So Many Fishes, So Little Time: A Report from the 1998 NANFA Annual Meeting in Chattanooga

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by

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To paraphrase Charles Dickens, "It was the best of times, it was the best of times."

In every way possible, the 1998 NANFA Annual Meeting, June 5-7 in Chattanooga, Tennessee —dubbed Fish Heads '98 by organizer Casper Cox— was the best annual meeting NANFA has ever had. It was also the biggest. Twenty-two NANFA members were in attendance (including two from as far away as Arizona), as well as a half-dozen spouses, guests and special invitees. It was a fun-filled, educational weekend of fish, fellowship, fish, food, and more fish.

The only negative comment to be heard was that there wasn't enough time to see and do everything to its fullest. We could have spent more time touring the awesome Tennessee Aquarium. We could have given more time to our speakers. We could have enjoyed more time getting to know our fellow NANFA members. And, of course, we could have spent more time in our waders, observing, collecting, and awing over Tennessee's abundance of colorful shiners and darters. But there are only 72 hours in a three-day weekend, and we made the most of them.

For NANFA members who did not attend, I hope this report will allow you to enjoy the meeting vicariously, learning what we learned, seeing what we saw. I also hope it will encourage you to visit Tennessee, tour its creeks and Aquarium, and to attend the 1999 Annual Meeting in Champaign-Urbana, Illinois (see page 33).

Six Terrific Speakers, Six Terrific Talks

Day one began at 8:00 am in the Board Room of the Tennessee Aquarium's IMAX® Theater building. We mingled over coffee and breakfast, most of us meeting for the first time fellow NANFA members we knew only from over the phone or E-mail. I finally got to meet Maurice (Scott) Mettee, with whom I collaborated (via E-mail) on an article on pygmy sunfishes (*American Currents*, Feb. 1998). He autographed my copy of his wonderful book, *Fishes of Alabama and the Mobile Basin*. David Etnier autographed his book, the definitive *Fishes of Tennessee*.

Chris Coco, the Tennessee Aquarium's Curator of Fishes (and NANFA member), formally welcomed us. He spoke briefly about the Aquarium's history and conservation efforts. Three weeks earlier, the Aquarium had hosted a symposium on paddlefish and sturgeons; it's currently involved in a pilot project to propagate the lake sturgeon (*Acipenser fulvesens*). The Aquarium also is rearing the federally endangered barrens topminnow (*Fundulus julisae*) and the locally endangered spotfin chub (*Cyprinella monacha*). In fact, the Aquarium has already released 2,500 captive-bred spotfin chub into the wild.

The day's first talk, "The Conasauga River," was given by George Ivey, the Conasauga's field representative for the Tennessee and Georgia chapters of the Nature Conservancy. Stretching like a giant upside-down letter
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"J," the Conasauga flows northwest from the mountains of northern Georgia into southern Tennessee. It then meanders east along the state line for 10 miles before it turns south and re-enters Georgia. The Conasauga's water quality and habitat is threatened by accelerated erosion, toxic chemicals and excessive nutrients. Cattle farming, forestry, development, chicken farming, and industry are the biggest culprits. Three of its 77 native fish species are listed (and more should be, Mr. Ivey says), and only 20 or so of its 42 species of mussels are believed to be extant. Fortunately, many conservation and restoration efforts are underway, and the bulk of Mr. Ivey's slide presentation was given to them. Low-growing trees which do not interfere with power lines are being planted to slow or stop erosion. Farmers are being encouraged to keep their cattle out of streams. Dump-truck loads of trash are being removed. And in one project, logs with saw-cut grooves are being sunk into portions of the river to provide spawning habitat for federally threatened blue shiners (*Cyprinella caerulea*), which like to lay their eggs in the cracks of submerged logs. Mr. Ivey's talk was an excellent introduction to a river we would collect in the next day.

Scott Mettee gave the second talk, "Alabama Fishes." Alabama's 75,000 miles of rivers and streams are inhabited by over 425 species of native freshwater and marine fishes—more than any other state or province in America. (Tennessee comes in second, with 305-319 exclusively freshwater fish species. The fact that many Atlantic species enter Alabama's freshwaters gives Alabama the statistical edge.) Dr. Mettee, an ichthyologist with the Geological Survey of Alabama, showed slides of 55 of these species, offering brief commentary on each of them. Among the most interesting fishes he discussed were:

- gulf sturgeon (*Acipenser oxyrinchus desotoi*): What "a grand opportunity and privilege [it is] to put your hands on these creatures," Dr. Mettee said. They migrate 100-150 miles in two days. The 8-foot, 175-pound specimen shown in his slide was caught in a river you could walk across.
- Alabama shad (*Alosa alabamae*): His specimens were the first ones collected in 104 years. "They're not gone; you just gotta know where to look, with a little luck."
- bay anchovy (*Anchoa mitchilli*): Now recorded 270 miles inland having crossed two locks and dams.
- rainbow shiner (*Notropis chrosomus*): They spawn the first or second week of May on the mounds of chubs and stonerollers. They're a metallic blue, but instantly lose that color when pulled from the water.
- blue sucker (*Cycleptus elongatus*): "One of the sexiest fish in Alabama."
- striped bass (*Morone saxatilis*): A "concrete block with fins."
- And, of course, darters: "the Rodney Dangerfield of fishes because they don't get a lot of respect" from fisheries professionals and the public-at-large.

