



RIVERS OF RICHES

A wealth of diversity
hides in North Carolina's
mountain waters



*Written and Photographed
by Todd Pusser*

*Yellowfin shiners and
Bluehead Chub*

THE state of North Carolina is truly an aquatic state. Seventeen river basins flow within its borders. Over 20 natural lakes occur in the Coastal Plain, more than our neighboring states of Virginia and South Carolina combined, while hundreds of manmade lakes, ponds and reservoirs dot the landscape. Nearly 300 miles of shoreline borders the Atlantic Ocean. Water is everywhere in North Carolina. This series of three articles will examine the incredible diversity of life that call our state's waters home and will show aspects of this element from a perspective few see—from beneath the surface.

The sudden rush of cold water down the back of my wetsuit momentarily takes my breath away. Adjusting my facemask and snorkel, I float quietly over a large mound of golf-ball sized rocks standing like a miniature ancient pyramid over the surrounding sandy bottom. The words of North Carolina Wildlife Resources Commission Biologist Stephen Fraley echo in my mind: “Keep in mind that you are hunting Easter eggs and I wasn’t the one who hid them. You are going to have to look around a lot to find them and cover long reaches of streams to find what you want.”

For three days, I have done just that, driving hundreds of miles, wading and snorkeling countless streams, searching for a rock pile just like this. Not just any run-of-the-mill rock pile, mind you, but one swarming with a mass of brightly colored fish that instantly brings to mind a vibrant tropical coral reef. This is not the Caribbean. I am snorkeling the waist-deep waters of a small stream high up in the North Carolina mountains near the town of Cashiers. Below me is one of the greatest wildlife spectacles that this state has to offer. I have finally found my Easter egg.

With heads pointed into the current, hundreds of yellowfin shiners swarm over the rock mound, an underwater tornado of bright oranges, yellows and reds. This aggregation of breeding minnows, affectionately called “liquid sunshine” by some ichthyologists, has gathered over the rocky nest of another much larger species of minnow, the bluehead chub, in an annual rite of spring. The chub, stout and nearly 7 inches long, straining the very definition of what it is to be a minnow, has spent hours upon hours lifting rocks with its mouth and piling them in a neat pyramid, also known as a chub mound, near mid-channel of this stream.

Nestled within the rock mound are hundreds of eggs, laid at an earlier time by female

chubs. The male chub constantly mouths the rocks, picking them up gently and placing them back down on the mound, something he will do for many days. The brilliant shiners, dull and brown for most of the year except during breeding season, swirl over him in a chaotic ballet, themselves releasing milt and eggs into the rock pile. The chub, by constantly moving stones and creating a mound elevated above the streambed into the water column, has created the perfect environment for nurturing its eggs and those of the shiners. The rocks provide the eggs with shelter from predators and the height of the mound exposes the eggs to the current that flushes the nest free of silt and sediment.

“Research has shown that yellowfin shiner will not spawn in the absence of bluehead chub, the species relies entirely on the chub for successful reproduction,” said Brandon Peoples, whose lab at Clemson University works to understand the relationships of fish and the habitats that sustain them. “But that is only half the story. This past summer we conducted a large experiment and found that chubs may need yellowfin shiners as much as shiners need the chubs. Their relationship is mutually beneficial to each other.”

An Aquatic Candy Store

The Appalachian Mountains—extending from Virginia, through the Carolinas and down to Alabama—are blessed with an abundance of creeks, rivers and streams. Yet few among us take the time to stop and really appreciate them. We drive over them every day, on old blacktop roads and interstates, rarely giving them a second glance. We cast fly lines into them with hopes of catching a trout for dinner. On hot summer days, we float their currents on inner tubes, feet dangling in cool waters. To the uninitiated, a mountain stream or creek



Opposite top: When mating, a male chub, with white tubercles on his head, arches his body in a semicircle to clasp a receptive female, seen here arching her head upward. Opposite bottom: A male bluehead chub (*Nocomis leptoccephalus*) works tirelessly moving small rocks around his nest in hopes of attracting a female.

might appear empty; nothing more than shifting rock and sand sculpted by flowing water. Yet, for those who look closely, just beneath the surface, an incredible world of riches awaits.

In these waterways, shaped over eons of time, life has achieved a staggering level of diversity unrivaled by any other temperate region in the world. Over half of the 850-plus species of freshwater fish found in the United States and Canada call these waters home, as do more than 600 species of freshwater mussels and snails, 250 species of crayfish and the planet's greatest diversity of salamanders.

"The Appalachian highlands are a virtual candy store for those who study and seek to understand the diversity of fish and the roles they play in the ecology of their stream homes," says Wayne Starnes, retired curator of fishes for the North Carolina Museum of Natural Sciences and the co-author of the book "Fishes of Tennessee."

In the North Carolina portion of that "candy store," perhaps no other fish stand

out more than the family of bottom dwelling perches known as darters. Lacking swim bladders, darters are negatively buoyant and regularly rest on the bottom of streams, balanced on their front fins and tail. When threatened by a predator or seeking prey, they dart away in a flurry of tail strokes, hence their name.

