

Introduction to Fly Fishing & Water Conservation



Revised 2019



Welcome to the Rocky River Chapter of Trout Unlimited!

Fishing - Conservation - Social Events - Lasting Friendships

While fly fishing is a primary focus of our chapter, we hope you'll take advantage of the special opportunities that we offer.

Through your active participation, you'll be able learn about trout and the insects they eat, how to tie flies that resemble those insects, the importance of water and soil conservation, where to look for trout in a stream, and more - all related to the natural world around us. With a better understanding of nature, we can protect our world for us and the generations that follow.

During the year, our regular meetings feature interesting presentations on fishing techniques and experiences, chances to meet up and fish on nearby streams, and opportunities for getting to know each other, and building enduring friendships - all along gaining a deeper appreciation of the majesty of nature and learning to love a sport that can be enjoyed for a lifetime.

Your active participation will help achieve the goals of Rocky River TU and the national goals of Trout Unlimited.



TABLE OF CONTENTS

S	SECTION I: EQUIPMENT AND BASIC SKILLS	1
S	SECTION 2: FLY FISHING	11
S	SECTION 3: FLY TYING	25
S	SECTION 4: ENTOMOLOGY	35
S	SECTION 5: CONSERVATION	45
S	SECTION 6 STOCKING & MONITORING FISH POPULATIONS	61
S	SECTION 7: FISHING REGULATIONS	69
S	SECTION 8: FLY FISHING RESOURCES	79

SECTION 1: EQUIPMENT & BASIC SKILLS

Fly Fishing Equipment and Clothing Five Essential Principles to a Good Cast

Basic Knots

Fly Fishing Etiquette

Safety Tips on the Water



Fly Fishing Equipment and Clothing

- 1. Fly rod, reel and line
- 2. Waders, boots, hat
- 3. Equipment carriers (vest, sling pack, chest pack, waist pack, lanyard)

4. Necessary items to have with you

Fly Box(es) Extra leader and tippet Clippers/nippers Forceps

5. Recommended items

Polarized Sunglasses (for eye protection and visibility) Wading Staff (for wading through currents, over rocks) Net (to reduce stress on fish and aid in hook removal)

6. Other equipment

Strike indicators Split shot Dry fly floatant Leader Straightener Stream Thermometer Insect repellent Rain jacket Packable Trash Container (Ziploc bag) Small flashlight or headlamp Magnetic or other Net Release/Retrieval Device

Suggested Rod/Line Lengths and Weights

Freshwater Type by species	Rod/Line(s)	Saltwater Type by size	Rod/ Line(s
Trout	7.5-9'/3-5 wt.	Bonefish, Redfish	9-10'/8-9wt
Bass	9′/6-8 wt.	Tarpon, Sailfish	10' /10-12wt

Five Essential Principles to a Good Cast.

1. Pause and vary the duration of the pause between the forward and back cast according to the length of line out past the rod tip.

When false casting, allow the line to straighten before proceeding with the casting stroke in the opposite direction. This pause will lengthen as the amount of line being carried lengthens. It is sometimes good to look over your shoulder to watch the back cast to assure the line is extended. Eventually you may find you can time the pause on the back cast using the duration of the pause on the forward cast as a benchmark. You might also find you can feel the rod load on the back cast which will signal when to begin the forward cast.

2. Keep slack line to an absolute minimum.

The line should be anchored either by clamping it to the rod with the casting hand or by holding it with the other (line) hand. If the line is not anchored it will slide and prevent the line from loading the rod, thus preventing an efficient cast. Additional causes of slack line are too much overhang between the rod tip and the water (prevent this by starting the cast with the rod tip low), wind, moving water and poor timing of the pause mentioned in the first principal. Stripping the line until the tip of the fly line moves helps in minimizing slack.

3. Move the rod tip in a straight line path when casting.

The line follows the path the rod tip makes. If the rod tip swings in a convex, windshield wiper-like arc the line will take on a wide, inefficient (open) loop in flight. If you dip your elbow in mid-flight or apply too much power too soon in the stroke, a concave tip path might result. This concave path often results in a tailing loop and "wind knots". One aid in achieving a straight-line path is to aim the forward cast directly at the target and the back cast directly opposite the target.

4. Vary the length of the casting stroke with the length of line past the rod tip.

Short cast, short stroke. Long cast, long stroke. The proper stoke length for the amount of line out will help in eliminating slack and other problems.

5. Apply the correct amount of power must be applied at the proper time in the cast.

It is best to apply power by starting the cast slowly and accelerating to a crisp stop. The most energy should be applied when the rod is at least past perpendicular to the target. The closer you can create maximum acceleration to the end of the cast, the tighter and more efficient the loop will be. It is the <u>stop</u> that makes the line move!

Courtesy of Jack Cummings, Carolina Fly Fishing Club

Source: The Essentials of Fly Casting, Fly Fishing International, Livingston MT

Improved Clinch Knot



Uses: The Improved Clinch knot is one of the most widely used fishing knots. It provides a good method of securing a fishing line to a hook, lure, or swivel. The "improved" version shown here includes an extra tuck under the final turn (step 9). It is commonly used to fasten the leader to the fly. Because it is harder to tie in heavier lines it is not recommended if you are using over 30 lb test line.

Tying it: Wind the loops in a neat spiral round the standing line and hold the loops under your fingers as you wind the line on. Although five or more turns are recommended, with heavier lines this may be reduced to four.

Pulling the Knot Tight: When lubricated and pulled tight, the knot changes its structure. Pulling on the line forces the wrapped turns to redistribute the twists so that the inner strand becomes an outer wrap. When tightened the tag end is actually gripped closely against the hook.

Advantages: The Improved Clinch knot is regarded as a fisherman's reliable standby. It is particularly suited for attaching a small diameter tippet to a heavy wire hook. The extra final tuck improves your chances of holding a strong fish.

animatedknots.com



Uses: The Surgeon's Knot, or Surgeon's Join, is easy to tie and is useful to join two lines of moderately unequal size, e.g., a tippet to a leader. It is actually tied as a Double Overhand Knot - which probably explains why it is sometimes known as the Double Surgeon's Knot - redundant because "*Surgeon's*" implies the use of the two turns.

The Surgeon's Knot allows you, with the same leader, to select the size of tippet to suit the size of the fly. It is usually used to join two pieces of monofilament.

Tying it: The Surgeon's Knot can only be tied with a tippet because the usual method of tying it requires the entire length of the tippet to be passed through the overhand knot twice. After forming the knot, carefully set the knot by pulling on all four ends.

Alternative: As an option, the two lines can be passed through the overhand knot a third time to form the **Triple Surgeon's knot**.

Advantages: The Surgeon's Knot is one of the easiest knots to learn and is an excellent knot to join two lines of moderately unequal size.

Disadvantages: It is rather bulkier than the Blood Knot and creates a slight angle in the line.

animatedknots.com

Surgeon's Loop Knot



Uses: The Surgeon's Loop is essentially a Double Overhand Knot. It can be tied quickly and easily in the end of a line. It is often used to make a "Loop to Loop" connection in the same way that two elastic bands can be hooked into each other. It can also create a fixed loop that allows the artificial lure or fly to move naturally.

Tying it: It is tied in the same way as the Surgeon's Knot.

Alternative: An extra turn can be used to create a Triple Surgeon's Knot. However, this provides minimal additional benefit and makes the knot bulkier.

Advantages: The advantage for this knot is that is reliable, easy to learn, and some sources claim that it retains a high proportion of the rated line strength.

The Davy Knot



Tying: (1) Pass the tippet through the eye, (2) wrap it around the running end, and (3) pass it back through the loop to make a half hitch. (4) Continue around and (5) back through the loop a second time. (6) Tighten carefully so that the tag end is (7) enclosed by the knot against the eye. (8) Trim the end.

Tightening it: Many writers describe tightening without lubrication; the knot is so small and simple that there is little friction to generate heat. With care, the running end can be used to tighten the knot leaving the tag end so short that trimming may be unnecessary. Although it may be easier to do this gripping the tag end with your teeth, Davy himself advises against doing this because of the risk of bacterial contamination in too many lakes and streams, particularly if there are beavers or rats present.

Positioning the Tag End: The tag end must lie against the eye under the knot. If the tag end slides away from the knot towards the center of the eye, the knot holds much less well.

Advantages: The Davy is small and economical. With practice it can be tied using up only a smallest amount of tippet length. It can also be tied extremely rapidly, even in cold and awkward conditions. It has been claimed that the Davy is extremely strong by comparison with other knots; that may well be true. Careful tests suggest that the strength percentage around 50 - 60% of that of clinch knots.

FLY FISHING



An important part of fly fishing basics is practicing good fly fishing etiquette. Be polite and courteous to others, respect the environment, and you find that it adds up to a very enjoyable day of fly fishing for everyone.

Whatever You Do:

- <u>Catch and release native trout.</u> Because hatchery fish often mix with native species, you are encouraged to take them home. Hatchery steelhead trout have their adipose fin clipped. Learn about best ways to catch and release trout.
- <u>Know the laws!</u> The fishing regulations for most states are about the size of a small book, but keep up on the rules. Ignorance of the law is no excuse. I keep at least two copies, one at home and one in my car.
- <u>Recycle your monofilament line, and don't leave it on the riverbank.</u> Monofilament line is non-biodegradable and can remain in the environment for over 600 years.
- <u>Don't fish if the water is over 70 degrees.</u> The trout are stressed and are just trying to survive. Give them a break; they will not survive your release! Carry a thermometer. If you must, fish in the morning when the water temperatures are lower.

Fly Fishing from the Bank

- <u>Respect property rights</u>. Some areas are now closed because other fishermen have not asked for permission, or have left trash on the bank.
- <u>Give plenty of room to your fellow fishers</u>. The first person on a section of water should be allowed to fish it. Walk on by (away from the water if possible) and have patience, they may be "resting the water." This is done after a disturbance of some kind (like landing a trout).
- <u>Keep the noise down;</u> trout are very wary. If you spook a trout near another fisherman it may shoot past other fish in that section of water, spooking them.
- <u>Don't litter.</u> Carry out all your trash AND some of the trash left by others. It helps even if you only pick up just a few pieces each trip. Always bring the small pieces of monofilament line that you have cut off home with you.
- <u>Observe the right of way.</u> The person working their way upstream has the right of way. Try to keep some distance between you and others.
- <u>Yield to others who have a fish on.</u> Politely ask if you can lend a hand. They may really appreciate it.
- <u>Wade only when needed.</u> The aquatic life you are walking through is very fragile.

Fly Fishing from a Boat



- Most of the fly fishing etiquette for bank fishermen also applies to the fly fishers in a boat.
- <u>Give bank fishers a lot of space.</u> You have the ability to fish more of the water, so let them have the section they are on.
- <u>Be aware of the threat of non-native species.</u> Be sure to wash off your boat before moving to another river or lake.

It's a Win–Win Situation!

Etiquette that is at the root of fly fishing basics is respecting the environment and being courteous to others. As a result you will find most other fly fishers to be a great source of information and friendship. This adds up to a more enjoyable day on the water.

Editied from: https://www.trout-fly-fishing.com/fly-fishing-etiquette.html

SECTION 2: FLY FISHING

Thout Species

Trout Life Cycles Trout and Water Temperature Reading the Water Which Fly Should I Use? P. A. U. S. E. and M. A. T. C. H.



Trout Species of North Carolina

Illustrations by Bruce L Bunch



Rainbow Trout

Oncorhynchus Mykiss

Average Stream Size Length:10 in. to 16 in. Weight: 2 to 6 lbs.

Rainbow trout are native to the Pacific Ocean and fresh waters of western North America. They naturally range from Mexico to Alaska and inland to the Rockies. However, they have been widely introduced throughout the world, and now occur across central North America to the eastern coast. Rainbow trout were first introduced to Atlantic Canada in the late 1800s.

Food

Rainbow trout take a wide variety of foods, but in freshwater they eat mainly insects, crustaceans, snails, leeches, and other fish if available. All trout are opportunistic feeders, which means if a meal, such as a worm or a minnow--or what is perceived by the trout as a meal.

Spawning

They prefer water temperatures of 53 degrees to 64 and do well in clear, cool, deep lakes or cool, clear, moderately-flowing streams with abundant cover and deep pools. They spawn in the spring (usually from March to May) in small tributaries of rivers, or in inlets or outlets of lakes. Spawning can also take place in late fall or early winter.