Dr. Mettee then shared a secret he asked us not to reveal: He loves his job surveying fishes. "It's a hoot!" But he's afraid that if his boss got wind of this fact, he'd stop getting paid. (Fortunately, his boss is not a reader of *American Currents*. Or so we hope.)

Next up was Pat Rakes, speaking on the "Captive Propagation and Reintroduction of Rare Nongame Native Freshwater Species." Mr. Rakes, along with J.R. Shute, is the Director of Conservation Fisheries, Inc. (CFI), a nonprofit conservation company in Knoxville, Tennessee. Their goal is to use captive breeding to reestablish fishes in their native habitats so they may be downlisted or removed from protected status altogether. Mr. Rakes showed slides of CFI's facilities, and spoke of their success (and sometimes failure) with the following species:

- blackside dace (*Phoxinus cumberlandensis*): CFI collected this fish from heavily silted streams in Kentucky. Since it spawns over stoneroller nests in the wild, stoneroller milt was added to its tank, upon which it colored up quickly, spawned, and then died, as if "burned up" from its intense spawning activity.
- blue shiner (*Cyprinella caerulea*): Taking a clue from the fish's preference for wood cracks in the wild, CFI's specimens spawned in the ridges in a stack of tiles. These fish were propagated not to be reintroduced to the wild, but to be killed in water toxicity studies.
- spotfin chub (*Cyrpinella monacha*): As with blue shiners, CFI provides this fish with stacks of tiles; the fish deposits its eggs in the crevices between the tiles, usually only the bottom crevice. This habit and CFI's observation that spotfin chub larvae are strongly benthic (living near the bottom) for about the first 30 days, partially explains why the species is so rare (larval habitat and spawning sites must be silt-free).
- Cape Fear shiner (*Notropis mekistocholas*): The larvae of this fish have no mouth, digestive tract, or pigment; they're basically a "muscle mass connected to a yolk sac."
- smoky madtom (*Noturus baileyi*) and yellowfin madtom (*N. flavipinnis*): Since these fishes like to hide under slab rocks and PVC cover, the only way to view their behavior is to elevate the aquarium and look up from underneath. Although these catfishes

colored up and defended territory in CFI's tanks, they have yet to spawn. However, CFI has propagated hundreds of each from nests collected from Citico Creek (a Little Tennessee River tributary), reintroducing those specimens into nearby Abrams Creek, where the madtoms were poisoned out in 1957 by state and federal agencies seeking to enhance the trout fishery.

- duskytail darter (*Etheostoma percnurum*): Like all darters in the subgenus *Catonotus*, it lays its eggs in a single layer on the underside of slab rocks or other structures that provide a cavity with a flat "ceiling."
- boulder darter (*Etheostoma wapiti*): Like other members of the subgenus *Nothonotus* (and the genus *Percina*), the larvae of this darter feed in the water column for the first 2-4 weeks, not along the bottom. The males develop gorgeous, emerald green fins and a green throat. The females deposit their eggs on an angled wedge.
- channel darter (*Percina copelandi*): The larvae are too small to eat brine shrimp nauplii; they have to be fed rotifers, which must be continually dipped into the tank through an IV. Only a few individuals have been reared to a juvenile size.

Mr. Rakes closed his talk with a "wish list" of fishes CFI would like to propagate, or are beginning to work on right now. Topping the list is the endangered pygmy madtom (*Noturus stanauli*); its numbers are so small in the wild that it's almost impossible to collect.

After a lunch break it was time for some NANFA business. Elmer Guerri presented his regional representative program proposal to the four Board members in attendance. We discussed some fineries of the proposal and gave Elmer the go-ahead to develop it in full. (See p. 21.)

Now it was time for David Etnier and his talk, "The Snail Darter Issue in Retrospect." If there's one darter the public has heard of, it's this one: a non-descript member of the *Percina* genus no one knew existed until Dr. Etnier hand-cupped a specimen while snorkeling in the Little Tennessee River in 1972. Little did Dr. Etnier realize that three years later he would help wage a legal battle to save the fish from the Tennessee Valley Authority (TVA) and its proposed Tellico Dam, and that *Percina tanasi*—as the professor eventually named it—would become the "poster fish" for the newly formed Endangered Species Act (ESA). Dr. Etnier's recounting of this episode kept us on the edge of our seats.

"Dr. Etnier, what is the size of this snail darter fish?" a TVA lawyer asked in U.S. District Court in Knoxville. His tone implied that such a small fish was unworthy of such a big fuss.

"It's about three times the size of the Devils Hole pupfish," Dr. Etnier replied. The Devils Hole pupfish had recently won protection against developers in Nevada.

As Dr. Etnier explained, irreconcilable differences between the ESA and federal projects like the Tellico Dam led to the formation of a special advisory group, disdainfully called "The God Committee," which had the power to decide the fate of a species when serious "progress" was at stake. Fortunately, the God Committee ruled against building the dam. But wouldn't you know, some shifty lawmakers put a rider on a bill exempting Tellico Dam from all federal law. So the dam was built anyway and the original habitat of the snail darter was wiped out—but not before TVA biologists removed 316 specimens and introduced them to the nearby Hiwassee River.

