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BIODIVERSITY
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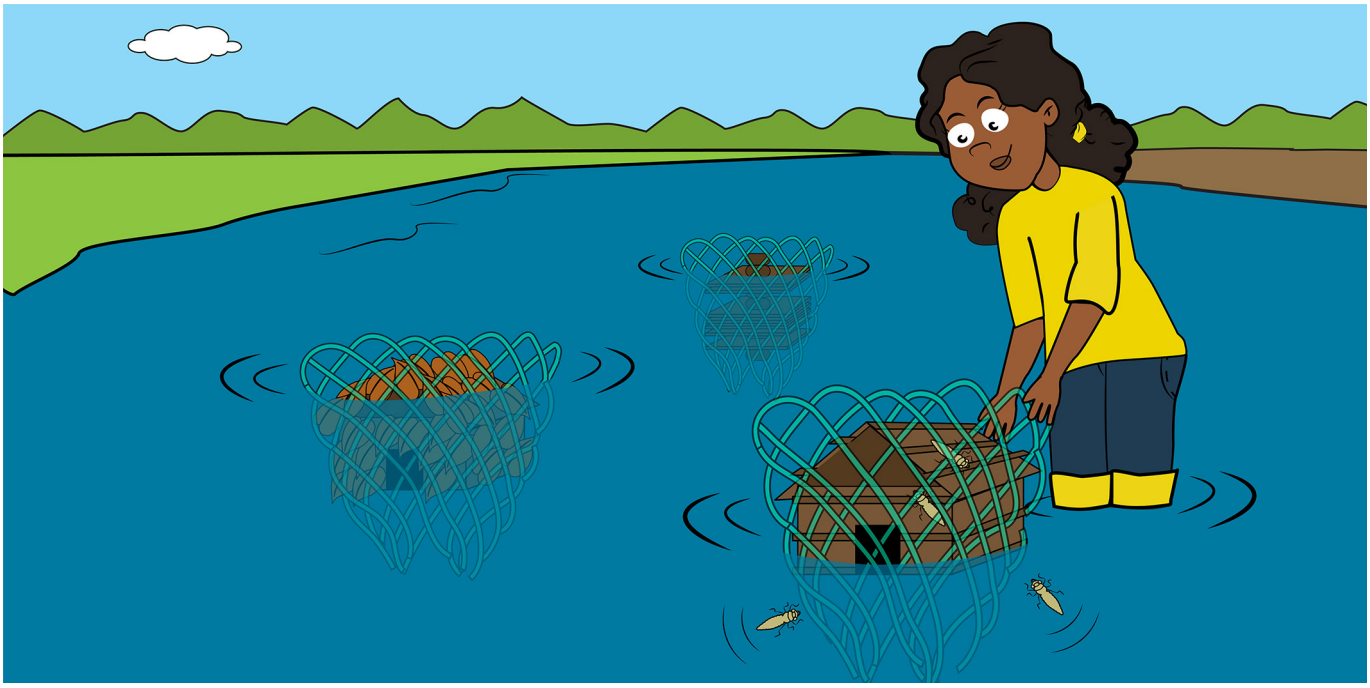

FISHING FOR RIVER CRITTERS: THE IMPORTANCE OF WOOD AS BAIT

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A river's residents can tell us a lot about the health of their home. Groups of small insects and other river critters, called macroinvertebrates, can change if pollutants are affecting the river. We used snags in bags (basically pouches of wood and bark) as a new method for collecting critters in larger rivers in the southeast US. We compared the types and numbers of critters collected with snags to those collected with two other commonly used methods. We found snags to be a suitable method for collecting macroinvertebrates in large rivers, as these resemble an important habitat for river critters.

WHY STUDY CRITTERS IN RIVERS?

As the world fills with more and more humans, it becomes important to understand the freshwater systems that humans live near (and live off of). We humans, for example, produce waste—from our industries,

farms, lawns, and even our toilets—that eventually enters streams. Since this waste can be hard to see with the naked eye, scientists have found that they can (literally) look at the river's residents for clues! Studies of this kind are called **bioassessments**. Specifically, scientists like to look at the small critters called **macroinvertebrates**, for clues about the extent that human activities have affected rivers. Macroinvertebrates are animals that lack a backbone and you can see with your naked eye. The macroinvertebrate community can be very good at giving scientists clues [1]. After all, macroinvertebrates are diverse, they pretty much stay in one area, they live a long time in that area compared to other river critters, and they each have unique and specific survival needs.