Life Expectancy

Generally seldom longer than 6-8 years in the wild.

Description

In North Carolina, the adults in fresh water colors vary from becoming silvery on the sides to becoming yellow on the sides and brown on the back.

Many small black spots cover the head, back, sides and fins, and spots on the tail are in obvious rows. The adipose fin (small fin in front of the tail on the back) has a black border. Mature fish have a distinctive rosy stripe along the side that extends from the gill cover to the caudal fin.

Young rainbow trout (parr): have 5 to 13 well-spaced dark part marks on the sides and show less spotting on the body than adults.

Water Habitat

Rainbow trout prefer very similar habitats to brown trout and can tolerate higher water temperatures. They often use lower reaches of rivers and streams.



Brown Trout Salmo Trutta

Average Stream Size Length: 8 in. to 14 in. Weight: 2 to 4 lbs.

For centuries before the discovery of rainbows, cutthroats, and brookies, when people went "trout" fishing, they went brown trout fishing. Native to Europe, browns were first formally stocked in the United States on April 11, 1884 in Michigan's Pere Marquette River. Today they can be caught in the Northeast, the Appalachians, the Upper Midwest, and the mountainous regions of the West.

Food

Variety of aquatic and terrestrial insects, earthworms, snails, crayfish, salamanders, frogs, sculpins, dace, and even their own fry. All trout are opportunistic feeders, which means if a meal, such as a worm or a minnow--or what is perceived by the trout as a meal, is usually eaten. Many larger browns are primarily nocturnal feeders, and during prolific insect hatches, browns can be extremely selective about what they'll eat.

Spawning

Brown trout spawn in the fall and early winter (October to February) at the same time Brook (speckled) trout spawn, or later. The female uses her body to excavate a nest (redd) in the gravel. She and the male may spawn there several times. A 5 lb female produces about 3400 golden Coloured eggs that are 4 to 5 mm in diameter. Females cover their eggs with gravel after spawning and the adults return downstream. The eggs develop slowly over the

winter, hatching in the spring. A good flow of clean, well-oxygenated water is necessary for successful egg development.

After hatching, the young fish (called alevins) remain buried in the gravel and take nourishment from their large yolk-sacs. By the time the yolk-sacs are absorbed, water temperatures have warmed to 44 degrees to 53 degrees. The fish (now known as fry) emerge from the gravel and begin taking natural food. They mature in their third to fifth year and many become repeat spawners.

Life Expectancy

Generally seldom longer than 6-8 years in the wild.

Description

In North Carolina, their sides are silvery or brownish yellow and bellies are white or yellowish; dark spots, sometimes encircled by a pale halo, are plentiful on the back and sides; spotting also can be found on the head and the fins along the back; rusty-red spots also occur on the sides; the small adipose (or fatty) fin in front of the tail has a reddish hue; They closely resemble Atlantic salmon and rainbow trout, but salmon have no red coloration on the adipose fin and rainbow trout have lines of black spots on the tail. Young brown trout (parr) have 9-14 dark narrow parr marks along the sides and some red spotting along the lateral line.

Water Habitat

Brown trout prefer very similar habitats to our native brook (speckled) trout except that they can tolerate slightly higher water temperatures. They often use lower reaches of rivers and streams that are unsuitable for brook trout.



Brook Trout

Salvelinus fontinalis

Average Size Length: 6 in. to 8 in. Weight: 1/4 to 1/2 lbs.

The brook trout is regarded, as one of North America's most beautiful native fish species. In the Southern Appalachians, locals call them "specks." Recent genetic studies suggest that the native brook trout found in the Southern Appalachians, including the mountains of western North Carolina, may be a separate subspecies of the brook trout found farther 15 north.

Food

Variety of aquatic and terrestrial insects, earthworms, snails, crayfish, salamanders, frogs and occasionally small fish. Artificial flies in the 12-18 size.

Spawning

Occurs in fall, generally September through November. Female constructs nest (redd) in gravel. Adults do not guard nest. Numbers of eggs vary from 100 to 5,000 depending upon the size of female. Incubation period varies depending upon water temperature. Eggs hatch in 50 days at 50 F.

Life Expectancy

Generally short-lived, seldom longer than 4 years in the wild. Maximum 8 years.

Description

In North Carolina, brook trout are generally small, ranging in size up to about 8 inch seldom more than 12 inches. They are handsomely colored with the back and upper sides of the body typically olive-green with mottled, dark green wavy markings that extend onto the dorsal and caudal fins. The lower sides are lighter with yellow spots interspersed with fewer spots of bright red surrounded by blue.

Easy Identification:

The lower fins are orange with a narrow black band next to a white band that borders the forward edge. Spawning fish acquire a heightened brilliance when the belly and lower fins become a bright red-orange. The color of a fish can vary from one area to another, depending upon the surrounding habitat.

Water Habitat

Brook trout are most abundant in isolated, high-altitude head-water streams and brooks where the water is free of pollution and rich in oxygen. Brook trout are inherently cold-water fish, and can perform well within a temperature range of 40 to 68 degrees Fahrenheit. However, brook trout have been shown to feed at temperatures as low as 34 degrees, and the lethal temperature limit of the brook seems to be around 30 degrees. Brook trout prefer streams with stable water flows, silt-free gravel for spawning and an abundance of deep pools and riffles with sufficient in-stream cover, such as logs, boulders and undercut banks. In North Carolina, brook trout spawning begins in September and continues through November. The fertilized eggs are covered with gravel and remain in the redd until they hatch in the early spring (usually March).

Eggs develop in the gravel and hatch into alevins.

Alevins stay in the gravel. They get food from their yolk sacs and grow bigger.

After the yolk sac is used up, the tiny fish are **fry**. They swim out of the gravel to find food. They will live in gentle water near the stream bank until they get bigger.

As the fry grow stronger, they can take up positions in the main current of the stream. They eat insects and other small animals that live in, or fall into, the stream.

> Adults often eat other fish, even smaller trout. Although they may live longer, trout do not grow as large as their relatives, the salmon and steelhead, because they don't go out to sea.

Some trout live in lakes. They may live there all their lives, but often spawn in streams.

Spawning trout lay eggs

in gravel stream bottoms.

Trout often spawn several

times in their lives.

TROUT LIFE CYCLE

Trout and Water Temperature

When normal seasonal temperatures are affected by extreme climate-related weather, countless cool flowing freestone trout streams occasionally turn into something altogether different. Even freestone streams with strong cold water influences and spring creeks that normally remain temperature stable throughout the year have seen soaring temps with fish abandoning their normal feeding and holding lies in search of cold refuges. Most of us who fish know that when trout streams get too warm, the fishing goes downhill fast. Fish are either nowhere to be found or aren't actively feeding.

When it comes to trout, how hot is too hot?

The upper limits of the temperature range within which trout will feed, grow and remain unstressed by thermal conditions varies by species, however not all that significantly. Upper limits (as high as 80 degrees, depending on the species) can be misleading. These limits characterize thermal conditions under which unstressed trout will die if those conditions persist for a certain period of time (typically 24-48 hours). These limits, however, don't provide much insight about how high water temperatures affect a fish that is further stressed by being hooked and played by a fisherman.

Warmer water contains less oxygen than colder water. As temperature rises and dissolved oxygen decreases, fish begin to experience stress. These stresses begin to set in well before the water temperature reaches lethal limits. For example, rainbow trout are said to be able to survive in temperatures up to and exceeding 77°F (24°C), but stop growing at 73°F (23° C). It stands to reason that a fish, one which is already oxygen stressed while positioned carefully in current that minimizes its energy use, will be dramatically more stressed after being hooked and attempting to fight its way to freedom. In fact, in many cases, a fish otherwise properly handled and released under thermally stressful conditions may be likely to not survive.

Though studies vary regarding accepted limits, a considerable consensus is that <u>all three</u> <u>major trout species (brook, brown and rainbow) begin to experience some level of stress at</u> <u>around 68°F (20°C)</u>, with that stress increasing rapidly as the temperature rises further. For brook trout, these limits are generally accepted to be a few degrees lower (some sources suggest as low as 65°). For many fishermen, 70°F (21°C) has become a round figure that represents the "don't fish" limit.

Of course, water temperature is not the only determining factor of dissolved oxygen (speed of current also plays a factor, for example). Trout which spend extended periods of time living on these generally accepted thermal margins will likely have a greater tolerance outside these margins. However, <u>68°-70° represents a valuable limit outside of which trout should not be fished.</u>

On days when temperatures soar, and especially during extended periods of high temperatures, the catch and release fisherman should pay specific attention to stream temperatures throughout the stream he or she is hoping to fish. When temperatures in moving water exceed 68°F (20°C), it's best to call it and return another day.

Which Fly Should I Use?

Make your selection in the following order and you should be in business:

1. The size of the fly. There is no need to measure the natural. Capture one if you can and place it on the lid of your fly box. If you cannot capture one, choose a fly that appears to be at least one size smaller than those you see on the water and two sizes bigger than those in the air. Looks can be deceiving.

2. The attitude and behavior of the fly on or in the water. You can determine this by watching the insects hatch, by knowing something of their life history, or by observing the behavior of the trout. You'll see how to gauge all these later in the book. Check the insect's attitude on the surface. Is it flush with the surface film or riding high on the water? If you can determine this, you can choose either a high-floating fly or one that just barely hangs in the film. Check the natural's behavior. Is the insect fluttering across the surface or riding the currents sedately? If the insect is a nymph, is it drifting calmly with the currents or actively wiggling in the water column? With subsurface flies, you can get away with moving the imitation yourself. With flies on the surface, trying to make the fly twitch like a natural is a dangerous process because we invariably move the fly too much and cause drag. Although there are techniques to make a fly move, they require special flies, treating the leader, and positioning the fly precisely on the water. It's much more reliable to simulate movement by choosing a fly with lots of hackle, which causes an apparent illusion of movement, at least to the trout."

3. The shape of the fly. Is it a mayfly, caddisfly, or stonefly? Are the wings upright or sloped along the body? Is the natural long and skinny or short and squat?

4. The color of the fly. Trout can see colors well, but their perception of color depends on lighting conditions and other factors beyond our understanding. A discussion of whether color makes a difference or not could fill an entire book. Experience shows that the most important factor is at least choosing the correct shade—if a trout is taking cream-colored flies, it often will reject a black one in favor of a tan or yellow one. Color is probably more important in subsurface flies than in high-floating dry flies.

Excerpt From: Tom Rosenbauer. "The Orvis Streamside Guide to Trout Foods and Their Imitations." Apple Books.



Are you a Stream Reader?

Do you ever wonder where certain animals live in a stream? How about where to catch a certain fish? Or which bait to use and where to collect it? Successful anglers and naturalists can answer these questions because they know how to read a stream.

How water works

Water is simple. It flows because of gravity and tries to get downhill as fast as possible. How fast water moves depends on the land's slope, or steepness. Along the way, water's speed, or velocity, influences the shape of a stream channel. Moving water has force. It wears and carries away particles like clay, silt, sand, gravel, pebbles, rubble (or cobble) and boulders. The faster water moves, the bigger the things it can carry. It doesn't take much water velocity to pick up and carry a sand particle the size of a pinhead. But water has to move much faster to pick up and carry marble-sized gravel or golf ballsized pebbles. And it has to move even faster to push rubble the size of softballs along the stream bottom. This kind of force is more than enough to push you off your feet in water above your knees!

Clay and silt particles are small and easy for water to carry. But they are also *cohesive* (they stick to each other). It takes a lot of force to erode them about as much water velocity as it takes to move gravel and pebbles.

Straight or meandering?

The shape of a channel is also influenced by the geology of the surrounding land. A headwater stream in the mountains will probably have a straight stream channel. The water flows fast and clean. The bottom is usually covered with sand, gravel or boulders. This is where you will find all of the trout's food—daces hiding under the boulders, stonefly nymphs clinging to the rocks and caddisfly larvae with their cases made of large sand grains. Think "wild brook trout." They are adapted to the fast water in these small headwater streams. Try baitfishing with a small worm, blacknose dace or stonefly nymph. You could also use a mayfly nymph, caddisfly larva or streamer if you prefer flyfishing.