In 1980, Dr. Etnier was seining in South Chickamauga Creek in downtown Chattanooga when a familiar looking fish caught his eye. "Well, I'll be a son of a bitch," he said. A second native population of the snail darter was found. Eventually, other populations were discovered, and the fish was downlisted from endangered to threatened. Dr. Etnier said he would not be opposed to considering removing the snail darter from the protected list.

As any good raconteur would, Dr. Etnier had us hanging on every word. Transcribed, his talk would make an excellent article for *American Currents*. I'm still kicking myself for having left my pocket tape recorder at home.

Next up was one of Dr. Etnier's former students, Ed Scott, whose scheduled topic was "The Snail Darter: Its Status in the Lower French River," but whose actual talk was far more broad in scope. Mr. Scott spoke of his work as an aquatic biologist for the TVA, helping monitor and improve flow in the tailwaters of Tennessee's numerous dams. Much of his talk was far too technical for my slow note-taking skills to keep up with, but he did a superb job of making a complex and unfamiliar subject easy to understand. Mr. Scott also has a delightfully twisted sense of humor. One of his slides showed a number of sculpin skewered on a stick and a number of his cohorts eagerly anticipating their "sculpin kabob" feast. Mr. Scott doesn't like sculpins much. "They eat darters," he said.

The day's sixth and final talk was a pointed contrast to the previous five. Ichthyologist and Board member Peter Unmack spoke on "Threatened Fishes and Habitats of the Southwest." Western streams tend to be turbid, Mr. Unmack said, so their fishes tend to show fewer colors than those in the southeast. There is less diversity, too.

Compared to Tennessee's 300+ native species, the entire Colorado River system is home to around 40. And that number is shrinking. Mr. Unmack said the razorback sucker (*Xyrauchen texanus*) is "for all intents and purposes, extinct—as far as able to maintain its own existence without human assistance." Since exotic fishes like bass and ictalurid catfishes eat razorback larvae, wild larvae are collected and raised in hatcheries and backwaters. The bonytail chub (*Gila elegans*) is even worse off. "It's the rarest fish in the West," Mr. Unmack said, "not a wild one taken in years." And every native minnow has just about disappeared due to the release and epidemic-like spread of the red shiner (*Cyprinella lutrensis*).

Mr. Unmack's closing remarks ended the day's talks with a sobering irony that illustrates the folly and tragedy of man's impact on native fishes: "Brook trout have replaced native rainbows in the West. Rainbows have replaced native brookies in the East."

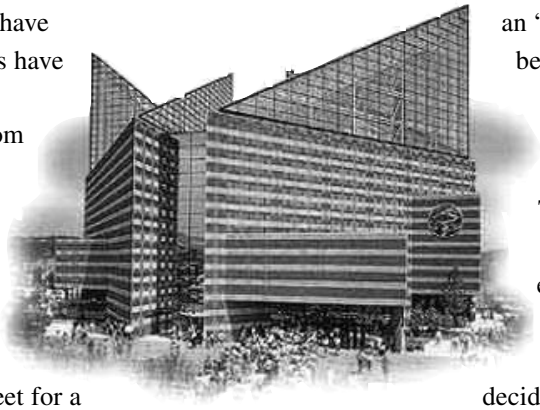
You could almost hear everyone in the room thinking the same thought. *Now where's the sense in that?*

The Tennessee Aquarium: A Must-See for Native Fish Enthusiasts

After the talks, we gathered across the street for a group photo in front of the Tennessee Aquarium's main exhibit building (see back cover). Then we filed inside to see many of the fishes we had heard about earlier.

Most public aquariums in the U.S. have only a cursory display of local freshwater species. The Tennessee Aquarium is almost wholly devoted to them! Sitting on the banks of the Tennessee River, this $45 million facility, which opened in May 1992, bills itself as the largest freshwater aquarium in the world. Focusing primarily on the Tennessee River and related systems, the Aquarium's exhibits are organized to guide visitors on a journey from the river's source in the Appalachian high country, through its midstream, and finally, to the Mississippi Delta. In addition, the Aquarium boasts impressive freshwater displays with fishes and other aquatic animals from other rivers in the world. There's the Volga River in Russia, with its beluga sturgeon and huchen trout; three tanks on the Amazon, one with tetras and discus, one with red-bellied piranha, and a large flooded forest tank with arapaima, arowana, pacu, and red-tailed cats; a tropical Asian exhibit with some of the most colorful barbs you'll ever see; a tank featuring the colorful rainbowfishes of the Fly River in New Guinea; an exhibit featuring the endangered freshwater fishes of Madagascar; and two exhibits portraying the Zaire River, including a massive exhibit featuring tilapia, distichodus, river puffers, and the comically thick-lipped bubu catfish (*Auchenoglanis occidentalis*). But it's the native displays we were oohing and aahing over. They certainly put the best efforts of basement fishkeepers like myself to shame.

