

American Currents

Publication of the North American Native Fishes Association

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(See Contents page.)

IN THIS ISSUE:

NANFA CONVENTION 2017, MERAMEC STATE PARK, MISSOURI

IN MEMORIAM: DOUG STUBER

***FUNDULUS NOTTII*, A STARHEAD TOPMINNOW**

PURE COLORADO TROUT SAVED BY CALIFORNIA

FRESHWATER SNORKELING: WHY AND HOW TO GET MORE PEOPLE INTO THE WATER

OBSERVATIONS OF SHORTNOSE GAR BEHAVIORS IN THE MISSISSIPPI RIVER AND BOWFIN FEEDING

A SOUTHERN ILLINOIS OUTING

FISH IN FOCUS: KEEPING THE YUCATAN SAILFIN MOLLY (*POECILIA VELIFERA*)

GRANT REPORT: BRUKNER NATURE CENTER'S SNORKELING THE STILLWATER RIVER PROJECT

REGIONAL REPRESENTATIVE REPORTS

The North American Native Fishes Association

Est. 1972 — John Bondhus, founder

Mission: The North American Native Fishes Association (NANFA) is dedicated to the appreciation, study and conservation of the continent's native fishes. NANFA is a 501(c)(3) not-for-profit, tax-exempt corporation chartered in the State of Maryland. The purposes of the organization are: • to increase and disseminate knowledge about native North American fishes; • to promote practical programs for their conservation and the protection/restoration of their natural habitats; • to advance the educational, scientific and conservation benefits of captive maintenance and husbandry; • to encourage the legal, environmentally responsible collection of native fishes for private aquaria as a valid use of a natural resource; and • to provide a forum for fellowship and camaraderie among its members.

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American Currents

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CONTENTS

NANFA Convention 2017, Meramec State Park, MO	1	A Southern Illinois Outing	23
		<i>Lance Merry</i>	
In Memoriam: Doug Stuber	2	Fish in Focus: Keeping the Yucatan	25
<i>Fundulus nottii</i> , a Starhead Topminnow	5	Sailfin Molly (<i>Poecilia velifera</i>)	
<i>Charles Nunziata</i>		<i>Greg Sage</i>	
Pure Colorado Trout Saved by California	10	2012 NANFA Gerald C. Corcoran Education	29
<i>Phil Pister</i>		Grant Final Report: Brukner Nature Center's	
Freshwater Snorkeling: Why and How	16	Snorkeling the Stillwater River Project	
to Get More People Into the Water		<i>Deb Oexmann</i>	
<i>Jim Herrig</i>		Regional Representative Reports, 2016	31
Some Observations of Shortnose Gar (<i>Lepisosteus</i>	21	The 2017 NANFA Calendar	36
<i>platostomus</i>) Behaviors in the Mississippi River		Riffles	37
and Bowfin (<i>Amia calva</i>) Feeding			
<i>Ray Katula</i>			

FRONT COVER: Southern Illinois beauties (from top): Stripetail Darter (*Etheostoma kennicotti*), Fringed Darter (*E. crossotum*), and Spottail Darter (*E. squamiceps*). (Photos by Lance Merry)

BACK COVER: Some fishes of the Meramec River basin (clockwise from top left): Longear Sunfish (*Lepomis megalotis*), Bleeding Shiner (*Luxilus zonatus*), Gilt Darter (*Percina evides*), and Logperch (*Percina caprodes*). (Photos by Todd Crail)

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Thanks to the efforts of Tom Watson, you can own PDFs of every issue of *American Currents* published from 1972 to the present. CD #1 contains the years 1972-1988. CD #2 contains the years 1989 through the current issue. Each disc costs \$20 for members, \$40 for non-members. Yearly supplements will be available for \$5 (members) or \$20 (non-members). Postage is \$3.50 for up to 2 discs. Make check or money order payable to NANFA and send to: NANFA, P.O. Box 1596, Milton, WA 98354-1596.