Considered the warblers of the fish world with their abundance of flashy colors, darters have achieved an extraordinarily high level of speciation across North America. At least 40 species are found in North Carolina, of which more than half occur in mountain waters. Among the most striking members of the clan are tangerine darters, whose brightly colored orange-red males reach lengths of 7 inches. "Tangerine darters are very personable fish," said J.R. Shute, co-director of Conservation Fisheries, a nonprofit organization dedicated to breeding and reintroducing endangered native fish throughout the Southeast. "If you stay very still in the water, they will come right up to you to check you out." I noticed

▼ With mottled coloration, a box-shaped head and large lips used for overturning rocks and stirring up the bottom for small aquatic insects, the Northern hog-sucker (*Hypentelium nigricans*) is perfectly adapted for life in mountain streams.



▲ Above, left to right: Each spring, Appalachian creeks and rivers explode with color as tangerine darters (*Percina aurantiaca*), greenhead shiners (*Notropis chlorocephalus*) and crescent shiners (*Luxilus cerasinus*) come together to spawn. Below: A bright male gilt darter (*Percina evides*) and a crayfish (*Cambarus* sp) rest on the bottom of a small creek near Brevard.



this while snorkeling the Pigeon River near Canton last summer, where upon entering the water I found myself immediately surrounded by several tangerine darters. Each time I pushed my hands off the bottom, the darters rushed over, like eager puppies, looking for microscopic food stirred up by my fingers buried in the sand.

It's not just fish that make these streams so special. Our state's waters serve as the last stronghold for North America's largest amphibian, the hellbender. Living entirely underwater and reaching lengths of 2 feet on a diet of crayfish and small fish, these Godzilla-like giants sport huge flat heads, wrinkly skin and large toes for gripping rocks in strong currents. "Hellbenders are a vital link to our Appalachian natural history and are indicators of healthy river ecosystems," North Carolina Wildlife Resources Commission Biologist Lori Williams said. "I, personally, would rather not swim, fish, paddle or play in any stream that doesn't have a healthy hellbender population."

It may seem hard to take seriously creatures with names like purple wartyback,

Carolina heelsplitter, Appalachian elktoe and Tennessee pigtoe. Yet these mountain freshwater mussels, just a few of the more than 60 species found across the state, are among the most important creatures inhabiting our local waters by providing ecological and economic benefits for all life—including humans. By acting as living biological water pumps, mussels clean waters by filtering out algae, bacteria and detritus. Over their lifespan, which can exceed 100 years, mussels clean millions of gallons of water at no cost to humans.

Waters Worth Protecting

An old truism states that "the more you have, the more you have to lose." There is more than an element of truth to that statement when it comes to our state's creeks and streams. Water, earth's most precious commodity and sustainer of life, is also its most neglected resource. We tend to be shortsighted in our relationship with aquatic resources, not realizing or understanding that the consequences of our actions today

have meaningful impacts on the quality of the life for our children and their children of tomorrow. Who among us takes the time to think about where the water comes from each time we turn on the kitchen faucet?

The creeks, rivers and streams of the Appalachians face a multitude of challenges from an ever-increasing human population. Dams have dramatically altered habitat, disrupted fish migration, restricted water flows and impacted water quality. Sedimentation and pollution from mining, agriculture and urbanization have provided additional strains to aquatic diversity.

In his 1849 self-published book "A Week on the Concord and Merrimack Rivers," acclaimed writer and philosopher Henry David Thoreau questioned "who hears the fishes when they cry?" upon witnessing the changes occurring to his beloved streams at the onset of the Industrial Revolution. Over a century and half later, his words still hold relevance for Appalachian waters, where over 30 percent of the fish species and 70 percent of all mussel species are threatened with extinction.

Back at the chub nest, as I continue to watch the underwater fireworks show, I feel something bump me in the chest. Thinking it is just one of the fish, I keep my camera focused on the adult male chub. As the bumping continues, I look down and to my surprise find a large Northern water snake resting just beneath my wetsuit. Suddenly, the snake lunges out from underneath me and dives into the swirling mass of colorful fish. With a quick strike, it grabs a shiner and takes off upstream.

The action is so fast and so unexpected that I completely miss the shot. Despite the numbing cold water and lack of a photograph, I lift my head out of the water and chuckle into my snorkel at having witnessed a behavior few have seen. The natural wonders beneath our state's rivers, so often overlooked and rarely appreciated, never cease to amaze. ♦

Todd Pusser is a marine biologist and freelance writer whose articles and photographs frequently appear in Wildlife in North Carolina.



♦ Above: A musk turtle (*Sternotherus sp.*) crawls along the bottom of the Pigeon River near Canton. Little is known about the distribution and abundance of mountain turtles compared to other reptile species. Below: A queen snake (*Regina septemvittata*) forages for freshly molted crayfish in a shallow creek.

