



FRESHWATER STREAMS: What lives in our freshwater stream?

DIVE DEEPER:

- Did you have any questions as you watched the video? Take some time to explore and research the topics that sparked your curiosity.

GOT IT!



- Be the expert. See next page. Using what you learned, we are going to use macroinvertebrates as indicators of stream health. First, we will identify macroinvertebrates found in three different streams. Next, we will divide these macroinvertebrates into three categories of species – Tolerant, Facultative, or Sensitive. Finally, we will calculate a score for each stream that tells us how healthy that stream is.

GOT IT!

If a stream is healthy, we could expect to find many healthy things living in it. If the stream is unhealthy, we could expect to find few things living in it, or find it full of unhealthy creatures. When we conduct a biological survey of a stream, we study the things that live in the water and make inferences about the environment in which they live.

For the next portion of this investigation, you will need two things:

- First, watch the Video: Freshwater Stream Health
cbf.org/news-media/multimedia/video/cbf-education-videos/freshwater-stream-health.html
- Second, find the Macroinvertebrate Key from the Pennsylvania Department of Environmental Protection attached to this document.
You will use this resource to identify macroinvertebrates and calculate a score for your stream, revealing how healthy (or not so healthy) it is.

Application

Below are three lists of macroinvertebrates found in three different streams. Using the Macroinvertebrate Key provided by the Pennsylvania Department of Environmental Protection, find each macroinvertebrate. Below each critter is a T, F, or S. These stand for Tolerant, Facultative, or Sensitive. Once you find all the Macroinvertebrates in the list, categorize them into the following categories.

- Tolerant Species,
- Facultative Species
- Sensitive Species

Using the scoring charts below, add the totals for the three categories to come up with each stream's score. Finally, determine how healthy or unhealthy each stream is based on its score.

Macroinvertebrate Data Set 1

6 leeches
10 whirligig beetles
2 waterpennies
10 caddisflies (stick houses)

Macroinvertebrate Data Set 2

7 gilled snails
3 scuds
5 crayfish
3 stonefly nymphs
1 damselfly nymph
2 leeches
1 waterpenny
2 pouch snails
1 isopod

Macroinvertebrate Data Set 3

1 cranefly larva
6 crayfish
7 scuds
3 pouch snails
2 gilled snails
4 dobsonfly larvae
11 mayfly nymphs
5 stonefly nymphs
1 dragonfly nymph
2 caddisfly larvae
(no house, no tails)
4 planaria
19 whirligig beetles
1 caddisfly larva (2 tails)

Macroinvertebrate Data Set 1

Tolerant Species

Facultative Species

Sensitive Species

$$\underline{\text{Tolerant Total}} \times 1 = \underline{\quad} \quad \underline{\text{Facultative Total}} \times 2 = \underline{\quad} \quad \underline{\text{Sensitive Total}} \times 3 = \underline{\quad}$$

TOTAL SCORE = Overall, how healthy is this stream based on its score?*

Macroinvertebrate Data Set 2

Tolerant Species

Facultative Species

Sensitive Species

$$\underline{\text{Tolerant Total}} \times 1 = \underline{\quad} \quad \underline{\text{Facultative Total}} \times 2 = \underline{\quad} \quad \underline{\text{Sensitive Total}} \times 3 = \underline{\quad}$$

TOTAL SCORE = Overall, how healthy is this stream based on its score?*

Macroinvertebrate Data Set 3

Tolerant Species

Facultative Species

Sensitive Species

$$\underline{\text{Tolerant Total}} \times 1 = \underline{\quad} \quad \underline{\text{Facultative Total}} \times 2 = \underline{\quad} \quad \underline{\text{Sensitive Total}} \times 3 = \underline{\quad}$$

TOTAL SCORE = Overall, how healthy is this stream based on its score?*

* Scoring: 27+ = Excellent, 22-26 = Very Good, 17-21 = Good, 11-16 = Fair, Less than 11 = Poor

Be the Expert

Now that you've scored the three streams, match them with the written descriptions below. Read the physical descriptions of three streams below: Stream A, Stream B, and Stream C. Based on what you know about the characteristics of a healthy stream, match the macroinvertebrate data sets 1, 2, and 3 from above to the stream where they live using the descriptions below.

Stream A

This stream runs through a cow pasture. There is a fence keeping the cows out and a few shrubs along the water. The water is moderately clear and has no distinct smell. The banks are steep, without a lot of shade. The streambed is a mix of rocks and sediment.