The 2017 NANFA Convention

June 8–13, Meramec State Park, Missouri



Hosted in part by the Missouri Department of Conservation

- The Meramec River drainage is home to over 120 fish species, including the Meramec Saddled Darter (below)
- Boat trip to Pelican Island Preserve on Missouri River, with opportunities for collecting, fishing & trawling, plus an evening cookout on the island.
- Fellowship with other native fish fans, including aquarium keepers, anglers, snorkelers, biologists and more
- Presentations by native fish experts
- Annual NANFA auction and banquet
- Fish photography
- Roughly an hour from St. Louis airport
- Hotel (4- and 8-person rooms) & cabins on site (hotel rooms are being held for NANFA until May 1, but cabins could not be held. Reserve soon!)
- Registration includes banquet meal, two sack-lunches for field trips, and the cookout/boil on Pelican Island.
- There are several hotels located along Highway 44.
- *Did we mention the cookout on a Missouri River island?*



ITINERARY



JUNE 8: Travel day and check-in

JUNE 9: Check-in (9–noon). AFTERNOON FIELD TRIP TO THE MISSOURI RIVER AT PELICAN ISLAND NATURAL AREA (accessible only by boat). Buses will be provided. There will be trawling trips and ample space to collect fishes from an expansive gravel bar. Evening cookout on-site.

JUNE 10: MEETING AND PRESENTATIONS The afternoon is free so attendees can explore the park, chase fish, or enjoy area attractions.

EVENING BANQUET AND FUNDRAISER

JUNE 11 AND JUNE 12: COLLECTING TRIPS

Three options each day for exposure to different habitats (big rivers, medium-sized rivers, and smaller streams) and maximum species variety.

TRIP 1: LaBarque Creek Conservation Area. This creek has the highest fish species diversity in the Meramec River basin for a stream of its size.

TRIP 2: Canoe trip on Big River or Meramec River.

TRIP 3: To be determined.

JUNE 13: Bob Hrabik will guide a trip wherever (within reason!) remaining die-hards want to go.

REGISTER NOW! www.nanfa.org/convention/2017.shtml

FISHES OF THE MERAMEC RIVER BASIN: Northern Brook, Least Brook, Silver & Chestnut Lamprey • Lake & Shovelnose Sturgeon • Paddlefish • Spotted, Longnose & Shortnose Gar • Bowfin • Goldeye & Mooneye American Eel • Alabama & Gizzard Shad • Skipjack Herring • Largescale & Central Stoneroller • Goldfish Common, Grass, Silver & Bighead Carp • Red, Spotfin, Steelcolor, Striped, Bleeding, Redfin, Golden, Emerald, Bigeye, Ghost, Bigmouth, Wedgespot, Sand, Carmine, Mimic, & Channel Shiner • Gravel, Shoal, Silver, Hornyhead, Bigeye & Creek Chub • Silverjaw, Ozark, Suckermouth, Bluntnose, Fathead, Bullhead & Mississippi Silvery Minnow • Southern Redbelly Dace • Northern Studfish • River, Quillback & Highfin Carpsucker • White, Blue, Spotted & Northern Hog Sucker • Western Creek & Lake Chubsucker • Smallmouth, Bigmouth & Black Buffalo • Silver, River, Black, Golden & Shorthead Redhorse • Black & Yellow Bullhead • Blue, Channel & Flathead Catfish • Slender & Freckled Madtom • Stonecat • Northern Pike • Chain & Grass Pickerel • Rainbow & Brown Trout • Blackstripe & Blackspotted Topminnow • Western Mosquitofish • Brook Silverside • Mottled & Banded Sculpin • Flier • Green, Pumpkinseed, Warmouth, Orangespotted, Bluegill, Longear & Redear Sunfish White, Rock, Smallmouth, Spotted & Largemouth Bass • White & Black Crappie • Logperch • Western Sand, Crystal, Mud, Greenside, Rainbow, Fantail, Johnny, Stippled, Orangethroat, Banded, Gilt, Blackside, River Slenderhead, & Meramec Saddled Darter • Sauger & Walleye • Freshwater Drum • **AND THAT'S JUST ONE BASIN!**

IN MEMORIAM: DOUG STUBER

Douglas “Doug” Wayne Stuber, 62, of Fernandina Beach, FL, a member and tireless supporter of NANFA, passed away on November 28, 2016, from a heart attack.

