Mock Stream Habitat Assessment:

Bringing the outside in!

Objectives:

At the end of this activity, youth should be able to:

- Assess the overall health of a stream habitat
- Apply the terms abiotic and biotic
- Explain how abiotic and biotic factors relates in stream ecosystem

Time to prep: 30 minutes
Time to complete activity: 15-20 minutes

Skill level: Intermediate (grades 6-8)

Background:

Why monitor streams?
All life depends on water and we all contribute to the quality of our local watershed. Our activities and usage of water and land affects the quality of our drinking water and the health of aquatic plants and animals.

How do you determine the health of a stream?
An ecosystem is a fine balance of interactions between the living (biotic) and non-living (abiotic) factors. To fully understand the health of a stream ecosystem, we must collect data on all of these factors. Abiotic factors can be measured by recording the water chemistry and the physical characteristics of the stream. Biotic factors can be measured by collecting and identifying pollution indicator organisms such as benthic macroinvertebrates, fish, and algae. Certain organisms can help indicate water quality due to how sensitive or tolerant they are to pollution. This level of sensitivity is quantified using what is called the Pollution Tolerant Index (PTI) and is used to calculate the quality of water. The PTI takes into account the level of pollution tolerance of each organisms and the abundance of each organisms found. For instance, if mostly pollution tolerant organisms were found in a body of water, it would indicate the quality of water is mostly poor. However, if highly sensitive organisms were found along with pollution tolerant it would indicate good water quality.

Materials:

Building your mock streams

- 3 boxes (tissues boxes or other)
- 3 pictures of different streams environments (rural, agricultural, urban)
- Laminated cut-outs of macroinvertebrates and chemical parameters *(See resources)*
- Stream Health Data Sheets *(See resources)*
- Tape
- Optional: WaterQuality app and iPads

Build your mock stream by taping or wrapping the picture of a stream around the outside of each box. Place the corresponding macroinvertebrates and chemical parameters (as labeled) inside each box.

Methods:

1. Participants will be placed into groups of 2 to 4
2. Each group will receive a mock stream box and a stream health data sheet
3. Individuals will work together to collect data for the three parameters (as indicated on the Stream Health Data Sheet) and record their data on the data sheet
    a. Optional: Data can also be recorded in the water quality app for chemical and biological parameters. Physical observations can be recorded in the notes section of the app. Each parameter in the app can be clicked on to learn more about what it is, how it is measure, and how it relates to water quality. Each parameter displays this information in written form along with a graphic to aid all learners.
4. Groups will then analyze their collected data to determine their streams overall health
5. Each group will share their stream assessment and support their claim with data that was collected

Reflection Questions:

Why do you think we need to collect data on all three of the parameters (Physical, chemical, biological)?

a) An ecosystem is a balance of abiotic (non-living) and biotic (living) factors. Like any investigation, if we only look at one or two sides we may not get the full story.

What if one or more of the parameters indicated an unhealthy environment? Think of your own example from this activity and explain what could have caused this? Then, what do you think could be done to correct it?

a) E.g. Agriculture stream- Chemical parameters indicated poor water quality, very high levels of nitrates and high pH. Animal waste or fertilizer running off into the stream could have cause this. To correct this, animal waste could be picked up or less fertilizer could be applied. Since the physical parameters also indicated poor water quality due to a lack of vegetation, more plants could be planted along the sides of the stream to filter land runoff.

Can you think of another type of environment this type of assessment can be applied to? Why might it be important to know this environment's "full story"?

a) E.g. Soil- for agriculture, it is important to know and understand soil health when growing crops. Physical properties- soil texture, drainage, Chemical properties- pH, nutrients, Biological- microorganism and other invertebrates presents. All of these parameters determine what type of plants can grow and how well can they grow in the soil.