Stream B

The water is clear and doesn't have a noticeable smell. There are a few downed trees in the water and lots of trees on the banks that hang over the stream. The streambed is rocky, with some sediment on the bottom in the slower-moving parts of the stream. In the faster-moving parts, there are pebbles and stones that create bubbles and movement, or riffles. The water feels cool.

Stream C

This stream is choked with trash. It smells like dead fish and the bottom is mostly muddy. It's hard to see the bottom because the water is so murky. The water flows sluggishly. The banks are steep and covered in grass, but there are a few areas that are just dirt.

Which macroinvertebrate data set goes with each of the streams described above?

Draw a line to match the macroinvertebrate data with its matching stream.

Macroinvertebrate Data Set 1 •

• Stream A:

Macroinvertebrate Data Set 2 •

• Stream B:

Macroinvertebrate Data Set 3 •

• Stream C:

Why did you pair them the way you did? What clues did you use? Explain your answer.

Activity

If you can, go to your local stream and see what macroinvertebrates you find.

What do they indicate about the health of your local stream?

Can you complete your own macroinvertebrate survey and give your stream a score? _____

If so, how did your stream do?

Using what you have learned, can you identify any problems with your local stream and suggest possible solutions to make it better?

Identify the Problem(s):

Possible Solution(s):

DIVE DEEPER:

Test Your Knowledge

Test your knowledge of freshwater macroinvertebrates
[High School Students](#)
[Middle School Students](#)



Learn More

Learn more about macroinvertebrates found in the Susquehanna River watershed.
[Susquehanna Video](#)

Check Out a Video

Watch this excellent video from the Smithsonian. It discusses why healthy streams are important to the Chesapeake Bay region and how scientists determine the health of a stream.
[Smithsonian Video](#)

Explore

Watch scientists from Penn State University hunt for macroinvertebrates to determine the health of a stream.
[Penn State Video](#)



MACROINVERTEBRATE KEY

Pennsylvania Department of Environmental

Key to Macroinvertebrate Life in the River

This key was developed by the University of Wisconsin - Extension in cooperation with the Wisconsin Dept. of Natural Resources. It was modified for use in the SWAP/HO project by Pennsylvania Dept. of Environmental Protection, Watershed Support staff. It may be reproduced for educational, non-profit purposes.

MACROINVERTEBRATE STUDY

Have your instructor show you how to use a fine mesh net to collect aquatic bugs and other invertebrates. Disturb the streambed for an area of about 1 square meter or yard (that's a square about 3 ft. long by 3 ft. wide). Try to catch all the organisms. If you don't have a net, you can carefully turn over rocks and look for organisms on and under the rocks and in the stream. Use the key you received with this packet to try to identify all the organisms you find. Scoring the invertebrates and determining a "WATER QUALITY RATING" can be done on the KEY sheet.

All the invertebrates on the key are marked with a "T", "F", or "S"

"T" = "tolerant," meaning they are not very sensitive to pollution and usually don't require a lot of dissolved oxygen. Each taxon (each kind, *not* each individual) you find in the "T" group scores 1 point.

"F" = "facultative," meaning that they are somewhat sensitive to pollution and require water of good quality. Each kind you find with an "F" rating scores 2 points.

"S" = "sensitive," meaning these macroinvertebrate organisms are very sensitive and require water of very good quality. These organisms are often referred to as "indicator organisms" because their presence indicates that the water is of good quality and probably not polluted with organic wastes. Each kind you find in this group scores 3 points.

You can rate the water quality based on both score and presence of sensitive bugs. See example and rating scale below:

Scoring and Water Quality Rating (revised 5/00)

Scoring and Taxon Quality Rating (Optional Box)

Excellent (score of 27+ or 5 or more "S" taxa) Fair (score of 11 - 16 or only 1 "S" taxon)
 V. Good (score of 22 - 26 or 4 "S" taxa) Poor (score of less than 11 and no "S" taxa)
 Good (score of 17 - 21 or 2 or 3 "S" taxa)

Example: if you found 8 pouch snails, 6 orb snails, 4 leeches, 6 water pennies, 3 riffle beetles, and 9 stoneflies Your score would be:
+1 +1 +1 +2 +2 +3 = 10

Note that one of your finds (stoneflies) was a Sensitive family! A score of 10 would normally indicate poor quality, however, since one of your bugs was an "S" (3 pointer), you would rate the water quality as "fair."

Use this space for reporting any additional information: