to bring or not bring, appropriate clothing, boots, etc.

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Published by Oregon Sea Grant, 1600 SW Western Blvd., Suite 350, Corvallis, OR 97333. Phone: 541-737-2714. Web: seagrant.oregonstate.edu/

This report was prepared by Oregon Sea Grant under award number NA16NOS4290143 (grant ID NA295A) from the National Oceanic and Atmospheric Administration (NOAA) StreamWebs Student Stewardship, U.S. Department of Commerce, and by appropriations made by the Oregon State Legislature. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of these funders.

ORESU-E-17-002

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