Upbeat and optimistic, Doug always encouraged younger members. He wrote for *AC*, attended NANFA conventions, and was an all-around great guy. He will be greatly missed.

In lieu of flowers, you can donate to the Amelia Island Sea Turtle Watch (PO Box 566, Fernandina Beach, FL 32035 or <http://www.ameliaislandseaturtlewatch.com>), a cause he cared deeply about.

CASPER COX

Stunned to hear, saddened for his family. I enjoyed his company several times. He was enthusiastic and talkative, always planning a new adventure and with family options. I recall him being at the NC convention. We really had a fun meal that last night, round robin style, at the Italian place.

The most intense memory I have is having him ride shotgun with me on one of the Florida Spring Swings where I showed the gang a primo Rainbow Shiner site. After that site, I took them to another where they struggled unsuccessfully seining for Bluenose Shiner. I was in the water snorkel style, had them carefully position the seine, then rushed and flushed two sparring males into it! We stayed at the FSU lab that night and the photogs stayed up all night taking pictures of the fancy fish all lighted up. Them FL guys travel like a whirlwind. I will miss spending time with Doug. I am remembering lots of snips and bits of conversations as I type.

JOSH BLAYLOCK

This is very sad news. I want to share a story about Doug.

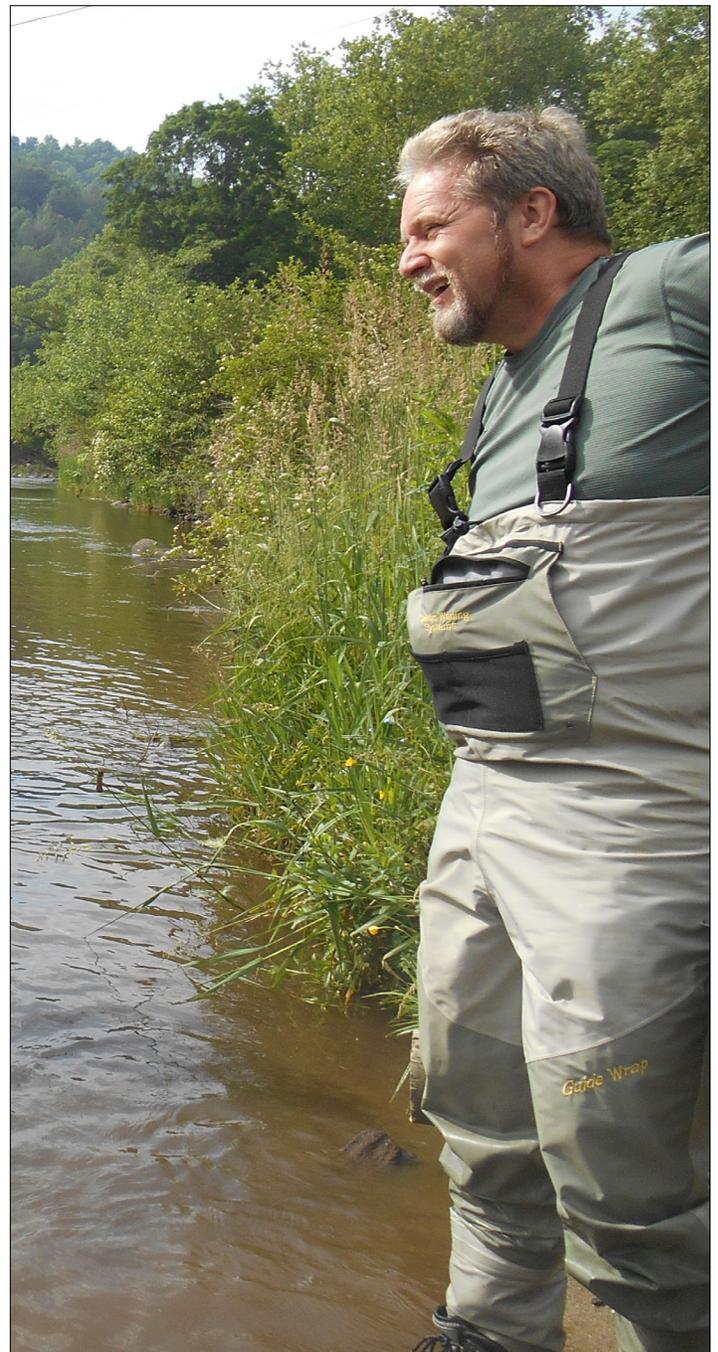
At the North Carolina convention, I was planning on riding with the two Dougs on our collection trips. Doug Dame got sick, so Doug Stuber and I rode together all day. I don't think we knew each other, but by the end of the day it felt like we had been friends for years. We talked all day about fish and basketball (I as a Louisville fan, he as a Wichita State fan). I really enjoyed his company.

At the convention auction that night there were two *Crayfishes of Kentucky* books up for auction. Doug and I battled over the first, but I eventually gave in and he won the book. Then Doug started to bid against me for the second copy. I knew he already had one, so I thought he was just messing with me. He continued to bid and ran me out of my price range, winning again. After the auction, he gave me the book. I was so moved by his kindness and generosity that the next year I wanted to pass it on. At the Oklahoma Convention, I outbid another NANFA member on a book, only to give it to him. I did this to honor what Doug did for me.

I will say that he will truly be missed, and I will never forget his kindness towards me.

BRIAN ZIMMERMAN

I too have really enjoyed having Doug at several conventions. I will always remember the crayfish book bidding war. He was sitting next to me and nudged me, grinning, and said “watch this!” It was a great act of kindness and it was a lot of fun to sit there next to Doug, feeling like I was in on the joke, watching Josh go nuts! That is how I will always remember him.



DOUG DAME

Doug Stuber's passing is a great shock to those of us who were lucky enough to meet him.

I can't top Josh's story—it's a perfect capsule of Doug's warm and generous personality. One of his special gifts was that if you spent some time with him, it felt like you'd known him for a lifetime. In trying to recall when I first met him, it felt like our relationship went back 20 or more years. In reality, he and Darla retired to Amelia Island in 2009, so our first meeting was actually some time after that.

The book auction story also touches on another of his great loves: books. I spent a couple nights in his den on trips where we used his home as our base, and I'd guess it held one or two thousand books, mostly hardbacks, on all topics—he was apparently eclectic in his interests. Shelves and shelves of built-in bookcases, and stacks on the floor. I suspect that to him, giving a book was an ultimate expression of appreciation and sharing.

Another thing that may surprise NANFAs who met Doug in the field on a collecting expedition is that he didn't keep native fish. He and Darla built a super koi pond on the patio just outside their back door, and he was active in the local koi club, but on all those expeditions where Doug was dip-netting and seining and photographing with great enthusiasm, sharing his catch with anybody who wanted species X, or sending fish by mail to faraway friends, he never kept any for himself. He just enjoyed the activity, seeing the fish, being with the people.

One of a kind.

He will be missed.

Other Doug

ISAAC SZABO

I was very saddened to hear this. I didn't know Doug well, but in my few conversations with him he was exceedingly warm and friendly. It sounds like he treated everyone that way, something we can all aspire to. I was the one outbid by Josh then given the book, and I hope to repeat this act of kindness in Doug's honor at a future convention.

JOSH PORTER

Very saddened to hear this. As a newer member of NANFA, Doug always reached out to me at any convention we both attended. More importantly, he went out of his way to make sure my wife Lauren felt comfortable and was having fun during collecting trips. He even enthusiastically helped her set up her first photo of a darter in a photo tank during the Seining Challenge. He was so nice to us, asked us about our careers with great interest, and always made sure that we went out to dinner together once during every convention. It became our tradition, and Lauren and I were looking forward to doing it again in June.



He was VERY passionate about the Sea Turtle Watch. A donations to them in his name means more than you may ever know. I have made many friends since joining NANFA, and he is the first of that group to pass away. Doug and his family will be in our thoughts and prayers.

SCOTT SMITH

Terrible news. I only collected with him once, but he was a genuinely nice guy and incredibly enthusiastic.

