

Mac

The Macroinvertebrate

by

Story by Chuck Dinkel
Illustrations by Erica Lawson

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Chuck is a member of the Potomac-Patuxent Chapter of Trout Unlimited (PPCTU) in Maryland. He serves as one of the two coordinators for the state's Trout in the Classroom (TIC) program. Currently 100 schools and environmental organizations across the state participate in TIC. His professional career as an electronics engineer spanned 30 years and included employment with the Naval Oceanographic Office, National Oceanic and Atmospheric Administration (NOAA), and the National Institute of Standards and Technology (NIST). Publications for which he has written articles include: Small Boat Journal, Fine Gardening, Maryland Natural Resource, and United States Power Squadron magazine. His enjoyment of fly fishing and sailing have taken him to many beautiful locations in the U.S. including several western states and Alaska.
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Illustrations by: Erika Lawson

Erika is a high school senior, a member of her school's Honor Society and an extremely gifted artist. The fact that she was able to take the author's very crude stick figure drawings and come up with the beautiful illustrations that decorate this book are a testament to her creative and artistic abilities.

Dedication

Trout in the Classroom (TIC) in Maryland would not exist were it not for the strong base of dedicated and passionate volunteers who annually support the program. These individuals come from all walks and organizations and comprise a very special and unique partnership. Foremost among these are the school teachers and educators who have understood the goals of TIC and embraced them. Today far too many students lack a basic understanding of their watersheds and the unique role they play in their lives. Life depends on the existence of clean water – the kind of clean, cold, oxygenated water in which trout thrive. TIC teachers are the carriers of this message and the students are getting it.

Annually the Maryland Department of Natural Resources' Aquatic Resources Education Section has provided grant money to enable schools to cover the initial cost of TIC participation as well as support in training and logistics. Albert Powell Hatchery donates over 15,000 fertilized eggs to the program and the food needed to feed the hatchlings. Biologists and support personnel respond to phone calls and emails to answer questions and conduct tours of the hatchery.

Early on it became apparent that TIC could grow only as the base of volunteer support grew. As the program expanded beyond the number of TU chapter volunteers able to assist, partnerships with other like-minded environmental organizations became essential. Members of International Federation of Fly Fishers, Izaak Walton League, and the Audubon Society stepped up to answer the call. These volunteers assist in delivering trout eggs across the state, provide expertise during school field trips to release the fingerlings and visit schools to meet with teachers and students.

During the past five years the Center for Coastal and Watershed Studies of Hood College, Frederick, MD has played a key role in the TIC program. The college has partnered with local high

schools to design, build and deploy recording stream temperature gages which have been placed in streams in the local watershed to study the possibility of extending the range of brook trout populations in these streams. Several schools have received TIC set-ups as part of this project. In addition, CCWS professors and staff have played a lead instructional role in the annual TIC training sessions.

Members of Trout Unlimited (TU) are the heart and soul of TIC. Both at the local and national level, their love of the outdoors and fly fishing for trout, take a back seat to the stewardship role they play when it comes to protecting and defending the environment and watersheds needed to ensure that future generations of fly fishers are afforded the same opportunities. Serving with these individuals has been a blessing. I tell TIC teachers that there is one important difference that distinguishes TIC volunteers from doctors - we still make house calls. The fact that these individuals take the time to meet with and interact with teachers and students is what plays such a key role in the success of the program.

From behind the scenes my wife, Mary Susan, has supported and encouraged my efforts coordinating the Maryland TIC program. In addition, she generously allows me time to indulge my fly fishing hobby.

The universe and planet earth do declare the creative hand of God. Fly fishing affords one the opportunity to travel to and visit some of the world's most beautiful and pristine places. There are few if any trout streams that fail this test. I believe God designed them this way to provide us a respite from the noise and clutter of daily life. As His stewards I hope this book encourages you to join me in protecting and defending these precious resources.

Mac

The Macroinvertebrate



Hi everyone! I'm a macroinvertebrate and a member of the caddis family. My parents call me Macro or **Mac** for short. You can too. That's a whole lot easier for my friends to remember and pronounce than macroinvertebrate.

So what's a macro? I'm a bug that's big enough to be seen without a microscope. That's where the "macro" part comes from. You ready for the next part? Think of it this way - "**In Vert A Bray**". That's a scientific way of saying I don't have a backbone.



There are lots of different types of macros. Some like ants and grasshoppers live in your yard. Others, like my friends and I, live in streams. To find us you'd have to look on, under and around rocks and vegetation in a stream. My shy friends hide in the mud and sediments on the stream bottom. Because we live in water we're also known as aquatic macros.

We spend a lot of time playing hide and seek; mostly the hiding part. If we didn't we'd be on the dinner menu for other creatures that live in streams - like the rainbow or brook trout you're raising in your school.



When your trout get to be about two inches long they are called fingerlings. This takes about five months. Soon your teacher and trout volunteers will bring you to a stream where you'll release your trout. Each of you will have an opportunity to gently place the trout in the stream and watch them swim away to grow up.

In the wild these fingerlings no longer have students feeding them every day. They'll look for bugs like my friends and me to eat. And guess what? They don't go "yuck" when they eat us. They go "yum".