Most of the Aquarium's exhibits are true "biotope" displays, combining animals from different taxa, lush plant growth, and naturalistic lighting to portray ecosystems, not just "fish in boxes." This is immediately evident in the first stop on our tour, the Appalachian Cove Forest located on the Aquarium's top (4th & 5th) floors. Termed an "immersion" exhibit because visitors walk through it, the Cove Forest re-creates the mountain source of the Tennessee River, complete with moss-covered rocks, indigenous plants (rhododendrons, azaleas, wildflowers), deciduous trees, free-roaming bullfrogs and birds, logs fallen across streams, waterfalls, and the constant roar of rushing water. A unique feature of this exhibit is that it changes with the seasons; the greenhouse-like roof opens up, making it hot in the summer, cold in the winter, and full of falling leaves in the autumn. At one end of the forest you can watch two male river otters (the only mammals on display at the Aquarium) frolic in a stream. Once nearly extinct in Tennessee, the river otter has staged a comeback in the wild, thanks to release programs begun in the 1980s. At the other end of the forest nearly 50 brook, brown and rainbow trout (all hatchery raised) swim in a pool, their muscular bodies poised in constant anticipation of their next meal. Two other tanks showcase a wide variety of dace, shiners, darters, and other smaller mountain stream fishes, including the endangered spotfin chub. Scattered throughout the exhibit are several snakes (timber rattlers, copperhead, black rat, corn, king, and northern pine), safely ensconced in exhibits built into the trunks of artificial trees. Some 24 species of year-round and migratory birds fly freely overhead.



You exit the Cove through a set of revolving doors, leaving the warm, moist air of the forest (this was in June, after all) for the dryer, air-conditioned air of the Aquarium's main exhibit galleries. First up is an 18-foot deep, 30,000-gallon re-creation of a mountain sink, the geological formation that occurs when the force of a waterfall wears a deep ravine into the waterbed. It takes a second, but you realize you're looking underneath the waterfall you saw in the forest. This is truly an impressive sight, as over 150 trout are at play under the churning waterfall. (Not surprisingly, the dissolved oxygen here is usually at 100%.) This water eventually spills over into a fast-moving mountain stream in which brook trout and white suckers hide behind boulders and beneath undercuts in the banks, fighting against the current. (The presence of young-of-the-year rainbow trout shows that fish are reproducing in this exhibit.) The entire system is naturally lit (be sure to visit it at mid-day to see the fishes in all their splendor). All told, the Cove Forest and its connecting streams display 34 species of fish (Table 1).

After the trout streams you take a detour through a temporary exhibit, the eerily beautiful "Jellies: Phantoms of the Deep." Jellyfishes require different types of aquaria called "kreisels." These specially built tanks circulate the water in a calm but constant way, preventing the water-filled creatures from being sucked up intake tubes or smashed against the aquarium acrylic. If you've ever seen a Lava lamp in a darkened room, then you'll have some idea of what it's like to watch shimmering jellies gracefully "swim" in their brilliantly illuminated tanks.

After the jellies you enter another immersion exhibit under a glass roof, "Delta Country," depicting the sultry areas where the Mississippi River slows to meet the sea, joining creeks, streams and lakes to form the fertile cypress swamps of the Louisiana Bayou. This exhibit is divided into four pools where fishes, birds, reptiles and bullfrogs live together (but not always peacefully) amidst a tangle of tree-trunks, vines and hanging moss. The largest of the pools is home to five alligator snapping turtles (including one male that weighs almost 150 pounds, making him more than a century old!), two Florida softshells, three river cooters, a Florida cooter, and a male American alligator that's over 6-feet long. Over a thousand mosquitofish live in this pool as well, providing a constantly reproducing food source for the ever-hungry turtles. Another pool, known by Aquarium staffers as the "snake pit," is a paludarium-like exhibit with burrows built up against the glass, providing close-up views of canebrake and eastern diamondback rattlesnakes. Many diminutive fishes swim in the water portion of this exhibit, including banded pygmy sunfish, but I was hard-pressed to find any. (A complete list of Delta Country's fishes is given in Table 2.) As in the Cove, birds (including a little-blue heron) roam freely. (During a subsequent after-hours visit, I was amused to see wood ducks wobbling down the hallway like nobody's business; they like to leave the exhibits at night and need to be collected the following morning.)

On your way to Delta Country you catch glimpses of the 88,000-gallon Gulf of Mexico tank, the only permanent saltwater exhibit at the Aquarium. You can see it in all its glory standing at the lower of its two stories. Because it's saltwater, with public aquarium staples like sharks, rays and tarpon prowling its depths, the Gulf of Mexico is the most generic of the Tennessee Aquarium's

Table 1. Fishes in the Tennessee Aquarium's Appalachain Cove Forest Exhibits

central stoneroller	*Campostoma anomalum*
rosyside dace	*Clinostomus funduloides*
bluntface shiner	*Cyprinella camura*
whitetail shiner	*Cyprinella galactura*
spotfin chub	*Cyprinella monacha*[1]
spotfin shiner	*Cyprinella spiloptera*
blotched chub	*Erimystax insignis*
flame chub	*Hemitremia flammea*
striped shiner	*Luxilus chrysocephalus*
warpaint shiner	*Luxilus coccogenis*
rosefin shiner	*Lythrurus ardens*
river chub	*Nocomis micropogon*
bigeye shiner	*Notropis boops*
Tennessee shiner	*Notropis leuciodus*
mirror shiner	*Notropis spectrunculus*
sawfin shiner	*Notropis* sp.
blacknose dace	*Rhinichthys atralatus*
longnose dace	*Rhinichthys cataractae*
creek chub	*Semotilus atromaculatus*
white sucker	*Catostomus commersoni*
Alabama hog sucker	*Hypentelium etowanum*
northern hog sucker	*Hypentelium nigricans*
black redhorse	*Moxostoma duquesnei*
golden redhorse	*Moxostoma erythrurum*
shorthead redhorse	*Moxostoma macrolepidotum*
rainbow trout	*Oncorhynchus mykiss*[2]
brown trout	*Salmo trutta*[2]
brook trout	*Salvelinus fontinalis*
northern studfish	*Fundulus catenatus*
banded sculpin	*Cottus carolinae*
greenside darter	*Etheostoma blennioides*
tangerine darter	*Percina aurantiaca*
logperch	*Percina caprodes*
dusky darter	*Percina sciera*