Supplemental Information:

Learn more about how water quality data is collected throughout the state of Indiana:
http://www.hoosierriverwatch.com/

Indiana watersheds:
https://www.in.gov/idem/nps/2369.htm

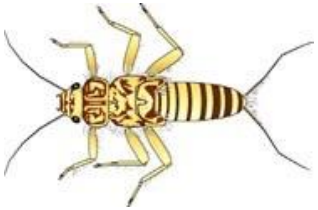
Water Science and Education:
http://www.watercontheweb.org/index.html
https://www.nwf.org/Educational-Resources/Educator-Tools/Lesson-Plans-and-Webinars
https://www.enviroscapes.com (Available to use from the State Office)

Vocabulary:

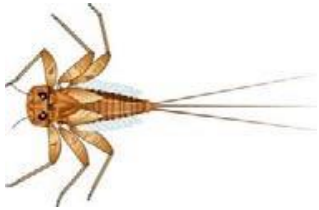
Abiotic- the physical (non-living) parts within an environment
Biotic- The living organisms within an environment
Ecosystem- a community of organisms interacting with their physical environment
Pollution- the introduction or presence of a potentially harmful substance in an environment
Watershed- Where water present on land drains and collects into a river system or other body of water

Rural

Resources



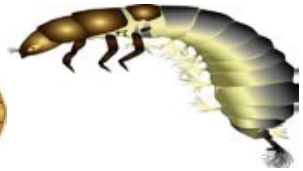
Stoneflies



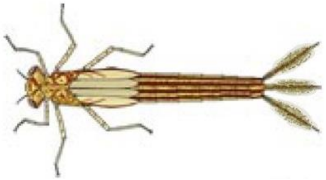
Mayflies

Dobsonfly Larva

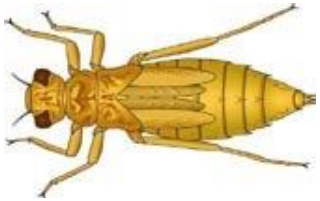
Water pennies



Caddisflies



Damselflies



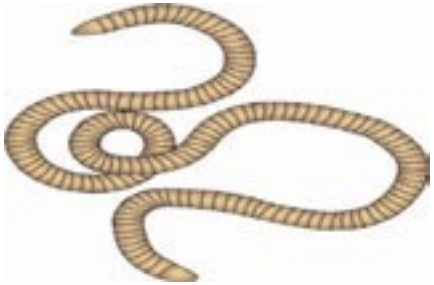
Dragonflies

Crayfishes

Aquatic sowbugs

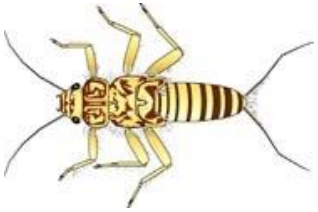
Flatworms

Leeches

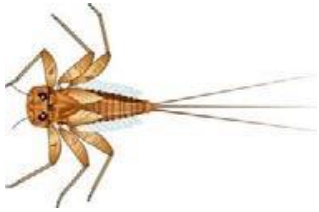


Aquatic worm

Agricultural



Stoneflies

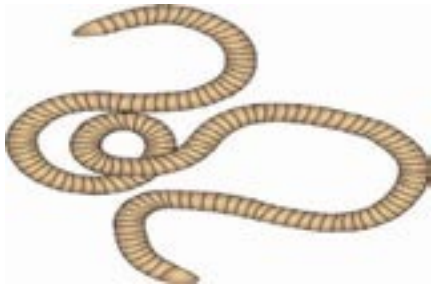


Mayflies

Black flies

Flatworms

Leeches



Aquatic worm

Blood Midge

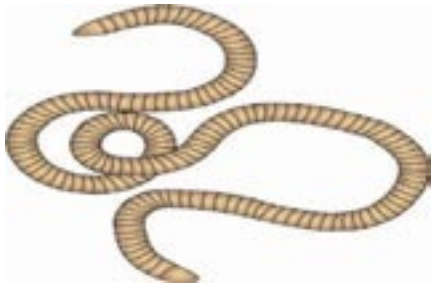