GERALD POTTERN

He was always a joy to be around and an energetic field partner. I chatted with him at the 2014 NANFA meeting, and the last time I saw him was Fall 2015 when the Two Dougs and several other killifish wonks converged on North Carolina to collect our endemic *Fundulus* species. Would not have guessed he was 62—he seemed younger. We will miss him.

BRANDON BROWN

Doug was as passionate and outgoing about fish as anyone I've ever met. He sent me a very nice letter and publication on killifish last summer, and despite my good intentions, I never got around to thanking him.

Vicky and I both feel as though we knew him better than we really did and were truly looking forward to surprising him someday by showing up at his house in Florida.

FRITZ ROHDE

As others have said, once you met Doug you felt as if you'd known him for a long time. He took a genuine interest in whomever he was talking to but rarely spoke about himself. I always wondered what he did that allowed him to retire so early. I am not sure when we first met, but I do remember the North Carolina convention in 2014. The first day we were collecting in the Ivy River and a friend of mine brought her 11-year old grandson, Elijah, along. He was crazy about the outdoors and the Two Dougs took him under their wings and he had a blast kicking rocks and scaring fish into the net.

It's been mentioned how talkative Doug was, but the Other Doug is equally talkative. I often wondered if they took turns or if both just talked until the oxygen in the car was depleted. Doug would call me occasionally to talk about ideas he had for articles and he was working with Dr. Joe (Scanlon) and getting him killifishes to breed. I last saw Doug when he and Florida mob came to North Carolina to catch Phelps Lake *Fundulus* and other natives. I will miss him.

CHARLIE NUNZIATA

Doug was a very active member of the Suncoast Killifish Society and NANFA's Central Florida Regional Group despite, as others have noted, not keeping killifish, natives, or fish other than Koi. Four of our six annual meetings are in the Tampa area, and one an hour further south, making the trip from Amelia Island 8 to 10 hours round trip. Yet he only missed meetings when he and Darla were traveling. He came not for the fish, but to see his collecting buddies that called the club home.

A frequent contributor to the SKS journal and *American Currents*, he was always looking for something to report or write about. His field reports were always interesting and kept alive the club's orientation toward collecting and studying our North American natives. I nicknamed him our club "Raconteur," a designation representing his interest in everything natural, his effervescent personality, and his enthusiasm for the club.

Doug exemplified the kind of man that everyone felt better being around. His enthusiasm was infectious, as was his well documented kindness and concern for others. The pain of losing him will not pass quickly, but we are comforted by the multitude of great memories, forged at meetings and during the many collecting trips we took together.

One last story. When Doug and Darla came to the Tampa Bay area for a meeting, they always stopped at an Italian supermarket, chock full of imported delicacies from the old country. He always brought my wife Angela a box of cannoli, a wonderful Sicilian pastry that once eaten will never be forgotten. Angela, always watching her diet, would pass them on to me since I don't live with such dietary limitations. Life was good, until I became guilty about it and decided to come clean. I saw Doug a few weeks before his passing, and confessed my crime. His last words to me were "not to worry, Angela told me about that months ago."

To Darla, Doug's lovely wife, we offer the profound sympathy of every SKS member and trust that God's grace will see you through and we trust the Stuber family will find comfort in their memories of this fine man. God bless you all, and thanks for sharing this wonderful soul with the rest of us.

NANFA 2016 Financial Summary

SUBMITTED BY TOM WATSON, TREASURER

BEGINNING BALANCE:	\$41,715.20	(as published in the January 2016 AC)	
<u>INCOME</u>		<u>DEBITS AND DISBURSEMENTS</u>	
Membership Dues	12,090.34	AC Printing, Shipping	-13,737.21
T-shirt sales	383.79	Conservation Research Grant	-1,000.00
AC CD Sales	182.42	Corcoran Grant	-2,000.00
Big Muddy Card Sales	95.18	Website	-1,044.35
Convention	5,322.61	Convention Expense	-2,350.18
Donations	1,022.23	T-shirts	-90.00
Interest Income	10.79	USPS	-886.54
Misc. Income*	258.35		
TOTAL INCOME	19,365.71	TOTAL DEBITS	-19,379.16
		YEAR END BALANCE (12/31/2016)	\$39,972.63

*Includes t-shirts, hats, AC-CDs, cards, decals, calendars, etc.

