How Healthy are Our Favorite Streams and Rivers? Sampling Macroinvertebrates Can Give Us the Answer

By Sam Mason

As a fly fisherman, I have experienced both accomplishments and aggravations from nymph fishing. Anytime I can't spot any mayfly or caddis hatches fluttering atop the water, I pick up different rocks in the stream and search their surfaces for any crawling nymphs. If nymphs are present, I break out my fly box and try my best to find a pattern that matches what I have seen on the rocks. From here, I try to replicate different nymph rigs that I have learned from guides over the years. These complex set ups that involve added weight, multiple flies and droppers lend themselves to becoming tangled after an imperfect roll cast. The times where these rigs *don't* get tangled and instead lead to big fish I count as accomplishments! These experiences of catching native brook trout on a size 16 nymph are much of what gave me my confidence in picking out which nymphs are which.

It wasn't until working with Connor Quinn, Tin Mountain's trout intern and a self-declared "stream guy," that my understanding of nymphs and macroinvertebrates changed. Connor, an ecology major at Sterling College, has a knowledge of macroinvertebrates that is much more developed than mine. Connor's understanding of aquatic insects has come from prior experiences conducting stream sampling and identifying macros under a microscope. The extent of my understanding of mayflies, stoneflies and caddisflies started and ended at their relationship with trout. However, the role of macroinvertebrates in a stream goes far beyond acting as a food source for trout.

Trout stream restoration intern Connor Quinn examines macroinvertebrates under the microscope

After sitting down to talk with Connor, he painted macroinvertebrates as organisms that can tell us lots about the water that flows through some of our

favorite streams in the White Mountains. Though small in size, these aquatic insects hold the answers to many big questions regarding stream health, streambed stability and the trout sustainability.

What is a macroinvertebrate?

Simply put, a macroinvertebrate is an organism without a backbone that is visible to the naked eye. Though lots of macroinvertebrates like mayflies, caddisflies and stoneflies are classified as insects, some animals like aquatic worms and clams are identified as macroinvertebrates as well. Macroinvertebrates play important roles in bodies of water as these organisms are good indicators of pollution levels and are vital to stream ecosystems.

A number of casemaker caddis flies found in surber samplers

Macroinvertebrates and Stream Health

The presence or the absence of macroinvertebrates in a stream acts as a strong tell for the water quality and overall health of a body of water. Macroinvertebrates, like most other types of organisms, have varying levels of tolerance to pollution. Through the Hilsonhoff Biotic Index (HBI), macroinvertebrates are ranked in accordance to their tolerance to pollution. The HBI classifies macroinvertebrates into three categories according to their tolerance to pollution:

1st class

- Most intolerant to pollution
- Class includes mayflies, stoneflies, caddisflies

2nd Class

- Average tolerance for pollution
- Class includes beetles, some types of dragonfly larvae, and some true flies (black flies, mosquitos)

3rd Class

- Highest tolerance to pollution
- Class includes true flies, aquatic worms and scuds

Tin Mountain researchers search the sediment and organic material from a kick netting sample for mayfly nymphs

Classifying aquatic organisms first requires collecting them from the stream. Common ways of doing this include kick netting and surber sampling. Though the ways in which samples are taken differ from organization to organization, Tin Mountain conducts kick netting samples by placing a net in parts of the stream that exhibit four different depth and water flow patterns (shallow-fast, shallow-slow, deep-fast and deep-slow). From here, one person in the water stirs up the riverbed in front of the net to push sediment and macroinvertebrates into the net. While this method can be done by kicking up sediment in front of the net, Tin Mountain brushes off the rocks, sticks and gravel in front of the net by hand.

Though Surber samplers can be used just as kick nets are, Tin Mountain researchers use them for continuous sampling of the macroinvertebrates in the water column over a 24-hour period. Surber sampling uses the river's flow to its advantage, as the nets have strainers at the bottom to catch the macroinvertebrates that run into the sampler. While this method is less labor intensive, not brushing off the organic material in front of the net by hand can lead to some macroinvertebrates being missed. However, each method produces strong samples that allow for those conducting research on the stream to accurately assess its health. After completing kick net or Surber samples, these organisms are sorted and identified. Once identified, assessing the abundance and diversity of the macroinvertebrate population in the river is possible.

Tin Mountain intern Donovan Spaulding sets up a surber sampler in Black Brook that will be left overnight

Why Conduct Macroinvertebrate Samples?

If an organization is looking to improve the quality of a stream, there is really no better place to start than with macroinvertebrate sampling. Through conducting these samples before altering the stream in any way, whether it be through stream restoration activities like woody additions or any sort of forest management, a benchmark can be established in terms of water and overall stream quality.

A section of Black Brook that lacks canopy cover because of logging operations that took place in direct proximity to the stream.

Establishing this benchmark is much of the reason why Tin Mountain chooses to conduct research around macroinvertebrates. Having an understanding of which macroinvertebrates are within the water allows for long-term monitoring projects, thus making assessing stream health from year to year simpler. If, for instance, a stream that had been sampled years ago was exposed to logging, which increased sediment runoff into the stream due to the absence of bank and soil stability after the tree removal, and the class one macroinvertebrates that were previously found in the stream were no longer present, a clearer picture to why these organisms disappeared is given. From here, an attempt to restore the stream could be made, as bringing back canopy cover could once again encourage a community of class one macroinvertebrates.

On top of gathering this data, Tin Mountain also does work to positively influence macroinvertebrate and trout communities within a stream. Adding wood to streams creates pool habitats allowing for organic matter to accumulate. As a result, more habitat for macroinvertebrates is formed, thus generating more food for the trout within the stream. Having these macroinvertebrates in a stream is important for a number of reasons, but being able to track their population changes overtime is a fundamental part of measuring the health of a stream for years to come.

To my fellow anglers, if you are not doing so already, consider lifting up rocks and examining the wood within the rivers and streams you are fishing prior to tying on a fly. You may find a world of macroinvertebrates crawling across these wet surfaces. Just like you match a hatch of terrestrial mayflies by examining their characteristics as they dance across the water, or even by catching one, do the same with the nymphs you find in the stream. You may find that the streams that hold macroinvertebrates with the lowest tolerance to population hold the biggest fish.

Even those who don't chase trout may enjoy exploring macroinvertebrates. Though not all of us fish, a relaxing day by the river is a universal decompressor. Understanding the world of organisms within these rivers and how they represent water quality is may help us keep pollutants out of our waters and keep our waterways healthy for years to come.