One of the fun things students do when they release their trout is collect macros. They use seines, D-nets and sometimes turn over rocks to find us. Then they spend time trying to identify us. That's the hard part. Many of the students have never seen macros before.

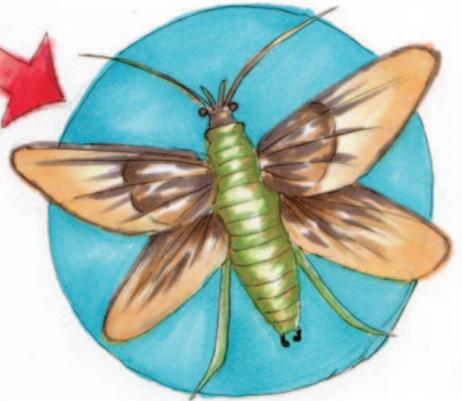
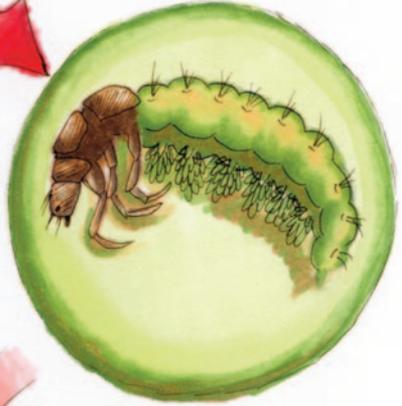
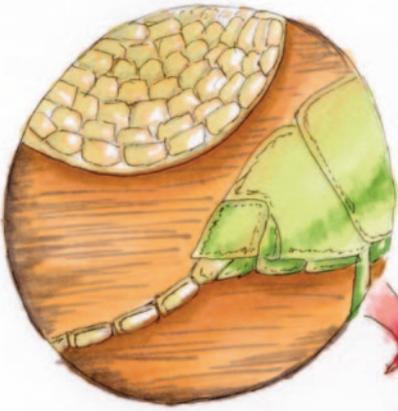
Finally the students take time to return us to the stream. It's our job then to find new hiding places.



My friend, **Caddis** the worm, looks very much like a caterpillar that lives on land and turns into a butterfly. Caterpillars feed on plants and build cocoons. Inside the cocoon the caterpillar changes into an adult butterfly. The adult butterfly will lay eggs on plants. The eggs hatch into tiny caterpillars that grow up, make cocoons and the cycle starts all over.