One big factor that determines which macroinvertebrates can live in which stream is the amount of oxygen dissolved in the water, which many macroinvertebrates need to breathe. Human pollution can decrease the amount of dissolved oxygen levels in water. Some macroinvertebrates have gills that take the dissolved oxygen directly from the water and, thus, are more sensitive to lower oxygen levels. Other macroinvertebrates can hold a bubble (called a plastron) of air close to their bodies, and still others have special cells (called hemoglobin cells) that help them survive on lower levels of dissolved oxygen—making them more tolerant to pollution. Of course, we cannot see how much oxygen is in the water with our eyes, but researchers have determined the oxygen needs of many common macroinvertebrates and they use this information as clues about the river's water quality. In bioassessments, the numbers of the different types of critters (**taxa**) found tell scientists the relative health of the river system in which they live.

HOW DO SCIENTISTS CATCH RIVER CRITTERS?

Several methods have been developed for catching (also called sampling) macroinvertebrates from their river communities [2]. Methods include active and passive sampling. **Active sampling** typically means using something that a scientist moves around, like a net or a scraper, to collect wood, rocks, or leaves from the river. The wood, rocks, or leaves that are netted or scraped up are **habitats**, or neighborhoods, where certain macroinvertebrates prefer to live. The critters that get netted or scraped are then brought back to the lab and identified. **Passive sampling** involves leaving some sort of artificial habitat in the stream or river for a period of time, to allow macroinvertebrates to "move in" to the newest neighborhood created by that artificial habitat device (Figure 1). Once the macroinvertebrates have moved in, the entire neighborhood (by this we mean "device") is removed and taken back to the laboratory. Both passive and active types of sampling are good at capturing a community of macroinvertebrates, but passive sampling methods are easier to use in large rivers.

BIOASSESSMENT

An evaluation of the conditions of a waterbody based on the types or number of organisms living within it.

MACRO-INVERTEBRATE

An animal that lacks a backbone and you can see without the aid of a microscope.

TAXA

A group of organisms of any rank, such as species, family, or class.

ACTIVE SAMPLING

A method for sampling macroinvertebrates in which scientists use nets to scrape or scoop a range of materials—containing various habitats—from the study location.

HABITAT

The place where an organism lives and grows.

PASSIVE SAMPLING

A method for sampling macroinvertebrates in which scientists deploy a device and allow organisms to colonize the device before it is retrieved after a set period of time.

Figure 1

Macroinvertebrate sampling devices for bioassessments include artificial habitats such as (from left to right) a wood bag, a leaf bag, and a Hester-Dendy sampler (photo credit: Checo Colón-Gaud).

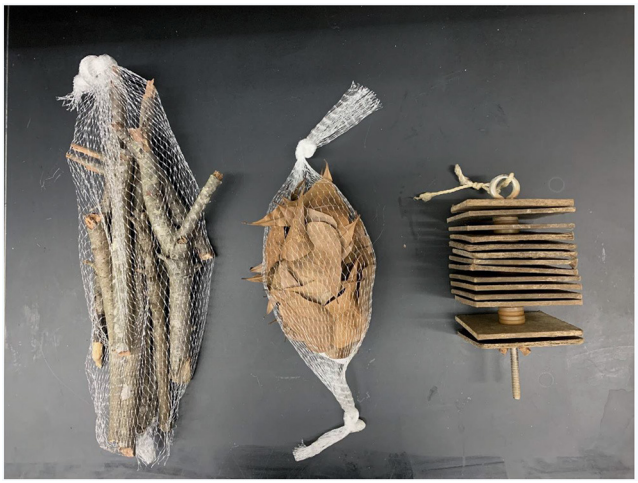

Figure 1

HESTER-DENDY

A device made of stacked plates of artificial substrates that is commonly used to collect macroinvertebrates from rivers and lakes.