The stream conditions are much different when the slope of the land becomes less steep. Water is in less of a hurry and takes its time down the stream channel. Sediment typically falls out of this slow-moving water and stays on the stream bottom. Stream in a flat floodplain may have many *meanders*, or bends. Meanders make a stream longer and increase the amount of habitat. They also increase the quality of the habitat. These benefits help your fishing. Here's how:

Water erodes stream banks. It undercuts the outside bank because it flows faster on the outside bend. You'll often see tree roots exposed beneath these *undercut banks*. It's the perfect habitat for aquatic insects, forage fish, panfish, trout and bass.

The water on the inside bend flows slower. Sediment and other materials carried by the flowing water are deposited here. Where to fish in these spots should be easy to figure out. Stand on the inside bank and make the perfect cast toward the root tangles under the opposite bank. Which bait should you use? Think about the critters that live under that bank! Try drifting a small shiner, dragonfly nymph or crayfish—live bait or imitation. Worms also work great.

illustration-Ron Kuhn

Riffles, runs, pools

A stream reader should also focus on riffles, runs and pools. Each one provides a different habitat. A riffle is shallow with lots of rocks that break the surface. These rocks provide great habitat for algae, aquatic insects and small fish. Larger fish like trout and bass often move into the riffles to search for dinner. Baitcasters should try a worm or minnow. Avoid using sinkers so your offering drifts naturally. Spincasters can try small plugs and spinners. They work best if you cast upstream and fish them down through the riffles in the direction of the waiting fish (fish will be facing

upstream). Fly casters may want to try mayfly nymphs, stonefly nymphs or caddisfly larvae.

Runs are deep and fast. Rocks do not break the surface, although runs may be turbulent. Bass and trout rest along the edges of a run and dart into the current when food passes by. A catfish might even be waiting at the tail end of a run for that perfect bite to eat. Any live or supermarket bait will work. Try worms, minnows, aquatic insects, chicken liver, dough balls, shrimp or corn. Just make sure you use enough weight to keep your bait down, where the fish are waiting. Fly casters should also use enough weight to keep their nymphs or wet flies deep enough.

Pools are wide, deep sections that have a slow current. They often occur after riffles and runs. Pools make great places where fish hide, rest and capture food from the surface. Pools have lots of *woody debris* and *detritus* (decaying leaves, sticks and animal material). Detritus is an important part of the food chain. Some aquatic insects eat detritus. This means that where there are aquatic insects, there's fish!

Woody debris is important because it provides places where fish and other critters hide. Try baitfishing a minnow or crayfish along the edge of woody debris. Small plugs or spinners work well when fished to imitate an injured minnow. Pools are also great places for casting a dry fly. Wait to see a rising trout. Then carefully cast just above it. Allow the fly to drift slowly toward the strike zone and...*bam*!

Now you are an expert Stream Reader. Well, not exactly. There is much more to it than just this information, but those skills will come with experience. You have the basics, so take a step back the next time you are fishing or participating in that stream study with your school class and use this information to understand how a stream flows.

P.A.U.S.E. and M.A.T.C.H. methods

P - **Parking lot** - Do not put a fly on in the <u>Parking Lot</u>. As you move toward the stream listen and observe what bugs are around, in the air, on the ground, and in bushes. Wait till you get to the water. Then observe the following:

A - **Above the water** - Migrating flights of caddis, for example, <u>may</u> not be a good indicator that bugs are lighting and laying eggs - just buzzing around. Other insects may rising off the water = good!

U - **Under the water -** Can you see any insects (larva, pupa, etc.) beneath the surface of the water?

S - **Spiderwebs** - Spider webs often capture what is hatching and flying around..Checking what's trapped in the webs may be a good indicator of the type of fly you might start with.

E - **Edges and eddies** - Look for back waters and side channels in still, shallow waters and look for any collections of bugs on the surface or just under the surface

"Match the Hatch" is familiar saying in fly fishing. Without trying to identify specific bugs and trying match your flies exactly, use the following as a guide (not a rule) for selecting your fly.

M - Most abundant bugs

A - Approximate size and profile

T - <u>Trout feeding behavior</u> (targets and location)

- C Color close to insect colors spotted hold it against the sun for more true color
- H Half an hour no bites? reevaluate patterns

Notice the behaviors of flying bugs:

Chaotic flight of insects = caddis Even flights over water = mayflies Helicopter flights (hovering) = stoneflies Birds active over water = could be eating surface flies or emergers (or not)

Source: Orvis Flyfishing Podcast, March 1, 2019

Handling and Releasing Fish

Ways to Safely Return the Fish to the Water

Some fish you might want to eat and others you might want to release alive to grow and be caught another day. Some wild fish populations can stand a lot of harvest (panfish) and others cannot. It takes six or seven years to grow a large trout or bass. If you want to preserve the large fish for future fishing, then you'll need to handle them properly or they will die. Here's how to handle fish you intend to release.

Fish have delicate guilds through which they breathe oxygen. And their bodies have delicate internal organs. Here are five steps to follow to prevent injury to the fish you catch for release.



Holding a fish upside down temporarily immobilizes it so that you can remove the hook. Keep the fishes head out of the water while you hold it upside down.

1. <u>If possible, don't handle the fish</u>. It is covered with a protective slime. When you handle the fish, you disturb the slime and the fish can develop a fungus and the spot you touch and die. Do not touch a fish with a dry hand. Simply reach down and release the hooking the hook from the fish's mouth and allow it to swim away untouched. Small pliers or forceps facilitate removal.

2.. <u>If you must handle the fish, do so gently by turning</u> <u>the fish on its side in your hand</u> where will become immobile or by turning it completely upside down in the water (facing up current) where it will usually becoming immobile. Then you can remove the hook and release the fish easily without a struggle.

3. <u>When handling the fish, make sure you do not put your fingers into the gills.</u> The fish can survive if it begins to bleed slightly from the gills, but its chances of surviving major gill damage are slim.

4. <u>Don't squeeze the fish when handling it</u> because you can damage its delicate internal organs.

5. <u>Make sure that you revive the fish completely before releasing it.</u> If the fish is exhausted, it will turn over on its side or upside down. Make sure you hold it upright in a gentle flow of water [with its head pointing upstream] so he can get it gills working and recover oxygen from the water. In still water hold the fish and gently glide it back and forth in the water so the water flows through the gills providing oxygen to the fish.

Don't try to revive the fish in the fast current. If it slips away, it will begin spinning and turned upside down and you won't be able to save it. Revive stream fish and and the general in the gentle flow to the bank.

SECTION 3: FLY TYING

Tools and Hooks

Fly Proportions

Fly Patterns

- Streamer: Wooly Bugger
- Nymph: Pheasant Tail
- Nymph: Gold Ribbed Hair's Ear
- Dry Fly: Yellow Palmer
- Dry Fly: Elk Hair Caddis



Fly Tying Tools

Tying tools as stated below will make or break a day at the vise. While it is certainly not necessary to have the newest, hottest, and most expensive tools, even for professional tiers, a certain standard of quality will reflect directly on your ease and success in tying. Below is a very basic list of tools that at a minimum those necessary to tie most patterns. Adding tools as needed can be relatively cost effective without breaking the bank. Some manufacturers are listed but do not begin to represent the only or the best, but do offer affordable quality.

Bobbin

The bobbin is central to every pattern and while it is not necessary to spend a fortune, this is one item where quality will make tying less frustrating and yield better results. The key element is a ceramic or jewel lined thread tube.



Dr Slick, Tiemco and Griffin all make quality bobbins at an affordable price.

Scissors



The other tool used in every pattern are scissors. Poor or low quality scissors will affect every pattern and almost every step. Like the bobbin, buying the best quality affordable will result in a happier tier with happier results. A fine tip will also help day in day out. Two pair can add a second pair for more coarse work and save wear on the fine tip. Dr Slick, Tiemco, Griffith are suppliers with multiple price points

Hackle Pliers

Hackle pliers are used to aid in wrapping or positioning all sorts of materials. There are multiple styles and sizes and a teardrop or English style are the most used and not very expensive.



Bodkin

A bodkin is essentially a needle with a holder. Useful in moving small items on the hook, loosening threads, plucking dub and applying cements. Very inexpensive. There are a great many models and often will include a half hitch tool, which is also useful.

Hair Stacker



A hair stacker will allow you to align the tips of various types and amounts of animal hair after removing from the hide. This is an essential operation for many styles of flies. There are also many vendors and styles, but a basic one is sufficient for the majority of needs.

Whip Finish Tool

The finished head is not only a representation of a natural insect, it also secures the materials at the head. A whip finish tool can be intimidating at first, but, with practice it becomes an essential part of most every fly tied. Using a whip finisher gives excellent control and thread placement and will aid in producing a beautiful head.



Bobbin Threader

Not essential, but also not expensive, a bobbin threader can reduce anxiety and add ease and speed to changing threads. Most will also include a half hitch tool as well.

Fly Tying Hooks



Hook choices are dictated by both the style of pattern and the tiers choice. Generally speaking, following the standard designated hook design will result in a more pleasing fly proportionally and functionally.

Proportions are an essential part of a correct imitation and having the length, shape, and weight hook will be much easier following the manufacturers recommendation. The same will apply to function, in that the function is the fishability and catchability for the hook.

The diagram above shows the part names for hooks, and which becomes extremely important in understanding and communicating recipes and patterns. Also, the above illustration is a very basic shape but the parts are universal for all hooks and all manufacturers. **Note*** This is only a guide and personal styles may vary, but if this is followed, we all know what each other is talking about when someone says:



Hook Proportions

- A = Hook Shank Length (H. S. L.)
- B = Hook Gap = Hook Size



Standard Dry Fly Proportions

- C = Tail Length = Hook Shank Length (A)
- D = Wing Length = H.S.L.(A)
- E = Hackle Length = 1 1/2 to 2 x Hook Gap(B)
- F = Body Length=2/3 to 3/4 H.S.L. (A)



Parachute Dry Fly Proportions

Same as for Standard Dry except for body length: F = Body Length = 4/5th H.S.L. (A)



Nymph Proportions

 $G = Tail Length = 1/2 H.S.L. (A) \\ H = Abdomen = 1/2 to 2/3 H.S.L. (A) \\ I = Thorax = 1/2 to 1/3 H.S.L. (A) \\ J = Lea (Hackle) Length = 1/2 H.S.L.(A)$
Pheasant Tail Nymph

Frank Sawyer introdu upstream, dry fly only E that represents many, increased chance of	uced the Pheasant Tail nymph early in the last century and a revolution inglish tradition to fishing below the surface, in the water column. The many species of mayflies and caddis. The ability to have a single fly f success. There are also many subtle and not so subtle variations por performance of the magnificent Pheasant	on of how to fish for trout began. Moving away from he Pheasant Tail is a simple material, straightforward tie v that covers multiple bugs give the fisherman a much ossible with this pattern, furthering the flexibility and t Tail.
Recipe		
	ноок	Standard Nymph 12,14,16,18,20
	THREAD	Brown 8/0
	TAIL	Pheasant Tail fibers
and the second se	ABDOMEN	Pheasant Tail fibers
C	THORAX	Peacock Herl
	RIBBING	Copper wire
	WEIGHT (optional)	lead free wire
	BEAD (optional)	Gold, black tungsten or brass bead
	WINGCASE	Pheasant Tail fibers
	WINGCASE	
	Debarb and mount the hook in the vise. Begin thread wraps three the one third from the eye and	e eyelengths from the eye. Make tight touching turns to let the bobbin hang.
	Select a six inch piece of copper wire and tie in at the one third ma wire at a forty five degree, on your side of the hook, pointing dow Make three wraps of thread to bind in the wire. At this point you c the eye) by pulling very carefully un	ark where the bobbin is hanging. Tie in by holding the vn. This will aid in trapping the wire where you want it. an withdraw the wire that extends past the tie in(toward til the end is out of sight.
A	Continue the thread wraps over the wire and toward the hook ber shank on your side. Stop at the point above the hook barb, mov bobbin hang	nd while maintaining the wire position against the hook e the wire straight down and out of your way. Let the g.
	Select four or five pheasant tail fibers by pulling off of the stem. The of thread immediately in front of the wire. The pheasant tail fiber less than the length of the less than the less than the length of the less than the less than the length of the less than the length of the less than the length of the less than the l	ie these in where the bobbin is hanging with two wraps s must remain on top of the hook shank and should be e hook shank.
	After making the two wraps of thread and happy with the length and of thread, one on top of the other immediately in	nd placement of the pheasant tail, make two more turns front of the wire. Let the bobbin hang.
	Make one or two turns of wire directly on top of the thread wraps Move the thread out of your way. Advance the thread to the one	s, trapping the pheasant tail on top of the hook shank. e third back of the eye mark and let the bobbin hang.
	Wrap the pheasant tail forward in tight, touching, slightly overlappi of thread. Add three turns of thread in front of the pheasant tail p bobbin hang	ing turns to the thread bobbin. Secure with three wraps bushing it up to right angles of the hook shank. Let the g.
Contraction .	Wrap the wire in open turns to where the bobbin is hanging. Secu two behind. Helicopter the wire to remov	are wire with three turns behind, three turns in front and re waste. Let the bobbin hang.
Cristin .	Select six or eight pheasant tail fibers, remove from the stem by al tie in on top of the hook shank immediately in front of the win	igning the tips and pulling away. Trim the "curlies" and re with the shiny side down. Let the bobbin hang.
	Select two or three peacock herl fibers and tie in as a bundle, by the tips) immediately in front of the pheasant tail. Advance the thread to hang.	eir tips (after removing a half inch or so of the fragile o within three eyelengths of the eye and let the bobbin
C.	Advance the peacock herl in tight, slightly overlapping turns to the away the waste. Let the	he thread. Secure with three wraps of thread and trim bobbin hang.
	Bring the pheasant tail fiber wingcase forward, over the peacock h wraps of thread. Trim away the waste pheasant tai	nerl and on top of the hook shank and secure with three I. Whip finish and trim away the thread.