[1] Endangered species propagated at Conservation Fisheries, Inc. and raised at the Aquarium.

[2] Exotic species introduced into Tennessee. A hybrid brown x rainbow trout also is on display.

tanks. It's the kind of big, flashy tank the general (i.e., non-native fish enthusiast) public ogles over most. It houses twenty-five species of fishes (Table 3), none of which have been added since the Aquarium opened; in fact, the sting-rays have have given birth to four litters during the past year. (The foot-long babies have been given to other U.S. zoos and aquariums.) Volunteer divers feed the fish daily. The Aquarium hopes to add more fish in the coming year, including moray eels.

Around the corner from the Gulf of Mexico is the Amazon and other "Rivers of the World." Among them is Canada's St. Lawrence River. This exhibit, which is chilled to 56°F year-round, showcases lake sturgeon (*Acipenser fulvescens*), lake trout (*Salvelinus namaycush*), yellow perch (*Perca flavescens*), walleye (*Stizostedion vitreum*), and sauger (*Stizostedion canadense*).

The centerpiece of the Aquarium is its multi-exhibit Tennessee River gallery, featuring fishes and other animals from the Tennessee River and its various nooks and crannies. Graphic displays examine the history of the river, comparing the "original" Tennessee with the river as it now exists as a reservoir system harnessed by 35 dams. (Also included in this gallery is "Turtles: Nature's Living Sculptures—Architecture in Bone," which bills itself as the largest collection of freshwater turtles on public display in the world.) The first tank contains "Miss Patty," the largest largemouth bass (*Micropterus salmoides*) ever caught during a B.A.S.S.-sanctioned tournament—a hefty 13 lb. 9 oz. She was caught in Corsicana, Texas by Mark Menendez, who donated her to the Aquarium. The second tank re-creates a Tennessee River oxbow; fishes include orangespotted sunfish (*Lepomis humilus*) and flier (*Centrarchus macropterus*).

The next Tennessee River gallery tank plunges you into the swamp-like, lily pad-covered waters of northwest Tennessee's famous Reelfoot Lake (featured in the movies *In the Heat of the Night* and *U.S. Marshals*). Reelfoot Lake was formed in 1812 as the result of a massive earthquake (perhaps the largest in recorded North American history). The force of the quake caused an 18,000-acre section of cypress swamp to sink 10 feet to form a basin that was covered by water when the Mississippi River's flow was diverted and ran briefly upstream. The exhibit features young paddlefish (*Polyodon spathula,* front cover), golden shiner (*Notemigonus chrysoleucas*), blue sucker (*Cycleptus elongatus*), and a shoal of creek chubsucker (*Erimyzon oblongus*), among others. The paddlefish enjoy brine shrimp that are dripped in through an air hose from a catwalk above the tank; the instant the shrimp hit the water, the 18 prehistoric filter feeders open their cavernous mouths and strain the shrimp through their long gill rakers. The blue suckers are indeed blue, and sleek; I can see why Scott Mettee thinks they are sexy. They sift through the gravel with great poise and determination. (Note: Neither paddlefish nor blue sucker are currently found in Reelfoot Lake, although they probably once occurred there. The Aquarium is in the process of converting its Reelfoot Lake exhibit into a Mississippi River exhibit.)

Table 2. Fishes in the Tennessee Aquarium's Delta Country Exhibit

shortnose gar	*Lepisosteus platyrhincus*
bowfin	*Amia calva*
taillight shiner	*Notropis maculatus*
flagfin shiner	*Notropis signipinnis*
lake chubsucker	*Erimyzon sucetta*
sharpfin chubsucker	*Erimyzon tenuis*
blacktail redhorse	*Moxostoma poecilurum*
least killifish	*Heterandria formosa*
golden topminnow	*Fundulus chrysotus*
russetfin topminnow	*Fundulus escambia*
blackstripe topminnow	*Fundulus notatus*
western mosquitofish	*Gambusia affinis*
longear sunfish	*Lepomis megalotis*
brown darter	*Etheostoma edwini*
blackbanded darter	*Percina nigrofasciata*
banded pygmy sunfish	*Elassoma zonatum*

Table 3. Fishes in the Tennessee Aquarium's Gulf of Mexico Exhibit

bonnethead shark	*Sphyrna tiburo*
southern stingray	*Dasyatis americana*
cownose ray	*Rhinoptera bonasus*
tarpon	*Megalops atlanticus*
squirrelfish	*Holocentrus adscensionis*
crevalle jack	*Caranx hippos*
lookdown	*Selene vomer*
permit	*Trachinotus falcatus*
yellowtail snapper	*Ocyurus chrysurus*
porkfish	*Anisotremus virginicus*
caesar grunt	*Haemulon carbonarium*
smallmouth grunt	*Haemulon chrysargyreum*
French grunt	*Haemulon flavolineatum*
Spanish grunt	*Haemulon macrostomum*
white grunt	*Haemulon plumieri*
bluestriped grunt	*Haemulon sciurus*
Atlantic spadefish	*Chaetodipterus faber*
gray angelfish	*Pomacanthus arcuatus*
French angelfish	*Pomacanthus paru*
sergeant major	*Abudefduf saxatilis*
great barracuda	*Sphyraena barracuda*
common hogfish	*Lachnolaimus maximus*
Spanish hogfish	*Bodianus rufus*
ocean surgeonfish	*Acanthurus bahianus*
blue tang	*Acanthurus coeruleus*

Next to Reelfoot Lake are two heavily-planted tanks depicting Tennessee River backwaters. The first one contains starhead topminnow (*Fundulus dispar*), bluefin killifish (*Lucania goodei*), bluespotted sunfish (*Enneacanthus gloriosus*), and banded sunfish (*Enneacanthus obesus*), among others. The second tank contains the endangered barrens topminnow, sailfin shiner (*Notropis hypselopterus*), and a number of invertebrates, including spotted royal crayfish (*Procambarus pictus*), apple snails (*Pomacea paludosa*), and giant water bugs (*Abedus indentatus*).

The largest tank at the Tennessee Aquarium is the 145,000-gallon Nickajack Lake exhibit. Nickajack Lake is not a lake; it's the area of the Tennessee River just outside the Aquarium's window. Created by the Tennessee Valley Authority in the 1930s to reduce flooding and to provide drinking water, Nickajack Lake was once shoreline. Its fish inhabit its sunken forests, stump fields, abandoned bridges and road beds. The exhibit, which has a shallow end and a deep (25 feet) end, contains more than 30 species of fishes (Table 4). This is the Tennessee Aquarium display to which I would love to bring a folding chair, a lunch, and park myself in front of for five or six hours. Its enormity, and the size and diversity of its fishes, is breathtaking. Most impressive are the three blue catfish (*Ictalurus furcatus*) which prowl the tank's deepest water. These 80-pound behemoths are among the largest catfish on exhibit in the U.S. Exotics like common carp and grass carp get equal time, too; when displayed properly, as they are here, their beauty, form and strength overshadow their nuisance status in the wild. In addition to the fishes, two types of divers frequent the tank—the volunteer divers who hand-feed the fishes daily, and the diving ducks, which comically dive-bomb for their food, then bob like corks to the surface.

But our Tennessee Aquarium visit didn't end here. We broke for dinner, then returned for a behind-the-scenes tour led by fish curator Chris Coco and two aquarists, Stephanie Brough and Darlene Walder (NANFA members both). Stephanie maintains the Cove Forest, Reelfoot Lake and backwaters exhibits; she breeds darters, too. Darlene is a fish health specialist who also is responsible for the Aquarium's barrens topminnow breeding program.

I've been on behind-the-scenes public aquarium tours before, and I've always been struck by the constant drone of water pumps, and the labyrinthine network of pipes that snake along seemingly every available inch behind the exhibit walls. The Tennessee Aquarium is no exception. Most of its larger exhibits are filtered two levels down, in a deafeningly loud room beneath the lobby. The main filtration medium is sand. Ozone contact chambers are hidden throughout the building; they help remove dissolved organics from all but the smaller exhibits. Also hidden throughout the building are heat exchangers. Water in copper coils is chilled to 43°F. These coils come in contact with water from the exhibits; how much water is sent through the coils determines how cold the water gets. The trout tanks are chilled to 58°F; they reach 48°F on their own in the winter.

Our tour took us by the Aquarium's life support center; here staffers monitor via computer each tank's water level and temperature 24 hours a day, 365 days a year. If something goes wrong, aquarists and maintenance technicians are on-call to come in and fix the problem and prevent or minimize animal casualties. We also visited the food preparation room and its walk-in refrigerator and freezer. Fishes in the Tennessee Aquarium eat more than

Table 4. Fishes in the Tennessee Aquarium's Nickajack Lake Exhibit

lake sturgeon	*Acipenser fluvescens*
alligator gar	*Atractosteus spatula*
spotted gar	*Lepisosteus oculatus*
longnose gar	*Lepisosteus osseus*
grass carp	*Ctenopharyngodon idella*[1]
common carp	*Cyprinus carpio*[1]
bighead carp	*Hypopthalmichthys nobilus*[1]
river carpsucker	*Carpiodes carpio*
quillback	*Carpiodes cyprinus*
smallmouth buffalo	*Ictiobus bubalus*
bigmouth buffalo	*Ictiobus cyprinellus*
black buffalo	*Ictiobus niger*
blue catfish	*Ictalurus furcatus*
flathead catfish	*Pylodictis olivaris*
muskellunge	*Esox masquinongy*
redbreast sunfish	*Lepomis auritus*
green sunfish	*Lepomis cyanellus*[2]
warmouth	*Lepomis gulosus*
bluegill	*Lepomis machrochirus*[2]
longear sunfish	*Lepomis megalotis*
redear sunfish	*Lepomis microlophus*
spotted sunfish	*Lepomis punctatus*
smallmouth bass	*Micropterus dolomieu*
largemouth bass	*Micropterus salmoides*
rock bass	*Ambloplites ruprestris*
white crappie	*Pomoxis annularis*
black crappie	*Pomoxis nigromaculatus*
sauger	*Stizostedion canadense*
white bass	*Morone chrysops*[3]
yellow bass	*Morone mississippiensis*
striped bass	*Morone saxatilis*[3]
freshwater drum	*Aplodinotus grunniens*

[1] Exotic species introduced into the United States and found in Tennessee.