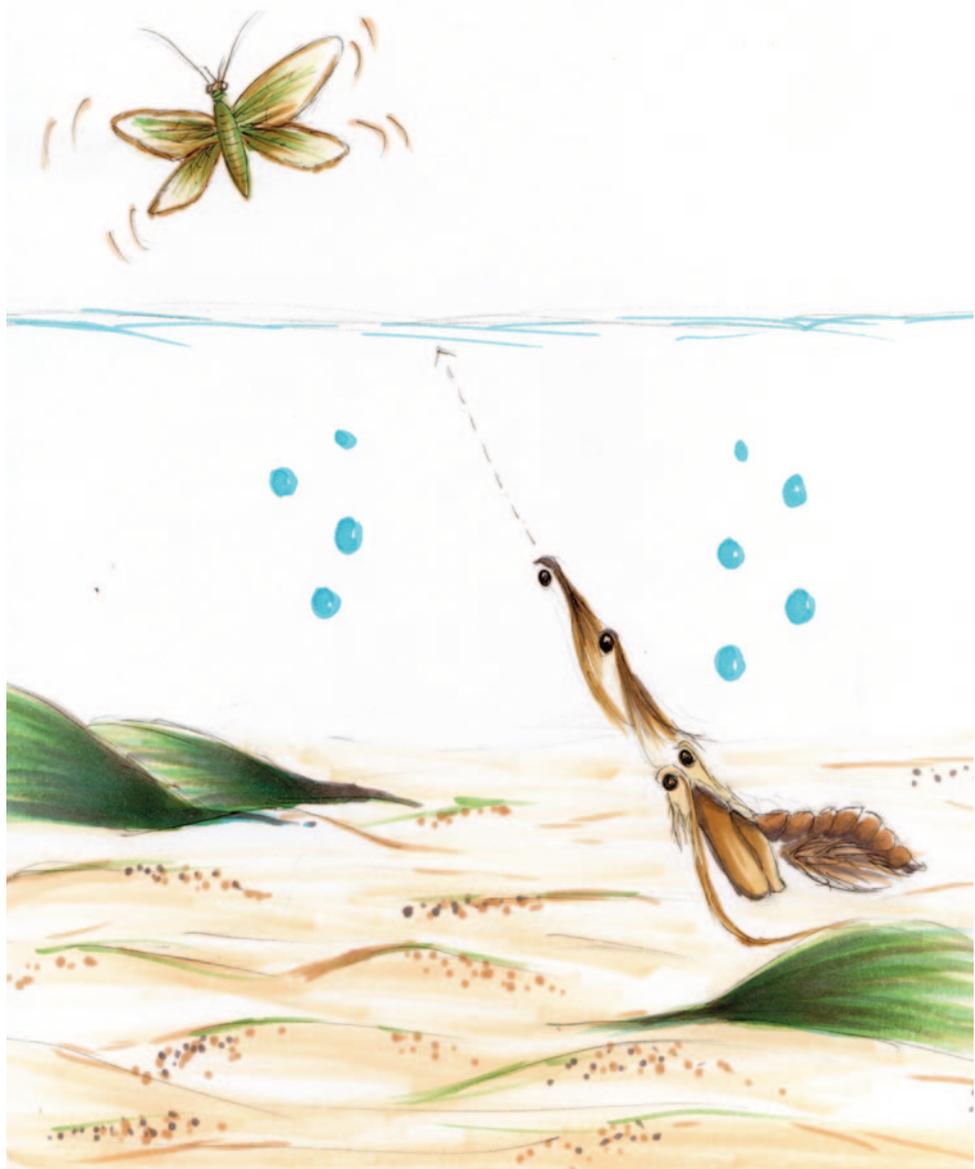


My macro friends, like **Caddis**, begin life as an egg, hatch into a worm, and build an underwater cocoon from which an adult caddis fly emerges. **Caddis** spends almost his entire life in the stream. Only when he becomes an adult does he leave the stream to fly into the air. This cycle takes about a year to complete.



If you were to visit a stream when my friend, **Caddis**, became an adult caddis fly, you would see lots of caddis like him becoming adults and flying away. Fishermen call this a caddis hatch.

Fish, like your trout, also wait for the caddis hatch because they know there will be lots of caddis flies to eat.



Adults that escape the fish will fly off, mate, and lay eggs in the stream for the next generation of caddis. The eggs settle to the stream bottom. When they hatch, the worms look for places to hide from predators.



I also have some friends that have a different type of life cycle. Instead of going through four growth stages (egg, worm or larva, cocoon or pupa and adult) like **Caddis**, they have only three. These stages are called egg, nymph and adult.

My friends, **Stonefly** and **Mayfly**, are in the nymph stage. If you saw the three of us hiding under a rock together you might think **Stonefly** and **Mayfly** were brothers. But they come from different families and I have even discovered how to tell them apart. I'm going to share this secret with you.



First of all, neither of them looks anything like a caddis worm. If you ask me they look like prehistoric creatures. But that doesn't frighten me and I bet it doesn't you either.

The clue to telling **Stonefly** and **Mayfly** apart is on their backs. If you look closely you will see that **Mayfly** has one "backpack" and **Stonefly** has two.

Scientists studying bugs wouldn't call them backpacks. They have a fancy name for them - wing pads. When my friends **Stonefly** and **Mayfly** become adults, **Stonefly** will have two sets of wings; one from each wing pad. **Mayfly** will have only one set of wings.



Some stonefly nymphs get very large and spend three years in the stream before they become adults. Most spend just a year growing to adult stage. Just before they become adults the nymphs crawl along the stream bottom to the edge of the stream. There they will look for rocks to crawl onto. Once in the air and sunlight the back of their casings split open and the adults emerge and fly off.



Mayfly nymphs do not crawl along the bottom to emerge as adults. Instead they swim to the surface of the stream and ride in the current while their backs split open and wings emerge.

On sunny days the wings will dry quickly and the mayfly adult will fly off. However, on a rainy or overcast day it will take much longer for the adults to take to the air. Because they can't fly right away many get eaten by trout and other fish.



If you look closely at mayfly and stonefly nymphs, you will also notice that just like bugs you're more familiar with they have six legs. These legs end in claws that help the nymph grab and hold onto rocks in the stream. Without these claws, nymphs would get washed away in the current and could easily get eaten by fish.

As nymphs grow they molt (shed their hard outer casing) and grow a bigger one. The hard shell helps protect them.



Just like my friend, **Caddis**, **Mayfly** and **Stonefly** spend only a few days or at most a couple of weeks living outside the stream before they lay eggs and die.

Another interesting fact about macros is that many of us are vegetarians. We feed on algae, and pieces of leaves and other vegetation that fall or grow in the stream.

We are happier and healthier when the water we live in is clean, cold and has lots of oxygen. Just like fish, macros have gills for breathing under water.



The next time you go trout fishing or are at a park that has a trout stream, take a few minutes to carefully turn over some rocks. If you look closely, you may see me hiding there with some of my caddis brothers and sisters or our mayfly and stonefly friends.

If you lift us off the rock for a closer look please do it carefully. We don't bite, but we might tickle your hand as we try to escape back to the water. Since we breathe through gills we will suffocate if you keep us out of the water too long. So take our picture to show your friends at school, but return us to the stream quickly. We'll find another rock to grab onto and call home.



I hope you enjoyed meeting me and my macro friends. We're counting on you to keep our streams clean and healthy. Then they'll be lots of us for your trout to feed on when you release them.

Even if some of us get eaten most will grow to adults and start new families of macros. In nature this is called achieving a balance.



By the way, if you turn over a rock and spot a green colored worm, it could be me, **Mac!**