Midge

Urban


Black flies


Flatworms


Leeches

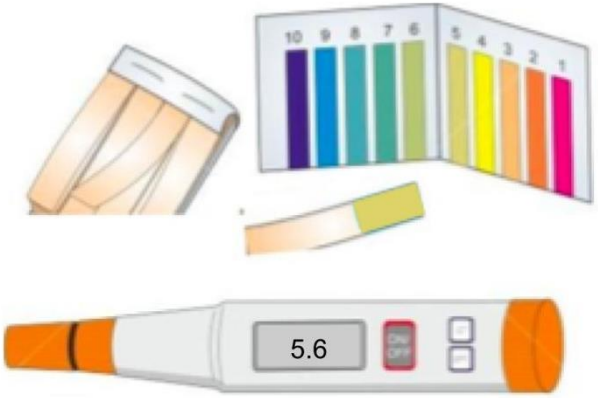

Aquatic worms


Blood Midge


Midge

Source of macroinvertebrate images:
Kentucky River Water Watch
Administered by the Kentucky Water Resources Research Institute, University of Kentucky
http://www.uky.edu/krww/content/watershed-watch-materials

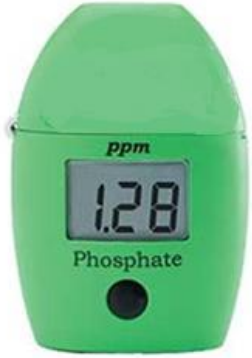
Urban Chemical Parameters



pH

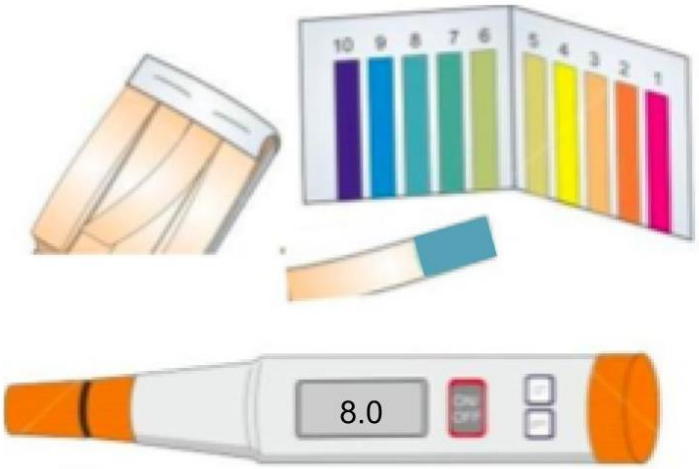
Temperature (25 °C)

Nitrates (mg/L)



Phosphates (mg/L)

Agricultural Chemical Parameters



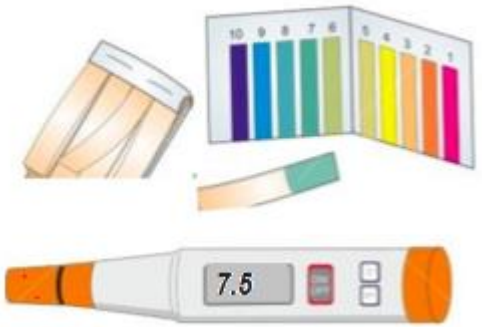
pH

Temperature (21 °C)

Nitrates (mg/L)

Phosphates (mg/L)

Rural Chemical Parameters



pH

Temperature (16 °C)

Nitrates (mg/L)

Imaged modified from:
https://americanmarineusa.com/

Phosphates (mg/L)

Imaged modified from:
https://www.bulkreefsupply.com

Rural stream

Source:
http://rockandriffle.blogspot.com/2015/04/uodome-and-new-stream.html

Agricultural Stream

Source:
https://www.hobbyfarms.com/promote-healthy-waterways-on-your-farm/

Urban Stream

Source:
https://www.blogto.com/city/2016/05/the_weird_and_wonderful_concrete_river_in_toronto/

Chemical Parameters

Circle the corresponding value for the chemical parameters collected from your stream in the data table below

Chemical Parameter	Good (4)	Fair (3)	Marginal (2)	Poor (1)
pH	6.8-7.7	6.5-6.7 7.8-8.2	6.2-6.4 8.3-8.5	<6.2 >8.5
Temperature* (°C)	14-20	21-24	25-27	>27
Nitrates (mg/L)	<1.5	1.6-3.5	3.6-8.4	>8.4
Phosphates (mg/L)	<0.1	0.2-0.4	0.5-0.9	>1.0