[2] Hybrid bluegills (*L. cyanellus* x *macrochirus*) also are on display.

[3] Hybrid striped bass (*M. saxatilis* x *chrysops*) also are on display.

1,200 pounds of restaurant quality seafood each month. ("So does B.G. Granier," someone behind me muttered.)

The most interesting stop on our behind-the-scenes tour was the cafeteria-size quarantine (or "Q") room. Here we saw many recently collected fishes completing their 30-day minimum quarantine, and many fishes that were temporarily off-exhibit. The Q room also is where Stephanie keeps the rack system where she breeds rainbow (*Etheostoma caeruleum*), blueside (*E. jessiae*), and Tennessee snubnose (*E. simoterum*) darters. The rack consists of three separate 5-foot-long hand-built glass tanks with one filtration system (cartridge filter and bio-ball tower). Water is pumped in at one end and goes down stand pipes through gravity into a sump. Water temperature and light cycles are controlled to simulate the change of seasons; water is kept as low as 53°F to simulate winter and up to 72°F to simulate summer.

Access to most of the Aquarium's tanks is from a platform or catwalk above. The spaces here can be pretty cramped with little or no headroom, and aquarists need to be agile to maneuver through them. Aquarists don SCUBA gear and dive into the larger tanks for tank maintenance. For example, in the fall, an aquarist needs to regularly dive into the cold water of the mountain sink to remove tree leaves that are blocking pump intakes. Volunteer divers do much of the hand-feeding in the larger tanks. The Aquarium's volunteer program has over 100 divers.

One of the biggest thrills for a Tennessee Aquarium aquarist is the opportunity to collect fishes from the wild to supplement their exhibits. Aquarists regularly schedule collecting trip and have specially-outfitted trucks with which to bring fishes back. But not all of the Aquarium's fishes are wild-caught. In fish ponds in Cohutta, Georgia, the Aquarium rears sunfishes and sturgeon, and raises larger fishes like catfish and gar to adult size.

After our behind-the-scenes tour we gathered in the suite connected to B.G. Granier's room (aka the "NANFA Room") and discussed everything we had seen and heard that day. We could have sat up all night talking fish, but we needed our rest. Tomorrow we would be hitting the creeks and collecting our own.

Collecting: Fishes, Freebies and Prizes

Day two of the Annual Meeting began in B.G.'s suite, determining who would ride with whom for the first of our collecting forays. Casper worried that recent rain, and a forecast for more that day, would make collecting difficult, if not impossible. A light rain was falling when we convoyed out of the hotel parking lot for the half-hour drive to our first site, the Conasauga River and an adjacent tributary at and just east of USFS trail 61, one mile below the mouth of Jacks River. The water was indeed high and tough to seine, and rather chilly, too; only Casper and Stephanie, who wore wet suits, bothered to snorkel. We netted at least 14 species of fishes:

- largescale stoneroller, *Campostoma oligolepis*
- Alabama shiner, *Cyprinella callistia*
- blue shiner, *Cyprinella caerulea*
- tri-color shiner, *Cyprinella trichoristia*
- rainbow shiner, *Notropis chrosomus*
- Coosa shiner, *Notropis xaenocephalus*
- creek chub, *Semotilus atromaculatus*
- banded sculpin, *Cottus carolinae*
- redeye bass, *Micropterus coosae*
- holiday darter, *Etheostoma brevirostrum*
- Coosa darter, *Etheostoma coosae*
- greenbreast darter, *Etheostoma jordani*
- Mobile logperch, *Percina kathae*
- bronze darter, *Percina palmaris*

The endangered blue shiner was especially abundant, and we had to be careful to remove this fish from our buckets and coolers before we left. Ed Scott (of sculpin kabob fame) showed us how to skip sculpins across the water like a stone.

"I don't like sculpins," Ed said. "They eat darters."

Sure enough, we caught a four-inch sculpin with a three-inch darter lodged in its mouth.

It seemed to take us forever to drive to the next site. At one point, Dr. Etnier's van (he was leading the way) got caught in the mud along the side of a mountain road. Since Bob Bock was the only one who kept his waders on, he waded into the mud and gave the van its ultimately freeing push. But as the back wheel spun free, Bob got sprayed from head to toe with mud. Then Stott Noble fell on top of him. I refused to let Bob enter my Cherokee until he was out of his waders and cleaned up. Naturally, no one waited for Bob to change. By the time Bob finished, the convoy was way ahead of us and I had to double-time to catch up.