Gold Ribbed Hare's Ear		

The Gold Ribbed Hare's Ear is one of the most versatile imitations for nymphs in all fly fishing. Simple to tie and many effective variations are available for different conditions. A solid staple in any good fly box. Multiple sizes are also an aid for expanding offerings. Any water, anywhere will yield fish to a GRHE.

Recipe		
	НООК	Standard Nymph 12,14,16,18,20
	THREAD	Black 8/0
	TAIL	Pheasant Tail
	ABDOMEN	Hares Ear light dubbing
	THORAX	Hares Ear dark dubbing
	RIBBING	Gold Wire or Tinsel
	WEIGHT	Lead or Lead Free
	BEAD (optional)	Brass or Tungsten
	WINGCASE	Mottled Turkey or Pheasant Tail
	Debarb the hook and mount in v	ise. Begin six or eight wraps of lead free wire in center of hook shank and move to three eyelengths behind eye.
S. Martin	Attach thread two or three eyel	engths from eye. Begin tight, touching wraps to behind the lead wire and let the bobbin hang
	Select a six inch piece of gold wi turns	re and tie in on the side of the hook shank, closest to you and begin tight touching of thread back to the hook bend. Let the bobbin hang.
	Select four or five pheasant tail fi advancing to the lead wraps. Secu and l	bers and holding the fibers on top of the hook shank begin to tie in with the thread ure with three thread wraps and advance the thread in open wraps to the hook bend et the bobbin hang. Trim away any pheasant tail waste.
All and a second	Form a small light hares ear dub	bing noodle and advance in tight, touching turns to the lead wrap. Let the bobbin hang.
- Children .	Advance the gold wire in open to front and one behir	urns to the lead wrap. Secure the gold wire with three thread wraps behind, two in ad again. Let the bobbin hang and helicopter the wire until it breaks.
	Select eight or ten pheasant tail fi down and with the tips facing the top of the hook shank. The posi and advance the th	bers or turkey tail fibers and remove from the stem. Tie in these with the bright side hook bend. Their position is on the thorax and about half way to the hook eye, on tion is to allow the wingcase to fold over the thorax dubbing. Secure the wingcase rread to the lead wraps toward the hook bend. Let the bobbin hang.
	Form a small dubbing noodle with The thoray	n dark hares ear dub and begin wrapping to within three eyelengths of the hook eye. < should be thicker than the abdomen. Let the bobbin hang.
- Contraction of the second se	Bring the wingcase forward, tow three eyelengths in front	ard the hook eye and center over the thorax dubbing. Hold tight and tie in leaving to allow for a head. Secure with three wraps of thread and trim the waste.
	Form a small tapered head with t pull out, p	thread and whip finish to complete. Using a bodkin or other tool, pick out or gently partially, some of the thorax dubbing. This will look like legs.

|--|

The *Elk Hair Caddis* is a versatile and effective Caddis pattern. The Elk Hair Caddis is a great fly for pocket water or fast moving water. The elk hair and hackle on the body make the Elk Hair Caddis a high floating and buoyant fly. The Elk Hair Caddis can be tied in sizes #10-20 and in every color from tan, brown, black and grey. Caddis look just like a small moth, and act like one too. Caddis like to flutter, skate and dapple the surface. The Elk Hair gives the fly "implied movement" and gives the Caddis the appearance of fluttering its wings.

Dasias		
Kecipe	HOOK	Standard Dev Elv 10.12.14.14.18.20
	TURSER	Statioard Diy Fry 10,12,14,16,16,20
A second second	THREAD	8/U lan
A CONTRACTOR OF THE OWNER	IAIL	n/a
	ABDOMEN	Superfine dubbing
	HACKLE	Brown Rooster Hackle
2 17 ASV PHC4	RIBBING	Fine gold wire
	Debarb and mount the	e hook in the vise, start thread one third back from the eye and let the bobbin hang
	Cut a four inch piece o advance to the hook b	of gold wire and mount to the hook shank at the one third mark and begin wrapping the wire to the side of the hook closest to you and end. Move the wire out of the way. Let the bobbin hang.
	Select a very small arm dub forward from the Let the bobbin hang.	ount of dub and spin onto thread. The length of the noodle is about an inch an a half. Better to add than to take away. Begin wrapping the hook bend to the one third mark using tight, touching turns and maintain a tight noodle. Twist noodle to tighten as advancing if necessary.
	Select a hackle feather hackle to be just stem. and let the bobbin har	and strip the stem about 3/16 of an inch. To make the first wrap of hackle neater, allow enough stem to be able to make the first turn of . Tie the hackle in at the hook bend immediately in front of the wire, securing firmly and trim any waste. Leave the thread at the hook bend 19.
	Begin wrapping the ha the waste and let the b	ackle forward in open loops (about four turns of hackle) to where the bobbin is hanging and secure with two or three thread wraps. Trim away sobbin hang.
	Begin wrapping the wi thread. Bind in the wir	ire at the same rotation as the hackle, wiggling through the hackle fibers to trap as few a possible to the one third mark and capture with re with three or four thread wraps and break the thread off by rotating. Let the bobbin hang.
	Select a portion of elk deal of loss. Clean the Once the underfur and	hair and trim tight to the skin. The amount is about the size of a pencil in diameter. Remember, when cleaning the hair there will be a good hair by trapping the tips in between your left hand index and thumb and gently stroke through the stub end with you right index and thumb. I short hairs are removed, stack in hair stacker, tips down
	After stacking, tie the e immediately in front of the length and position	elk in with the tips facing the hook bend and the tips slightly past the hook bend. To tie in hold the tips in your left hand and tie in f the earlier materials at the one third mark with two or three soft wraps. Tighten these wraps slowly and once somewhat secured make sure n are okay.
	Holding the tips again the manner are fine. N	n, begin tighter wraps (two or three) and start advancing the thread through the stub end by gathering a few hairs at a time. Three wraps in Make sure to maintain the hair position on top of the hook shank and avoid slippage to the side by keeping pressure with your left hand.
	Return the thread to th hair from slipping. On	ne initial tie in point of the elk and make two or three very firm, overlapping wraps while still holding the tips in your left hand to prevent the ce secure, maked several half hitches or whip finish turns and cut the thread.
	Trim the stub ends of e cement to the thread v	alk, using the hook eye as an angle guide in one smooth cut leaving them sloped at about a forty five degree. You make add a drop of head wraps as an option for security.

Yellow Palmer

The Yellow Palmer is an original Smoky Mountain recipe. Roger Lowe has been a recent champion. This pattern is a high floating dry fly that is an attractor and is also tied in orange.

	Recipe	
WI/ KARA IL	НООК	Standard Dry fly 12,14,16,18
	THREAD	Black 8/0
	TAIL	Grizzly and Brown rooster hackle
	ABDOMEN	Yellow dry fly dubbing
	RIBBING	Grizzly and Brown rooster hackle
	6	
	Debarb the hook, mou	nt in the vise and start thread at three eyelengths from
A	the eye. Let the bobbir	n hang.
	The tail is a combinatio	n of brown and grizzly rooster hackle. Holding the two
	color feathers together	after matching up the length at the tips, select sufficient
	barbs (five or six of eac	h color) and remove from the stem. Keeping the tips
	aligned, judge the leng	of the second state of the second share. Use three, soft turns
	touching turns to the h	ook bend, trim any waste and let the bobbin hang.
	Select one arizzly and	and brown rooster backle feather and strip the lower part
	of the stem of about 3/	(16 inch of barbs. Tie each in, one at a time with the
	shiny side toward the e	ye. Let the bobbin hang.
	Form a yellow dub dry	fly noodle of sufficient length to advance to three
	eyelengths back of the	eye. Better to have to little and repeat the step as to
	have too much. Advan	ice in tight touching turns and let the bobbin hang.
	Advance the foremost	hackle feather, either brown or grizzly in open, spiral turns
	to the bobbin. This she	build be about five turns. Irap with thread, secure with
	Repeat the same pro-	cess as above with the other hackle. Once complete,
	form a small head, whi	o finish to complete.

SECTION 4: ENTOMOLOGY

Typical Insects on the Water Hatch Chart for Smoky Mountains



Caddisfly Life Cycle for the Fly Tier



Caddisflies are the order of aquatic insects that go through complete metamorphosis or four stages of life cycle. The egg, the larva, the pupa and the adult make up these stages. Butterflies and moths have complete metamorphosis. Caddisflies are a huge order of insect and common in virtually, if not all, trout habitats. Ignored as a trout food source for many, many years modern fisherman have come to realize the importance of the order. On the water the adult is easy to spot when flying. Unlike the graceful and delicate flight of the Mayfly, Caddis are erratic in the air and appear to almost stumble as they fly. Their wings are tent like and are folded back across the abdomen, giving a moth like profile.

Caddis Larva are wormlike in appearance although they have six legs near the head. Some larva have silk spinnerets and will form tiny houses of sticks or of stones and live inside until the next stage. Some use the silk to form nets to trap vegetation for food. Some are "free range" and crawl on the bottom hunting animal foods. Finally they construct a cocoon and enter to develop into the pupa. Living on the bottom and often losing grip with what they are clinging to make them vulnerable to trout. There is also a special time, called the benthic drift, where thousands of caddis leave the bottom to drift downstream to resettle. A very popular time with trout.

Pupa grow wings in the cocoon in about two weeks. They emerge from the cocoon and rise to the surface as the wings are expanding and soon as the reach the surface and the wings are dry they fly away from the water. This journey from the bottom to the surface makes caddis pupa very vulnerable to trout predation. There is also a delay at the water surface as the wings are drying.

Adult caddis live in nearby tree or shrubs at the waters edge and after mating the female will deposit the eggs on the surface in a fly by situation or even dive and swim to the bottom to lay the eggs on stones. Unlike mayflies, caddis adults can live for weeks or even a month as adults.

Mayfly Life Cycles for the Fly Tier



Mayflies are the beauties of trout food water insects. From the order of Emphemeroptera which by definition means "of a fleeting existence". Pretty romantic for a bug. As adults, mayflies are very delicate and graceful. For the trout fisherman and therefore the fly tier, the life cycles are very important.

Mayflies have incomplete metamorphosis, which is to say they go through three stages of development as opposed to four. The three stages are Egg, Nymph and Adult. For tiers, the egg has no importance, too small and inaccessible for trout.

The Nymph shown above, is however, of great importance. These nymphs go through many stages of growth, called instars. They live on or near the bottom of the water column and are either "clingers", "burrowers", "swimmers", or "free range" depending on the species of mayfly. This represents various degrees of direct important to the tier.