FUNDULUS NOTTII, A STARHEAD TOPMINNOW



Charles Nunziata

Within the subgenus *Zygonectes* of the genus *Fundulus*, there is a super species group known as the “Starhead Topminnows,” which includes *Fundulus blairae* (Western Starhead Topminnow); *F. dispar* (Starhead Topminnow); *F. escambiae* (Russetfin Topminnow); *F. lineolatus* (Lined Topminnow); and *F. nottii* (Bayou Topminnow). According to Ghedotti and Grose (1997), this super species group has been confirmed through a molecular biology analysis.

The subgenus *Zygonectes* includes a number of other *Fundulus* species, some similar to the starheads, and some significantly different in color and size. The other members of *Zygonectes* are *F. chrysotus*, *cingulatus*, *euryzonus*, *luciae*, *notatus*, *olivaceus*, and *rubrifrons*. Among these, *F. luciae*, a brackish water fish that inhabits an enormous coastal Atlantic range, is the most divergent from the others.

There are a few distinctive markings shared by all the starhead topminnows: a dark blue to black bar under each eye, suggesting a teardrop pattern; a large well-defined gold spot on the top of the head; and a small gold dot at the dorsal fin insert. They are all commonly shaped and sized as well, with similar fin locations and proportions. There are variations by sex and species in the pattern of stripes and rows of dots that appear on the flanks, and these differences are the

main identification factors. The body pattern differences are well summarized in Page and Burr (2011).

They are all excellent pond species suitable to the southern regions of the US that do not experience hard freezes or prolonged periods below 40°F. Natural populations tend to be seasonal, breeding outdoors between late spring and late summer. One can expect pond populations to continue over many generations.

Because the starheads are not flashy, they were never popular in the killifish hobby. They have an elegant look



Male *Fundulus nottii* (wild). Autauga Creek, Prattville, AL.
(Photo by Mike Jacobs)

Photos and graphics by the author unless otherwise indicated.

Charlie Nunziata has been an active aquarium hobbyist for more than 55 years, specializing in killifish and North American native fishes. A founding member of the Long Island Killifish Association (NY) and the Suncoast Killifish Society (FL), he is a life member of the American Killifish Association, and has been honored by that organization several times. He is NANFA's Florida representative and chairs the AKA Conservation Committee and the George Maier Fund, a non-profit that issues grants supporting the conservation and study of killifish.

Charlie has published in the *Journal of the American Killifish Association*, several European killifish journals, *American Currents*, and commercial publications. He coauthored the *Florida Collecting Guide*, a valuable resource for anyone collecting Florida's native and exotic fishes.

He has been married for 56 years, has two children, and hangs out with Dude, a very active cat that is always interested in helping out in the fish room.

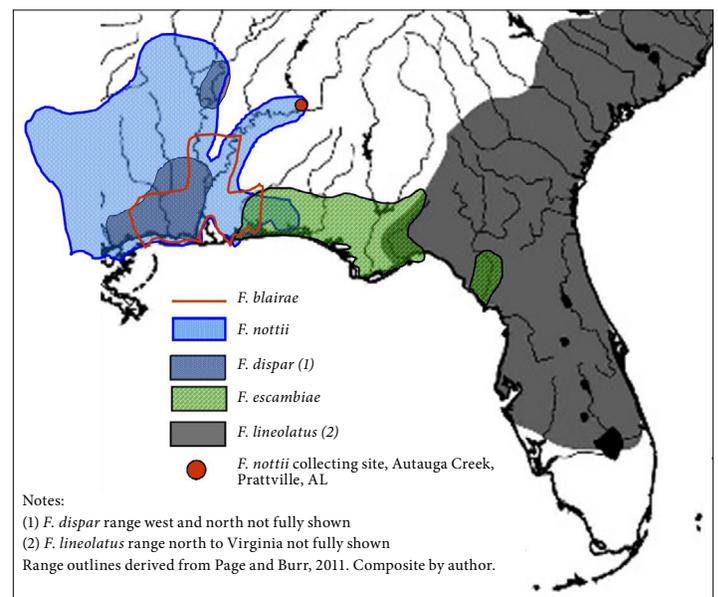


Figure 1. Starhead Topminnow Range Map.