The second site was also on the Conasauga, on Ball Play Road a half-mile east of US 411. Dr. Etnier knocked on the door of a house that sat on the river's bank and asked permission for us to collect (and to park our vehicles off the road). Permission was granted. The water here was shallower than at the other site, and was therefore easier

to seine. We caught most of the same species we caught at the previous location, plus the following:

- spottail shiner, *Cyprinella venusta*
- mountain shiner, *Lythrurus lirus*
- speckled chub, *Macrhybopsis* ca. *aestivalis*
- burrhead shiner, *Notropis asperifrons*
- silverstripe shiner, *Notropis stilbius*
- riffle minnow, *Phenacobius catostomus*
- Alabama hogsucker, *Hypentelium etowanum*
- southern studfish, *Fundulus stellifer*
- shadow bass, *Ambloplites ariommus*
- redbreast sunfish, *Lepomis auritus*
- longear sunfish, *Lepomis megalotis*
- redspotted sunfish, *Lepomis miniatus*
- speckled darter, *Etheostoma stigmaeum*
- blackbanded darter, *Percina nigrofasciata*

We spent so much time collecting that we forgot about the military ration lunch Casper had gotten us (not that missing such a lunch was a bad thing). In fact, it was now pushing dinner time, and we had reservations at a fancy restaurant back in Chattanooga. So we packed our coolers (removing the blue shiners that snuck in), and high-tailed it back into town for a quick shower and a fine sit-down meal.

After dinner we returned to the NANFA Room for collecting of another sort—freebies and prizes. Piled on a table were a number of aquarium products—cans of fish food, ammonia removers and the like—Casper had gotten various manufacturers to donate. We took turns removing one item at a time for our personal grab bags. Bigger items like filters and air pumps were auctioned off. B.G. served as auctioneer, with all proceeds going to NANFA's "coffee can." Then we drew the prize winners to the NANFA fundraising raffle from out of a box.

I did not attend the next day's collecting trips, but I know that the weather was nicer and everybody had a great time. The first site, North Chickamauga Creek, was pretty much a bust; the water was high and raging, and few fish were caught. At Falling Water Creek the water flow was surprisingly normal; rainbow, Tennessee snubnose, and redline (*Etheostoma rufilineatum*) darters were in abundance. More of the same were caught at Wolftever Creek, along with blackstripe (*Fundulus notatus*) and blackspotted (*F. olivaceus*) topminnows. After dinner, most everyone went to Casper's place to watch Peter Unmack's video on the desert springs of Ash Meadows, Nevada, and the Virginia Tech video *Swimming in Troubled Waters: America's Nongame Fishes*.

The next morning, Monday, was time for final goodbyes and last-minute fish swaps ("I'll trade you one tricolor shiner for two southern studfish"). We lamented the fact that we had regular lives and jobs to return to. And we wished that we could have spent more time together.

All the more reason to get together again, next year, in Illinois.

So Many Thanks, So Little Space

A successful event like the 1998 NANFA Annual Meeting doesn't happen without the generosity of many people and organizations. So on behalf of everyone who attended, I would like to devote space here to thank publicly all those who made Fish Heads '98 so memorable.

We thank the Tennessee Aquarium for donating our passes and providing a meeting room. We also thank Chris Coco, Stephanie Brough and Darlene Walder for taking the time on a Friday night to show us their impressive facility. (Stephanie gets an extra thanks from me for supplying information on the Aquarium's exhibits and reviewing this manuscript.)

We thank our many donors: Memphis Net and Twine (fish potholders); Penn-Plax (aquarium supplies); Windsor/Nature Discovery (fish posters); Garold W. Sneegas (photographs); Joseph R. Tomelleri (artwork); Tennessee Valley Authority (posters); Virginia Tech (posters and video); Chattanooga Bakery (Moon Pies); McKee Bakery (Little Debbie snacks); R.C. Steele (fish foods and supplies); Hagen (aquarium supplies); Rainbow Plastics-Filter Division (fluidized bed filter); Ginger (fish foods and filter cartridges); Hikari (fish foods); Perfecto (powerhead and UG filter); Jungle (water conditioners); Scott Mettee (sturgeon t-shirts); Peter Unmack (Arizona fish posters); Florida State Marine Lab (posters); Chattanooga Coca-Cola Bottling Company (refreshments); Market 212 (dinner); Aquatic Promotions (*Cichlid News* magazine); and the Chattanooga Choo-Choo (room discounts).

We thank our speakers, especially Dr. David Etnier for leading our Saturday collecting trip.

But most of all, we thank the one person who made it all possible, and who knocked himself out making sure we enjoyed ourselves—Casper Cox. NANFA is a volunteer organization, and Casper did the work of 50 volunteers.

The 1998 NANFA Annual Meeting in Chattanooga was the best of times, Casper. And you were the best of hosts. Thank you.

"Each species . . . is a masterpiece. It deserves that rank in the fullest sense:
a creation assembled with extreme care and genius."
E. O. Wilson

The paddlefish,Polyodon spathula,asseen in the Tennessee Aquarium's Reelfoot Lake exhibit(see p. 9). Contrary to popular belief,the paddlefish'spaddle is not used to stir up food from the river bottom;". . . these organs are too sensitive to be used comfortably as bull-dozers,"wrote Smithsonian ichthyologist Leonard P. Schultz in 1948. Instead,biologists believe the large paddle helps the fish swim upright,correcting for the drag produced by its open jaw during feeding. Photo courtesy of Tennessee Aquarium.