The next stage is sort of confusing and somewhat debatable in its description. Looking above at the illustration there is an Emerger and it is half in and half out of the water. The nymph, when reaching the stage of growth where it is ready to become an adult *emerges* from the bottom and rises to the surface of the water to ready to fly away as an adult mayfly. Emergers, depending on the species, rise as a half adult to complete on the surface, up to a full adult, only needing to dry their wings on the surface. Regardless of the type of emerger, they are all very vulnerable to trout and high on the trout menu. They are much easier for trout to catch than the adults.

The Dun is the full adult, ready to leave the water. The dun will have one more stage of growth, becoming a Spinner and then is ready to mate. After leaving the water the female will return to either drop the eggs on the surface or even swim to the bottom of the water column to lay the eggs. The Spinner Dun mayfly is the most popular representative of trout food insects and is the famous dry fly representation that is everyone's favorite way to catch trout on the fly.

The last illustration is on the Spent Spinner. This is the adult that has completed the life cycle and in death falls to the water surface and are readily gobbled up by trout.

Stoneflies Life Cycles for the Fly Tier



Stoneflies, like Mayflies go through incomplete metamorphosis. Three stages of development (egg, nymph, adult) and with one twist for the fisherman/tier. Mayfly adults have vertical and delicate wings, Caddis have a tent like wing, not unlike a moth, Stoneflies have a characteristic flat wing. There are four actual wings and these are the armored vehicle version of aquatic insects. Some are fierce in appearance and solid in construction. Some are small a delicate as well. They are excellent indicators of high quality water and live in the clear, rocky, fast waters.

The Nymph lives on the bottom of the water column and will live there for up to three years, for some species, before emerging. Mayflies and Caddis are underwater as nymphs for about one year. Stonefly nymphs look very different in appearance from mayflies and can also be a great deal larger. A good and large source of protein for the hungry trout, which is to say, "Trout love them". Accidently losing grip on the bottom, releasing a floating, helpless nymph makes a wonderful bugsize meal for opportunistic trout. A number of aquatic insects will also, for reasons debated, will release themselves voluntarily as well and float downstream for a distance before resecuring a safe position. More trout food.

A large difference in life cycle in regards to fisherman/tiers is the lack of an Emerger as a food source for trout. Stonefly nymphs when ready to emerge, crawl to the waters edge and cling to a rock for the actual emergence. This obviously takes stonefly emergers out as a trout food.

The Adult female does return to the water to lay eggs and becomes vulnerable to trout on the water surface, sometimes with astounding aggression by the hungry trout.

FLY HATCH CHART NORTH CAROLINA SMOKY MOUNTAINS

help you identify all the bugs and insects that hatch in Western North Carolina Mountains and the Great Smoky Mountains in the This Hatch Chart may be used for a North Carolina Hatch Chart, WNC Hatch Chart, and a Southeastern Hatch Chart. This will Southeastern areas. Conditions and fly selection may vary by stream. Check available sources before you head out.

INSECTS	EMERGENCE	SIZES & PATTERNS
	JANUARY	
Dipterae Midge	Afternoon	18 - 24 Gray Midge, 18 - 24 Olive Midge
Blue Winged Olive	Afternoon	18 - 24 Blue Winged Olive, 18 - 24 Adams
Early Black Stone Fly	All Day	18 Black Stone Fly Nymph 18 Black Adult Stone Fly
	FEBRUARY-MARCH	
Blue Winged Olive Baetis	February - March Early Afternoons - Warm Days	<i>18 Blue Winged Olive,</i> <i>18 Adams</i>
Early Black Stone	February - March All Day	18 Black Stone Fly Nymph 18 Black Adult Stone Fly
Blue Quill Paraleptophlebia Adoptiva	Late March Morning to Early Afternoon	<i>18 Blue Quill Wet & Dry</i> <i>18 Adams</i>
Quill Gordon Epeorus Pleuralis	Late March Early Afternoon	12 - 14 Quill Gordon, Wet & Dry
	APRIL	
Blue Quills Paraleptophlebia Adoptiva	Early April Mornings to Early Atternoons	<i>18 Blue Quill Wet & Dry</i> <i>18 Adams</i>
Quill Gordon Epeorus Pleuralis	Early April Early Afternoons	12 - 14 Quill Gordon, Wet & Dry
Dark Dun/Black Caddis	Mid-April Mid-Mornings	14 - 16 Black Soft Hackle 14 - 16 Dark Elk Hair Caddis

40

10ttled Brown/Gray Caddis	MAY All Day	16 Brown or Gray Soft Hackle, 16 Brown Elk Hair Caddis
endrickson phemerella Subvaria	All Day; Female Spinner has Yellow Egg Sac	14 Hendrickson, 14 Red Quill, 14 Female Adams
larch Brown tenonema Vicarium	Mid-May All Day Sporadically	12 March Brown, Wet & Dry
ight Cahill tenonema Ithaca	Afternoon - Evening	16 - 18 Light Cahill
ellow Midge Niptera	Early May	20 Yellow Midge
iray Fox itenonema Fuscum	Sparse Hatch	14 Gray Fox, 14 Ginger Quill, 14 Gray Fox Variant
ulphurs phemerella Dorothea	Early May Late Afternoon and Evening	16 - 18 Sulphurs, 16 - 18 Light Cahill
lack Caddis	Early May All Day	18 Black Soft Hackle, 18 Black Fluttering Caddis
ream Midge	Mid-May All Day	20 - 22 Cream Midge
Ilue Winged Olive taetis	Mid-May Early Atternoon	20 -22 Blue Winged Olive, 20 - 22 Adams
areen Drake Ephemera Guttulata	Late May Evening	10 Paradrake, 8 10 White Wulff
aiant Stone Fly teronarcys	Early May Early Morning	4 - 8 Stone Fly Nymph
	JUNE	
Aottled Brown àray Caddis	Early June All Day Sporadically	16 Brown or Gray Soft Hackle 16 Brown Elk Hair Caddis
ight Cahill Ntenonema Ithaca	Sporadically - Late Afternoon and Evening	16 - 18 Light Cahill

Sulphurs Ephemerella Dorothea	Late Afternoon and Evening	16 - 18 Sulphurs 16 - 18 Light Cahill
Isonychia Bicolor	Sporadically - All Day	12 Adams
Green and Yellow Stone Fly	Late Afternoons	16 Light Green and Yellow Fluttering Stone
Giant Stone Fly Pteronarcys	Early Mornings	4 - 6 Stone Fly Nymph
Terrestrials	All Summer	Inchworms, Black Ants, Beetles, and Crickets
	JULY	
Isonychia Bicolor	Sporadically - All Day	12 Adams
Green and Yellow Stone Fly	Late Afternoons	16 Light Green and Yellow Fluttering Stone
Golden Stone Fly Acroneuria	Early Morning and at Dusk	6 - 8 Stone Fly Nymph
Light Cahill Stenonema Ithaca	Sporadically - Late Atternoon and Evening	16 - 18 Light Cahill
Terrestrials	All Summer	Inchworms, Black Ants, Beetles, and Crickets
	AUGUST	
Isonychia Bicolor	Sporadically - All Day	12 Adams
Golden Stone Fly Acroneuria	Early Morning and at Dusk	6 - 8 Stone Fly Nymph
Light Cahill Stenonema Ithaca	Sporadically - Late Afternoon and Evening	16 - 18 Light Cahill
Flying Ants	All Day	20 -24 Spent-wing Black and Brown Ants
Terrestrials	All Summer	Inchworms, Black Ants, Beetles, and Crickets

	SEPTEMBER	
Light Cahill Stenonema Ithaca	Usually at Dusk	16 - 18 Light Cahill
Isonychia Bicolor	Sporadically -All Day	12 Adams
Flying Ants	All Day	20 - 24 Spent-wing Black and Brown Ants
Terrestrials	All Summer	Inchworms, Black Ants, Beetles, and Crickets
	OCTOBER-NOVEMBER	
Deptera Midge	October - November Afternoon	18 - 24 Gray Midge
Blue Winged Olive	October - November Afternoon	18 - 24 Blue Winged Olive, 18 - 24 Adams

SECTION S: CONSERVATION

A River Flows Through It

Water Cycle

What Aquatic Insects Tell Us About Water Quality

Pollution Tolerances of Macroinvertebrates

Importance of Riparian Buffers





A RÍVER FLOWS Through It

If you were asked to imagine a stream, what would come to mind? Each person asked would probably picture something a little different. Some would imagine a bubbling mountain brook. Others would dream of a warm, lazy creek teeming with rock bass or trophy smallmouth bass. Each of us would be right. Pennsylvania has more moving water than any other state-more than 83,000 miles. This water flows through Pennsylvania in one of six major watersheds, or basins: Lake Erie, Ohio, Susquehanna, Genesee, Potomac and Delaware. If you are familiar with the rivers after which the watersheds are named, you know that they differ greatly. They have been shaped by climate and thousands of years of geologic activity, including glaciers in some cases. These differences are the reasons why Pennsylvania has so many different kinds of fishing and boating opportunities.

Even in a watershed, though, one can find habitat differences. The babbling brooks, runs, streams, creeks and the major waterway in each watershed offer a variety of habitat types. These diverse waterways are home to nearly 160 species of fish and hundreds of invertebrate species. What follows is a simple explanation of why the differences occur within a watershed.

The boundaries of most major watersheds are found high in Pennsylvania's mountains. From there, the topography changes to more gradual slopes and often to very flat land. That is why the headwaters of a river, the Allegheny River, for example, are very different from the lower river near Pittsburgh. Even though they have the same name, they are very different waters, with different critters calling these waters home. That is why it is important to understand the changes that occur within a watershed. The transition from headwaters to larger rivers may be referred to as the **river continuum**.

The interactions of climate, moving water, surrounding geology and land topography affect the physical characteristics of the stream. The shape of the stream channel, the composition of the bottom, water temperature, and the water's chemistry (pH, alkalinity, hardness) are defined by this interaction.

These variables, especially temperature, bottom type and water chemistry, influence the type and number of organisms inhabiting the stream. Aquatic macroinvertebrates and other organisms have specialized **adaptations** (characteristics that help them survive). Some of these organisms are so specialized that they may be found only in specific sections of the watershed. Riffle beetle larvae, also called water pennies, are examples of this specialization. They have streamlined bodies and suction cups on their feet to help them cling to rocks in a swift headwater riffle. They feed on the film of algae growing on the surface of rocks.

Farther down the watershed, caddisfly larvae build elaborate tube-shaped nets to filter their food from slowmoving rivers. Some of these larvae are free-living. Others build shelters of sand and gravel on rocks. These



A river flows through it

This graphic highlights the changes that occur as we move down through a "typical" watershed. Typically, the amount of flowing water in a stream increases as you move down through the watershed. Often the speed at which this water moves and its temperature increase farther down in the watershed. The amount of dissolved nutrients also generally increases from the headwaters to the lower reaches of a waterway. Take note of the changes in the fish community from the headwaters to the lower reaches.

specialized adaptations let these organisms live in particular spots in a watershed. That is, they may not be found in the entire watershed—only in those places where their needs are met.

The predators that feed on these and other aquatic invertebrate animals are what SMART Anglers' dreams are made of! Fish are more mobile and often have wider tolerances than the invertebrates they feed on. As a result, they can be found in several different places in the watershed.

The fish community also changes as we move through a watershed. For example, anglers in search of small but feisty brook trout take to cold, fast-moving headwater streams. Brook trout are well-camouflaged for this weedless environment. The rocky stream bottom also provides nooks and crannies where tasty insects like stonefly nymphs and caddisfly larvae live. Record-musky anglers will head to bigger waters such as the warmer, slower currents of a river. The dark vertical bars on the side of the musky help it blend with the aquatic plants it uses for cover. Those same aquatic plants attract prey. Anglers seeking brown trout or smallmouth bass will likely find their quarries in the waters in between.

Stream Order: "Brook," "creek," "run," "stream" and "river" aren't scientific terms for describing a waterway. Streams can be more accurately categorized by their stream order. A first-order stream has no tributaries and flows directly from its source—a spring, lake or melting snow. When two first-order streams join, they make a second-order stream. Two second-order streams join to make a third-order stream, and so on. Stream order increases only when two streams of the same order join. The use of stream order classification lets us make accurate comparisons between two streams.

Headwater streams are usually cold, steep and fastmoving. They have steep gradients and high dissolved oxygen content, and they are shaded by the surrounding trees. The aquatic insect community is dominated by shredders and collectors like stonefly nymphs, caddisfly larvae and crane fly larvae. Brook trout, sculpins and dace also thrive in these habitats.

Trees are very important neighbors for moving water.



They shade the stream and help keep water temperatures cool. Tree roots stabilize the streambank and prevent soil from washing into the stream. The overhanging tree branches provide important shelter for fish and other organisms living in the water. One of the trees' most important contributions to first- and second-order streams is energy. The energy that drives the food chain in a headwater stream comes from *outside* the stream. Some species of stonefly and mayfly nymphs shred leaves and twigs that fall into the stream. Their wastes and smaller pieces of leaves and twigs are washed downstream.

Temperature is one of the biggest determining factors of fish populations. Each fish species has a preferred temperature range in which it can live, grow and reproduce. Biologists group fish into three preferred temperature categories: Coldwater (50 degrees) to 65 degrees), coolwater (65 degrees to 70 degrees) and warmwater (70 degrees to 85 degrees). Temperature preferences among groups can overlap, creating "transition waters." Coldwater transition waters often hold brown trout, blacknose dace and longnose dace.

As the stream's gradient declines farther down in the watershed, the current slows in medium-sized creeks and rivers. Water temperature increases and the channel is wider. Bankside vegetation can shade only the edges of the water. Riffles and pools with cobble, gravel and sand become more abundant and provide ideal habitat for a variety of mayfly nymphs that act as collectors and grazers. More predatory insects are found here, compared to headwaters. In addition, the rocks are often covered with algae and other types of vegetation. If the water is cool enough in these streams—less than 70 degrees in the heat of summer, brown trout will be found here. If the water is warmer, smallmouth bass, rock bass and shiners call this habitat home.

Wider and deeper channels that meander through the river valley characterize the lower reaches of a river. Fine sediment drops out and accumulates on the bottom as the current slows. Bottom-dwelling collectors like clams, midge larvae, snails and burrowing insects make a living in the sediment and among the rooted aquatic plants. Hunters and searchers such as the predaceous diving beetle and dragonfly nymph move about in the water column in search of their next meal. Warmer water temperatures and lower dissolved oxygen are the preferred conditions for the largemouth bass, pumpkinseeds and brown bullheads that live here.

Energy to fuel the food chain can now be found *within* the river. Wastes that were generated upstream accumulate in the slow waters of the lower river. These nutrients act as fertilizer. A variety of rooted aquatic plants, algae and phytoplankton thrives here, creating the basis of the food chain.



"We all live downstream"

This phrase is more than a catchy slogan. It is a fact of life within a watershed. The waste from insects breaking down leaves in headwaters provides nutrients and food for others downstream. The amount and quality of water in a headwater stream influences the water quality downstream. Removing streamside trees in a headwater may affect other waters many miles away, farther down the watershed.

The word "watershed" is more than a buzzword or a technical term. Watersheds are complex systems in which many factors interact. The physical characteristics of a stream section in a watershed influence the biological community found there. The physical characteristics are the result of the interaction between moving water and the land it drains.

Differences between the major watersheds are more obvious. But even within watersheds there are differences. Those physical changes create unique habitats for organisms equipped with special adaptations suited for that habitat. It is the same water flowing down the same waterway that creates different habitat often miles away. A better understanding of this important but complex concept will likely lead to more enjoyable (and maybe more successful) days on the water.

References, more information

There are many excellent resources for information on this concept. They provide more information than we can cover in these four pages.

• *Pond and Brook*, by Michael J. Caduto, ISBN 0-87451-509-2.

• *Rivers and Streams*, by Patricia A. Fink Martin, ISBN 0-531-11523-2.

• Stream Ecology–Structure and Function of Running Waters, by J. David Allan, ISBN 0-412-29430-3.

• Aquatic Entomology, by W. Patrick McCafferty,

ISBN 0-86720-017-0.

• *Pennsylvania Fishes*, published by the PA Fish & Boat Commission (also available online) ISBN 1-930369-01-8.

Web resources:

DCNR's Watershed Education program – www.watersheded.dcnr.state.pa.us/what/components.html Stroud Water Research Center – www.stroudcenter.org/research Portland State University – www.oaa.pdx.edu/cae/programs/sti/pratt/rec.html Michigan State University – www.kbs.msu.edu PA Fish & Boat Commission web site – www.fish.state.pa.us

Water Cycle Diagram

In a bid to make the concept of water cycle easier for you to understand, we have come up with a diagram and a brief explanation of each of the steps involved.

The water cycle, also referred to as the hydrological cycle, is basically the movement of water on the planet. It involves movement of water



on the surface of the Earth (surface flow)

above the surface of the Earth (evaporation and precipitation)

beneath the surface of the Earth (ground water flow)

The amount of water on the planet is basically stable, but it is in continuous cyclic movement and hence, is referred to as the water cycle.

Water evaporates from various water bodies by becoming water vapor. This water vapor continues to soar in the sky, until it reaches the point wherein it condenses and forms clouds. The clouds then precipitate to send the water back to the surface of the planet and the same process is initiated all over again.

This may seem a bit confusing, but a look at the diagram provided below, which highlights each step of the water cycle, will make things pretty clear.

Evaporation is the process wherein any liquid (water) turns to a gaseous state (water vapor) due to an underlying factor acting upon it, and gradually disappears in the atmosphere. This is one of the most important steps of the water cycle. In this case, the underlying factor is the Sun, which heats the water in various water bodies on the planet, like oceans, rivers, lakes, or wells. Even a bucket of water kept outdoors is subjected to evaporation. As the water turns to water vapor, its starts ascending in the atmosphere.



Evapotranspiration

Within the concept of evaporation, there is a process referred to as evapotranspiration. In this process, the water let out from the plants in the process of transpiration turns to water vapor, owing to the Sun's radiation, and evaporates into the atmosphere. Though the amount of water evaporated by this process may not be as much as the amount evaporated from the ocean, evapotranspiration does contribute to the water cycle. Condensation is the process wherein any matter in the gaseous state (water vapor) turns to a liquid state (droplets of water), as the molecules in it lose heat energy necessary to move around. In case of water cycle, evaporation takes water vapor to a certain height, wherein the molecules in it lose the energy to move around and condense to form a cloud with the help of dust or smoke particles suspending in the atmosphere.

As you can see in the diagram above, the next step of the process is precipitation, wherein the condensed water vapor comes down to the surface of the Earth in various forms. Precipitation occurs when the accumulation of water in the cloud exceeds its actual capacity and the clouds can no longer hold the water. Though there are quite a few forms of precipitation, rainfall and snowfall are the most common forms, and both have a few sub-types of their own.

In this step of water cycle, all the water which comes down in the form of precipitation is collected into different water bodies, from which it eventually evaporates. If the precipitation occurs over any water body, such as the oceans, rivers, or lakes, the water is directly accumulated into it. However, if precipitation occurs over land, the water either runs over the surface, or percolates into the ground. Water flow on the surface is referred to as surface run-off, while the flow beneath the ground is referred to as ground water flow. In either case, the water makes its way to some water body, from where it is eventually evaporated, and the whole cycle begins all over again.

This process, involving the movement of water by evaporation, condensation,



precipitation, and collection, has been occurring since millions of years and plays a crucial role in making Earth the only planet with life. Among the several benefits of water cycle, the most important one is natural water filtration, wherein the contaminated water on the planet is converted to fresh water as all the contaminants in it are left behind during the process of evaporation.

What Aquatic Insects Tell Us About Water Quality

by Debbie Hadley Updated January 20, 2019



Water Quality Sampling Net and Tray.- Will Heap / Dorling Kindersley / Getty Images

The types of insects and other invertebrates living in the world's lakes, rivers or oceans can tell us if that water source has very high or very little water pollutants.

There are a number of ways that the scientific community and environmental agencies measure water quality, such as taking the temperature of the water, testing the pH and water clarity, measuring the level of dissolved oxygen, as well as determining the levels of nutrients and toxic substances.

It seems looking at insect life in the water might be the easiest and perhaps most costeffective method especially if the surveyor can tell the difference from one invertebrate to the next upon visual examination. It can eliminate the need for frequent, costly chemical tests.

"Bioindicators, which are sort of like a canary in a coal mine – are living organisms that indicate the quality of their environment by their presence or absence," according to Hannah Foster, postdoctoral researcher in bacteriology at the University of Wisconsin-Madison. "The main reason to use bioindicators is that chemical analysis of water provides only a snapshot of the quality of a body of water."

Importance of Water Quality Monitoring

Adverse changes to the water quality of one stream can impact all the bodies of water it touches. When water quality degrades, changes to plant, insect and fish communities may occur and can affect the entire food chain.

Through water quality monitoring, communities can assess the health of their streams and rivers over time. Once baseline data on the health of a stream is collected, subsequent monitoring can help identify when and where pollution incidents occur.

Using Bioindicators for Water Sampling

Doing a survey of bioindicators, or biological water quality monitoring involves collecting samples of aquatic macroinvertebrates. Aquatic macroinvertebrates live in water for at least part of their life cycle. Macroinvertebrates are organisms without backbones, which are visible to the eye without the aid of a microscope. Aquatic macroinvertebrates live on, under and around rocks and sediment on the bottoms of lakes, rivers, and streams. Aquatic macroinvertebrates include species of insects, worms, snails, mussels, leeches, and crayfish.

For example, sampling macroinvertebrate life in a stream when monitoring water quality is useful because these organisms are easy to collect and identify, and tend to stay in one area unless environmental conditions change. Simply put, some macroinvertebrates are highly sensitive to pollution, while others tolerate it. Certain types of macroinvertebrates found thriving in a body of water can tell you if that water is clean or polluted.

Highly Sensitive to Pollution

When found in high numbers, macroinvertebrates like adult riffle beetles and gilled snails can serve as bioindicators of good water quality. These creatures are usually highly sensitive to pollution. These organisms tend to require highly dissolved oxygen levels. If these organisms were once abundant, but subsequent sampling shows a decline in numbers, it may indicate that a pollution incident occurred. Other organisms that are highly sensitive to pollution include:

Mayflies (nymphs) Caddisflies (larvae) Stoneflies (nymphs) Water Pennies Hellgrammites (dobsonfly larvae)

Somewhat Tolerant of Pollution

If there is an abundance of a certain type of macroinvertebrates, like clams, mussels, crayfish, and sowbugs, that can indicate that the water is in fair to good condition. Other macroinvertebrates that are somewhat tolerant to pollutants include:

Alderflies (larvae) Dragonflies and Damselflies (nymphs) Whirligig Beetles (larvae) Riffle Beetles (larvae) Fishflies (larvae) Scuds

Pollution Tolerant

Certain macroinvertebrates, like leeches and aquatic worms, thrive in poor quality water. An abundance of these organisms suggests environmental conditions in a body of water have deteriorated. Some of these invertebrates use "snorkels" to access oxygen at the water's surface and are less dependent on dissolved oxygen to breathe. Other pollutiontolerant macroinvertebrates include:

Black Flies (larvae) Midge Flies (larvae) Lunged Snails

<u>Useful links</u>

https://www.thoughtco.com/mayflies-order-ephemeroptera-1968042

https://www.thoughtco.com/stoneflies-order-plecoptera-1968059

https://www.thoughtco.com/characteristics-of-dragonflies-and-damselflies-1968256

Macroinvertebrates Grouped by Level of Pollution Tolerance

(Adapted from EASI and the Senior Environmental Corps, Volunteer Water Quality Monitoring Field Manual. Images from McCafferty. Aquatic Entomology, 1981 AND Kellogg. Monitor's Guide to Aquatic Macroinvertebrates, 1994.) Group I: Generally sensitive to pollution. Large numbers of these types of organisms normally indicate GOOD WATER QUALITY.









Water Penny Beetle Larva

Riffle Beetle Adult



Stonefly Nymph



Gilled Snail (has a thin, horny plate to seal shell opening)

Hellgrammite & fishfly larva

Non-Net-Spinning Caddisfly Larva

Group II: Can exist under a wide range of water quality conditions. Large numbers of these organisms, in the absence of Group I organisms, normally indicate MODERATE



Group III: Generally tolerant of pollution. Large numbers of these types of organisms normally, in the absence of Group I and Group II organisms, indicate POOR WATER QUALITY.