There are many different passive sampling devices that can be used to collect critter communities from rivers. One of these is called a **Hester-Dendy** sampler and it is made from square pieces of a hard board (called Masonite), spaced with plastic washers [3]. The Hester-Dendy sampler is easily made by scientists, which allows scientists anywhere to compare their results. Leaf litter is a habitat and a food source for macroinvertebrates, so researchers use mesh bags filled with leaves as a common passive sampling device. Wood is also an important habitat and food source for macroinvertebrates [4]! Because of this, there are probably a lot of macroinvertebrates who would like to move into a wood sampling device, but scientists do not often use these. Although we do not know exactly why wood samplers have not been used frequently by scientists, it is possible that the other types of sampling devices are more easily available, or maybe it is difficult for scientists to create wood sampling devices to resemble natural conditions.

After macroinvertebrates are captured, they are brought to the lab, identified, and counted (Figure 2). Researchers use many clues from the community of critters collected to estimate the health of the river, including which creatures are present, their known oxygen needs, and their known habitat preferences.

In our study, we compared three types of passive sampling devices: sacks filled with sticks (wood bag), sacks filled with leaves (leaf bag), and Hester-Dendy samplers. Because macroinvertebrates may have different habitat preferences and feeding strategies, we expected to see different taxa collected using each of the different sampler types.

Figure 2

Macroinvertebrate sample in the laboratory. Samples consist of a variety of insects from many different taxa (photo credit: Benjamin Hutton).

Figure 2

WHAT WAS SEEN?

We found that different samplers collected certain taxa better than other samplers. The wood samplers (the ones rarely used in past research) actually captured the greatest number of organisms! We theorized that this happened because wood provides a complex habitat, with lots of nooks and crannies in which smaller insects can hide. Additionally, wood is a food resource for many river critters. Some macroinvertebrates, like snails and crustaceans, were found in larger proportions on the bags filled with leaves. This probably happened because these types of macroinvertebrates prefer to eat leaves. We also found higher numbers of the types of animals that burrow into wood in wood samplers and in Hester-Dendy samplers. All samplers collected similar types of critters, but in different proportions. This told us that using any of the three samplers would be suitable for collecting macroinvertebrates for bioassessment purposes, and all three would likely provide similar results.

WHY DOES BIOASSESSMENT MATTER?

Since wood or snags are major habitats for macroinvertebrates in many rivers, our study provides a new sampling option that uses wood as a habitat for these critters to move into. Learning which types of critters are more likely to move into a specific habitat type can help scientists to understand bioassessment results. Bioassessments provide managers, policymakers, and scientists a tool to make informed decisions for our water resources that are based on visible clues. Bioassessments can be used in situations when chemical or physical tests would otherwise be needed to assess river health.

Bioassessment research can also help us understand what a healthy macroinvertebrate community looks like in the large rivers of the

southeastern USA. If macroinvertebrates can no longer live in a freshwater system, this would eliminate the critical functions that these organisms perform. For example, macroinvertebrates can help with the process of decomposition, by turning larger particles into smaller pieces. They can also control the excess growth of algae, and they provide an important food source for larger consumers, like fish, amphibians, reptiles, and even birds!

Rivers provide humans with drinking water, recreation, agriculture, industries, and many other benefits! Increased amounts of pollution in rivers and other bodies of freshwater could compromise the resources and services that humans obtain from these ecosystems. Clearly, the continued use of these water resources is important to us. Higher levels of pollution in aquatic ecosystems will not only impact their ability to function but will also impact our own quality of life. Thus, it is important to monitor rivers using bioassessment and other methods, so that we can keep our waterbodies, the organisms that live there, and ourselves, healthy.

ORIGINAL SOURCE ARTICLE

Wilbanks, K.A., Mullis, D. L., and Colón-Gaud, J.C. 2020. Comparison of a wood sampler for macroinvertebrate bioassessment of non-wadeable streams in the southeastern coastal plain. *J. Freshw. Ecol.* 35:429–48. doi: 10.1080/02705060.2020.1852122

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CONFLICT OF INTEREST: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

YOUNG REVIEWER

MEHA, AGE: 15

Hey, I am a sophomore in high school, and looking forward to a career in medicine. My hobbies include drawing, tennis, and just hanging out with friends! I also love to volunteer and give back to my community. I am excited to be a part of Frontiers for Young Minds, as I want my peers and other students to be able to access these great scientific accomplishments made every day.

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