*Range for cool-water species

Average chemical quality rating: _____

Analysis: 16-13 Good, 12-9 Fair, 8-6 Marginal, 4-5 Poor

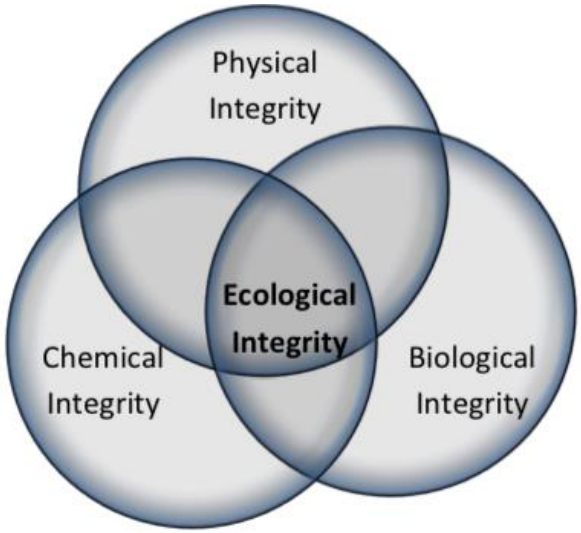
Overall Stream Health Assessment

	Good	Fair	Marginal	Poor
Physical				
Biological				
Chemical				
Overall Average Stream Health: _____				

Stream Health Data Sheet

Developed by: Alexus Maschinot,
Modified resources from: Maryland, Indiana,
and Kentucky's Department of Natural Resource

Record the data you collect on this sheet as you conduct assessments to determine the overall health of your mock stream. There are three types of parameters you will be investigating: (1) Biological- using macroinvertebrates presents to indicate stream health. (2) Physical- rating the condition of the stream habitat based on observed characteristics. and (3) Chemical- testing the water quality based on the chemical content of the stream. It takes a combination of all three parameter types to obtain a thorough understanding the health of an ecosystem.



Name: _____

Biological Parameters

Check all of the macroinvertebrates that you find in your stream and calculate the stream's water quality rating

Sensitivity to Pollution			
Very Sensitive	**Sensitive**	**Somewhat Tolerant**	**Tolerant**
Stoneflies	Damselflies	Midges	Aquatic worms
Mayflies	Dragonflies	Black flies	Blood Midges
Dobsonflies	Crayfishes	Flatworms	Rat-tailed maggots
Water pennies	Sowbugs	Leeches	Left snails
Caddisflies	Scuds	Clams	
# of checks _____ X 4= _____	# of checks _____ X 3= _____	# of checks _____ X 2= _____	# of checks _____ X 1 = _____

Sum total_____

Analysis: 23> Good, 22-17 Fair, 16-11 Marginal, <10 Poor

Physical Parameters

Circle the corresponding description for the physical characteristics seen in your stream

Characteristic	Good (4)	Fair (3)	Marginal (2)	Poor (1)
Channel alteration	Channel formed naturally and has many bends	Channel straightened in some places but some natural bends still present	Channel mostly straightened	Channel straightened and flowing along a paved channel
Erosion	Banks only slightly above the level of the water	Banks somewhat higher above the level of the water	Banks significantly above the level of the water	Banks extremely high compared to water level
Attachment sites for Macro-invertebrates	Lots of different sized rocks, wood, and plenty of leaf litter	Only small, gravel sized rocks, some wood and leaf litter present	No rocks or wood but some leaf litter present	No rocks, wood, or leaf litter present
Riparian Buffer Width (estimation)	More than 50 feet of trees and vegetation from each bank	20 - 50 feet of trees and vegetation	5-20 feet of trees and vegetation	0-5 feet of trees and vegetation

Total score _____

Analysis: 16-13 Good, 12-9 Fair, 8-6 Marginal, 4-5 Poor