NOTE: These organisms are the only macroinvertebrates used to calculate the PTI. Other organisms will be found; to identify them, refer to other macroinvertebrate identification sheets in this section of the handbook.

Creek Connections Aquatic Macroinvertebrates Module - PTI Bag of Bugs

Importance of Riparian Buffers

Riparian buffers are the natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports a robust stream system; narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Residential developments, urban centers, golf courses, and rangeland are the common causes of anthropogenic degradation of the riparian zone.



Riparian buffers are the most valuable protection a stream system has against outside influences. In most cases healthy riparian directly reflects upon the condition of the stream unless the source of the insult is a specific pollutant. Enhancement of the riparian buffer by re-planting native grasses, forbs, shrubs and trees is the first step in the recovery of the stream back to a more natural condition.

The benefits of a healthy riparian buffer include:

- Provides organic material as food for invertebrate, fish and wildlife;
- Supplies large and small pieces of woody debris that provide habitat for fish, invertebrates and amphibians;
- Alters how sunlight reaches the stream and is an important temperature moderator; Stabilizes stream banks and reduces erosion;
- Filters sediment and materials from overland runoff and roots of many plants traps and holds the sediments;
- Absorbs nutrients from overland and sub-surface flows; and
- Reduces the impacts of flooding through temporary storage, interception and slow releases from heavy rains.

Source: West Virginia Department of Environmental Protection

Individuals netting fish identify the number and type of each fish species caught and make any other necessary observations. Observations or notations are verbally relayed to the individual carrying the bucket and recorded in a standardized field notebook.

Caught fish will be transferred to the person with the holding bucket. This individual will monitor the health of the fish and make transfers to holding tanks or fish bins if they appear stressed or overcrowded.

WHY is shocking conducted?

Some surveys may require statistically valid estimates of the resident fish populations. This data helps agencies manage the fish populations and assure the health of the populations for us to enjoy.

The electrofishing protocol represents a consensus view on the best way to obtain quantitative and qualitative population estimates of juvenile salmonids in small to medium sized streams.

In fisheries management, electrofishing is used as a sampling method. Electrofishing is particularly useful in situations where other techniques, such as netting, may be ineffective due to the nature of the species you wish to capture, the "target species", or the habitat. For example:

- Some fish, such as eels are difficult to catch and some habitats, such as fast flowing water, weed beds and rocky shores are difficult to sample.
- Electrofishing gear can either be used to catch fish directly or influence their capture by enhancing other methods.
- Electricity can also be used for non-capture related purposes.
 The efficiency of electrofishing in terms of the proportion of a fish population that can be caught varies considerably from site to site, according to a variety of factors.

Qualitative sampling is the capture of representative specimens, and is used to determine their presence or absence. This is the most easily completed electrofishing operation. Typical purposes of such investigations include studies of:

- distribution and movements of fish,
- taxonomy,
- morphology,

- growth rates,
- feeding habitats.

The quantitative study of fish communities can provide information on:

- numbers,
- biomass,
- age composition,
- year class strength,
- production of the species being investigated.

The assessment of population density and age structure are the main aims of quantitative sampling, which therefore requires a more structured approach than qualitative sampling. Methods in common use include those based on several fishings of the sample area, with the fish caught in each fishing not returned to the sample area until the fishings are completed (removal method), and those based on standardizing the amount of electrofishing effort used (timed fishing method).

Decisions on what type of assessment and sampling method will be used are determined by the purpose of the survey, and will usually be made by the fisheries manager or other relevant person.

SECTION 6: STOCKING TROUT # MONITORING FISH POPULATIONS

Stocking Trout Streams in North Carolina Monitoring Fish Populations Using Electro-Shocking



STOCKING TROUT STREAMS IN NORTH CAROLINA

The N.C. Wildlife Resources Commission manages roughly 2,200 acres of impoundments or lakes. along with 5,300 miles of public mountain trout waters, including 1,100 miles stocked annually with brook, brown and rainbow trout, and a few thousand miles of wild trout waters.

Stocking of these waters enhances fishing opportunities and improves inland fisheries management in public waters by monitoring inland fish populations, assessing their habitats, and gathering angler input. NC State Fish Hatcheries produce more than 6 million fish annually for stocking into public, inland waters — from trout in the mountains to catfish in Piedmont ponds and reservoirs to American shad in coastal rivers.



Residents, visitors, and tourists in North Carolina are

provided more than 500 publicly accessible places to fish in North Carolina. The diversity of topography, from small creeks to high mountain lakes to large trophy trout waters, are also a lure, especially for out-of-towners.

As a result, mountain trout fishing brought \$383 million to the North Carolina economy in 2014 according to a study for the North Carolina Wildlife Resources Commission. In that same year, nearly 149,000 trout anglers fished in the state, and the money spent on trout fishing in supported approximately 3,600 jobs.

The NC Wildlife Resources Commission works in partnership with other land agencies, including the U.S. Forest Service, the Blue Ridge Parkway, state parks and forests and local towns and private landowners to ensure access to fishing.

Reasons for the increasing popularity of trout fishing vary widely, from those who want to make a tasty trout almandine to those who want to admire a colorful rainbow trout before releasing it to swim again, to those wanting to get outdoors and try something new.

The national trend in trout fishing, made popular by the sport of fly-fishing, has ebbed and flowed over the years since the explosion after the release of Robert Redford's 1992 seminal fly-fishing film, "A River Runs Through It," which drew some 29 million anglers.

Western North Carolina is the southernmost region where there is cold water habitat for trout. Weldon said as one of the reasons he sees for the exploding interest in WNC trout fishing.

There are a number of organizations dedicated to fly fishing and the conservation of cold water streams. Trout Unlimited, a national organization, supports several chapters in the NC, SC, VA, and TN areas.

Casting Carolinas is a nonprofit that takes women in any stage of breast cancer on a free, weekend-long retreat to learn the mechanics and mind and body healing effects of trout fishing. "People's moods are lifted from being outdoors, in the sunlight. There is research that shows the positive ionization of standing in and around water decreases depression and anxiety," said Starr Nolan, a psychotherapist from Greenville with a lifelong love of fly-fishing. "Water by its nature generates ions, and especially running water. The effects are



Flyfishing guide Simons Welter shows off a rainbow trout catch on the Davidson River in Transylvania County. (*Photo: Courtesy of Bill R. Chiles*)

very healing."

Simons Welter, one of the few female fly-fishing guides, says "I'm seeing an increase in interest from women and kids and families are coming, not just the fishing buddies anymore. I think people are putting more of an emphasis on experiences instead of just buying things."

Welter is also on the board of Casting Carolinas and volunteers her time to teach women with cancer to fish. She said those women often return to fish, and get their families into the sport as well.

There are as many reasons to fish as there are people inspired by the beauty of Appalachian trout streams. Here's what some have said about what fly fishing means to them.

"It's a great way to escape, to get your mind off work, and get outdoors. The saying goes that catching a fish is second and being outdoors is first "

"I just love being outdoors. I'm not a beach person. I love the mountains. I love standing in the streams."

"It's about a lifestyle and getting outdoors and not feeling the pressures that society puts on us."

"I was out early one morning, I looked downstream and there was a canopy of trees on both sides of the river and the sun was shining through on the rippling water. I thought, 'how lucky am I?'"

Source: "Mountain Trout Fishing: Economic Impacts on and Contributions to North Carolina's Economy" by Karen Chávez, Citizens-Times.com, Updated June 1, 2017

SAMPLING OF FISH IN WADEABLE STREAMS THROUGH THE USE OF ELECTROSHOCKING

WHAT is electroshocking?

Since the 1940's, electroshocking has been used as a sampling tool for fisheries management. By examining the fish collected by this method, managers can determine what kinds and how many fish are in a body of water as well as get an idea of the overall health of the fish community.

Electroshocking equipment utilizes 2 electrodes that deliver a current into the water. When fish encounter the electric current, it stuns them and causes them to rise to the surface. This allows researchers to collect the fish in a net. The fish are examined, weighed, and/or measured and returned to the water.Shocking a stream use electrical power to momentarily stun



fish within an effective range from the backpack shocking unit. Based primarily on ambient conductivity and the size and species of fish targeted for collection, a voltage is selected that effectively stuns fish in a non-lethal manner. This allows for the return of fish to the water body unharmed.

The minimum sampling team size is three to four individuals. Additional staff can be selected depending on the width of the water body being sampled and the need for complete coverage across the stream.

The configuration for a standard sized team consists of one individual wearing a portable shocking unit, two people positioned on either side of the "shocker" and slightly downstream, and a fourth individual behind the netters to transfer netted fish to a temporary holding bin and record data. The sampling is performed moving in an upstream direction focusing on shocking those areas most likely to harbor the targeted fish species.

Individuals netting fish identify the number and type of each fish species caught and make any other necessary observations. Observations or notations are verbally relayed to the individual carrying the bucket and recorded in a standardized field notebook.

Caught fish will be transferred to the person with the holding bucket. This individual will monitor the health of the fish and make transfers to holding tanks or fish bins if they appear stressed or overcrowded.

WHY is shocking conducted?

Some surveys may require statistically valid estimates of the resident fish populations. This data helps agencies manage the fish populations and assure the health of the populations for us to enjoy.

The electrofishing protocol represents a consensus view on the best way to obtain quantitative and qualitative population estimates of juvenile salmonids in small to medium sized streams.

In fisheries management, electrofishing is used as a sampling method. Electrofishing is particularly useful in situations where other techniques, such as netting, may be ineffective due to the nature of the species you wish to capture, the "target species", or the habitat. For example:

- Some fish, such as eels are difficult to catch and some habitats, such as fast flowing water, weed beds and rocky shores are difficult to sample.
- Electrofishing gear can either be used to catch fish directly or influence their capture by enhancing other methods.
- Electricity can also be used for non-capture related purposes.
 The efficiency of electrofishing in terms of the proportion of a fish population that can be caught varies considerably from site to site, according to a variety of factors.

Qualitative sampling is the capture of representative specimens, and is used to determine their presence or absence. This is the most easily completed electrofishing operation. Typical purposes of such investigations include studies of:

- distribution and movements of fish,
- taxonomy,
- morphology,
- growth rates,
- feeding habitats.

The quantitative study of fish communities can provide information on:

- numbers,
- biomass,
- age composition,
- year class strength,
- production of the species being investigated.

The assessment of population density and age structure are the main aims of quantitative sampling, which therefore requires a more structured approach than qualitative sampling. Methods in common use include those based on several fishings of the sample area, with the fish caught in each fishing not returned to the sample area until the fishings are completed (removal method), and those based on standardizing the amount of electrofishing effort used (timed fishing method).

Decisions on what type of assessment and sampling method will be used are determined by the purpose of the survey, and will usually be made by the fisheries manager or other relevant person.

SECTION 7: FISHING REGULATIONS

NC Trout Fishing Regulations Public Mountain Trout Waters Classifications Stream Access for Fly Fishing



Overview of Trout Fishing Regulations in North Carolina

Fishing in Public Mountain Trout Waters

- Fishing is limited to hook and line only.
- An artificial lure is defined as a fishing lure that neither contains nor has been treated with any substance that attracts fish by the sense of taste or smell.
- Natural bait is defined as any living or dead organism (plant or animal), or parts thereof, or prepared substances designed to attract fish by the sense of taste or smell.
- It is unlawful to take fish bait or bait fish from Public Mountain Trout Waters.
- It is unlawful to possess natural bait while fishing Wild Trout and Catch and Release waters, unless those waters are also specifically classified for use of natural bait.
- Dropper flies may be used when fishing any Public Mountain Trout Waters.
- Fishing is not allowed in Hatchery Supported Trout Waters during the closed season except in the Linville River and tributaries within Linville Gorge Wilderness Area and on power reservoirs and municipal water supply reservoirs designated as trout waters.
- Non-trout species may be harvested from Delayed Harvest Trout Waters during the catch-and-release only trout season under applicable size and creel limits.
- It is unlawful to place hatchery-reared fish into Wild Trout Waters or move wild fish from one stream to another on game lands without prior written authorization.
- Information and regulations about trout fishing on game lands are listed on The Mountain Trout Regulations pages.

Trout Fishing in Undesignated Waters

Some waters that are not designated as Public Mountain Trout Waters contain mountain trout. When fishing in undesignated waters, there is no size limit or bait restriction, and the creel limit is seven trout per day. A trout fishing license is not required to fish undesignated waters, and there is no closed season.

Public Mountain Trout Waters

Some Public Mountain Trout Waters are managed for self-sustaining trout populations, while others have to be stocked periodically to provide a fishery. Public Mountain Trout Waters are as follows:

- "Catch and Release/Artificial Flies Only Trout Waters"
- "Catch and Release/Artificial Lures Only Trout Waters"
- "Delayed Harvest Trout Waters"
- "Hatchery Supported Trout Waters"
- "Special Regulation Trout Waters"
- "Wild Trout Waters"
- "Wild Trout/Natural Bait Waters"

Some of these public trout waters are also classified as Mountain Heritage Trout Waters and are identified on The Mountain Trout Regulations pages.

Public Mountain Trout Waters are Managed by Seven Different Classifications

Consult the North Carolina Inland Fishing, Hunting and Trapping Regulations Digest for current regulatory information

Definitions:

- An <u>artificial lure</u> is defined as a fishing lure that neither contains nor has been treated with any substance that attracts fish by the sense of taste or smell
- <u>Natural bait</u> is defined as any living or dead organism (plant or animal), or parts thereof, or prepared substances designed to attract fish by the sense of taste or smell

Hatchery Supported Trout Waters

- Season is open from August 1, 2018 to February 28, 2019
 - No bait restrictions
 - No minimum length limit
 - Seven (7) trout per day creel limit
- No fishing allowed from March 1, 2019 to April 5, 2019
- Then from 7:00 a.m. April 6, 2019 to July 31, 2019
 - No bait restrictions
 - No minimum length limit
 - Seven (7) trout per day creel limit
- There is no closed season for fishing on power reservoirs and city water supply reservoirs designated as trout waters

Delayed Harvest Trout Waters

- October 1, 2018 to May 31, 2019
 - No trout may be harvested or possessed
 - Only artificial lures having one single hook may be used
- No fishing allowed at all between 1/2 hour after sunset on May 31, 2019 and 6:00 a.m. on June 1, 2019
- At 6:00 a.m. on **June 1**, **2019** these waters open to fishing for youths under 18 years old under Hatchery Supported Trout Waters regulations
 - No bait restrictions
 - No minimum length limit
 - Seven (7) trout per day creel limit
- At 12:00 p.m. on **June 1, 2019** these waters open for all anglers under Hatchery Supported Trout Waters regulations

NCWRC PUBLIC MOUNTAIN TROUT WATER DELAYED HARVEST

Y SINGLE HOOK ARTIFICIAL LU NO TROUT MAY BE POSSESSED ALL OTHER TIMES: HATCHERY SUPPORTED REGULATIONS APPLY

ONLY ANGLERS UNDER AGE 18 6 A.M.-12 P.M.

N FIRST SATU

NCWRC

PUBLIC MOUNTAIN

TROUT WATER NO LURE RESTRICTIONS

HATCHERY

SUPPORTED

MINIMUM SIZE - NONE DAILY LIMIT - 7 FISH SEASON - FIRST SATURDAY IN APRIL

TO LAST DAY OF FEBRUARY

Wild Trout Waters

- Season is open year-round
- · Only artificial lures having one single hook may be used
- You can only keep four (4) fish
- The four fish must be at least seven (7) inches long
- It is unlawful to possess natural bait on your person while fishing

Catch and Release/Artificial Lures Only Trout Waters

- · Season is open year-round
- · No trout may be harvested or possessed
- Only artificial lures having one single hook may be used
- It is unlawful to possess natural bait on your person while fishing

Catch and Release/Artificial Flies Only Trout Waters

- Season is open year-round
- No trout may be harvested or possessed
- · Only artificial flies having one single hook may be used
- · It is unlawful to possess natural bait on your person while fishing







Wild Trout/Natural Bait Waters

- Season is open year-round:
- You can use a single hook artificial lure (or)
- You can use a single hook with natural bait, except live fish
- You can only keep four (4) fish
- The four fish must be at least seven (7) inches long



Special Regulation Trout Waters

The Special Regulation classification allows the Commission to implement site specific regulations on unique trout fisheries in the state that do not fit into existing categories. The regulations for each water body managed under Special Regulation will be displayed on each sign.



NC Stream Access for Fly Fishing

What are my rights to access and then wade in any particular stream for purposes of fly fishing vs. those of a property owners who post "**No Trespassing**" by the steam? **NOTE:** THIS INFORMATION IS BASED ON 2019 RULES. REVIEW EACH YEAR FOR CHANGES.

According to the N.C. Department of Agriculture and Resource Economics:

Although riparian owners have certain rights to use water, they do not actually own the water itself. All surface and ground waters are legally "waters of the State." The water, plus the fish and other aquatic life belongs to the State. (There is an exception for fish in private ponds if the fish cannot escape to or enter from public fishing waters.) Even when all of the submerged land under a water body belongs to private owners, the State owns the water, although the riparian owners continue to enjoy their riparian rights.

If the body of water that lies over privately owned submerged land can be navigated by any craft such as a canoe or a raft, then the public has a permanent right to use the water surface for all purposes of recreation and commerce, including fishing, whitewater canoeing, and such. It is not clearly settled whether the public's right to use such water bodies includes the right to wade on the privately owned stream bed for fishing or other recreation. When a stream is so small that it is no longer navigable by smaller craft such as a canoe, there is clearly no public right to wade, fish, or otherwise use or enter upon the stream. Similarly, there is no public use right for man-made ponds on private property. On water bodies over submerged lands owned by the State (historically navigable waters and tidal waters) the public has a clear right to navigation, fishing, and other recreation on the water, as well as the right to use the foreshore the area between the low and high water lines.

There is no public right to travel over private property to obtain access to streams, lakes, tidal areas or other waters that the public has a right to use. Likewise, the public cannot generally trespass on private property on the banks of a stream, river or lake.

Therefore, it appears that the answer to the question of a N.C. fly fisherman's right to access a stream is (like high water after a strong rain) both murky and dangerous to step into!

While the right to access the surface of the stream for recreational purposes by the public is clearly defined, the right to walk on the stream bed for the same purpose is not clearly defined. Land owners may feel very strongly that they should have the right to deny access to "their" section of stream to anyone they choose. On the other hand,

fly fishermen may feel that the property owner's rights absolutely end at the water line and thus they also feel very strongly that they should have access to any stream that they choose to fish. Thus, conflicts have been known to ensue over this hotly contested issue and although legal cases have been fought in North Carolina over this matter, no clear resolution has yet been established.

So, what do you do when you see a posted sign on the stream you are fishing? The choice is up to you since your choice of action depends upon your interpretation of N.C. law. You could arm yourself with knowledge of the law as it pertains to this matter, ignore the posted signs, and continue to fish while wading in the stream. If confronted by either the landowner or a Game Warden, you can attempt to reason with them using your knowledge of the law. If at any time friendly conversation turns to confrontation, the best course of action is to agree to leave the property peacefully.

As soon as you see a posted sign on the side of the stream, you can respect the property owner's right to deny you access to that section of the stream and cease to fish beyond the posted signs. However, land owners are pretty congenial and, if you will simply respect their rights and stop and talk to them a bit and let them get to know you, they will gladly give you permission to fish "their" section of the stream you are on.

Stream Access Now Report

State fish	Brook trout Channel bass	Striped bass	Largemouth bass	Smallmouth bass
Stream access law in a nutshell	If a boater can float the water, it is navigable and can be used for recreation. Navigable waters are in the public trust, including streambeds. If the navigable water is tidal, public use extends to all waters that cover an average high tide.	In South Carolina, if a waterway can be floated and used as a public highway, it is navigable and open to recreational use up to the high water mark.	Navigable waters are those capable of regular barge traffic. The public may boat and fish to the low water mark only where the streambed is owned by the state. If the streambeds are private, you need permission to wade and fish.	On any river or stream that's capable of floating a craft, the public has rights to passage, hunting and fishing. The question of streambed use on designated non-navigable rivers, however, is less clear, and probably not legal
Right to portage above high water mark	Undecided, most likely yes	Undecided, most likely yes	NO	Undecided, most likely no
Streambed access through private lands	Yes, up to the high water mark	Yes	Yes, up to the low water mark	Yes, up to the high water mark
Public floating access through private lands	Yes	Yes	Yes, but land owners can block access if they own both sides of the stream	Yes
Definition of navigability	All waterways capable of being used for trade and travel through ordinary modes of transport. Uses a navigable in fact test that is more like a recreational boating test. If a waterway can be navigated by watercraft, it is navigable in fact and therefore navigable in law.	All waters capable of floating anything beneficial to the public are deemed navigable and "forever free."	Waterways capable of transporting boats loaded with frieght in the regular course of trade either for the whole or part of the year, however, there is no clear standard and navigability is often determined on a case-by-case basis.	If a stream can support a craft capable of commerce in any form, it's navigable. The state, however, recognizes the public right to float through, and enjoy, non-navigable rivers that pass over private lands. Rivers have no designation until so determined in state court.
River miles	37,853	29,898	69,547	61,075
State	North Carolina	South Carolina	Georgia	Tennessee

Source: Stream Access Report, BACKCOUNTRYHUNTERS.ORG

77

SECTION 8 ADDITIONAL RESOURCES

Products

Maintenance

Fly fishing Techniques

Fly Tying Patterns and Materials

Entomology

Water Quality and Conservation

Reading About Trout, Fly Fishing, and Related Subjects



Fly Fishing Resources

These links are provided for your general information and should not be considered an endorsement by RiverCourse, its staff, or Trout Unlimited.

Products

BassPro Stores BassPro.com Cabelas Stores cabelas.com Orvis orvis.com Simms Fishing simmsfishing.com

Maintenance

Cleaning A Fly Line Video (Part 1) <u>youtube.com/watch?v=taTfJMpiXeQ</u> Cleaning A Fly Line Video (Part 2) <u>youtube.com/watch?v=mVYjV_BL99M</u> How to Clean Your Fly Rod <u>news.orvis.com/fly-fishing/video-pro-tips-clean-fly-rod</u>

Fly Fishing Techniques

R. L. Winston Fly Casting Instruction youtube.com/watch?v=h1XP0NRRGkA

Cabela's Fly Fishing University cabelas.com/category/Fly-Fishing-University/112554180.uts

Fly Fishing Knots https://www.animatedknots.com/indexfishing.php

Tying the Davy Knot – <u>https://vimeo.com/95275189</u>

Fly Fishing Etiquette https://www.trout-fly-fishing.com/fly-fishing-etiquette.html

Fly Tying (patterns and materials)

Feather Craft Fly Tying Materials <u>feather-craft.com</u> Fly Fishing Fly Patterns <u>flyfishingnc.com/fly-bugs/fly-patterns</u> J Stockard Materials <u>jsflyfishing.com</u>

Entomology

NC Fly Fishing Entomology <u>flyfishingnc.com/fly-bugs/entomology</u>

Water Quality and Conservation

Trout Unlimited <u>https://www.tu.org/conservation/</u>

NC Trout Stocking Schedule https://www.flyfishingnc.com/trout-streams-maps/stocking-schedule

Reading

Baker, Alen, <u>Our Fly Fishing Heritage: The Making of the Fly Fishing Museum of the Southern</u> <u>Appalachians</u>, 2016.

Hall, J.E.B., <u>The Southern Appalachian Fly Guide</u>, Brushy Mountain Publishing, 2011.

Rosenbauer, Tom, Orvis Streamside Guide to Leaders, Knots, and Tippets, Lyons Press, 2000.

Rosenbauer, Tom, Orvis Streamside Guide to Approach and Presentation, Lyons Press, 2000.

Ross, John, Trout Unlimited's Guide to America's 100 Best Trout Streams, Falcon Press, 1999.

Williams, J., Dombeck, M., Wood, C., <u>My Healthy Stream: A Handbook for Streamside Owners</u>, Trout Unlimited, 2014.

Smith, Anthony Vinson, <u>Fly Fishing North Carolina</u>, No Nonsense Guides, 2017.

Stroup, Eric, Common-Sense Fly Fishing: 7 Lessons to Catch More Trout, Headwater Books, 2012.

Zimmerman, Jay, Top Ten Guide to Fly Fishing, Guilford, Conn. : Lyons Press, 2013.