Western Starhead Topminnow (*Fundulus blairae*). Rolling Fork River, Sevier County, AR. (Photo by Dave Neely)



Russetfin Topminnow (*Fundulus escambiae*). Lake Morality, FL. (Photo by Isaac Szabo)



Starhead Topminnow (*Fundulus dispar*) female (top) and male. Stoddard County, MO. (Photos by Lance Merry)



Lined Topminnow (*Fundulus lineolatus*) female (top) and male. Hopkins Prairie Lake, FL. (Photos by Nate Tessler)

about them, nicely proportioned fins, and in some species, dramatic markings as well. When well maintained, they will exhibit subtle hues of green and blue. All except *F. blairae* take easily to the aquarium, and given a good diet and clean water, will thrive in both species-only and community tanks housing non-aggressive and environmentally similar species. Although I've maintained and bred all but *F. blairae*, this article will focus on a recent collection of *F. nottii*.

F. nottii was discovered in 1854 by a Dr. Nott (for whom the species is named), and the well-known biologist, Louis Agassiz (Agassiz 1854). One sometimes sees the species name "notti", with the last letter dropped, especially in older literature, but the correct spelling is *nottii* with the double "ii", conforming to the original spelling in the Agassiz description. It is found from the Mississippi delta (western Lake Pontchartrain) and mouth of Mobile River on the Gulf Coast, and well inland in Louisiana, Alabama, and Mississippi. This range overlaps that of *F. dispar*, *F. lineolatus*, and *F. escambiae* (Figure 1), but sympatry has only been reported with the non-starheads, *F. chrysotus* and *F. olivaceus* (Killip Data, 2016).

Once acclimated to their new environment, *F. nottii* makes a good aquarium fish, has no exotic requirements, and is easily maintained. Adult size is 2.75 inches, females slightly smaller. A pair will thrive and breed in a 10-gallon aquarium. It is a known jumper, especially when startled, so a secure cover is a necessity. This species tends to lay just below the upper plant cover, with occasional forays to the bottom in search of food.

Water conditions for adults and fry are not critical. They are found naturally in neutral to alkaline conditions, but appear to tolerate a wide range in captivity. Cleanliness is important for full health and vitality, but well-maintained box or sponge filtration is adequate; more elaborate filtration is not required. *F. nottii* prefers calm water, so set a low to moderate air flow through the filters and avoid roiling the surface. Although this species tolerates low temperatures, a range of 70°F to 80°F is best for indoor maintenance, with breeding activity declining remarkably below that range. Seasonality is less prevalent indoors but activity is slower in the winter months, even in a temperature and illumination controlled fish room.

A dedicated species-only aquarium provided with a thick layer of floating plants is recommended to propagate *F. nottii*. The floating mat will provide a subdued and secure environment that brings out the colors of the fish, promotes a more natural behavior, provides cover for fry, and reduces the tendency to jump. A bottom substrate is not important, but if one is desired, use clean sand or fine gravel.

Plant choices are many. Larger plants such as Water Sprite (*Ceratopteris thalictroides*) left unplanted, will provide both cover, and dense mats of descending roots. For surface plants, the smaller species are preferred; the fern *Azolla*, the always popular and attractive *Riccia flutens*, and any of the duckweeds, especially the mid- and large-sized species that often provide hanging roots. Although duckweed species present a maintenance issue, the plant is a valuable element in *Fundulus* maintenance.

Like most native fishes, *F. nottii* will eat all feed stocks, live, frozen, and dry, with a preference for live swimming foods. When live brine shrimp, daphnia, or copepods are offered, *F. nottii* will chase and strike as soon as the prey item is within range, and not wait for the food to come by as would a dedicated ambush predator. Even foods that quickly sink to the bottom will be eventually consumed.

Healthy, well-fed *F. nottii* are easily bred using either of two generally employed methods. The so-called “natural” method allows the adults to breed in the plants and allow the resulting fry to remain with the adults. This method is a common option for those who don’t want to pick or handle eggs or provide separate quarters for fry. It is a virtually work-free approach to breeding killifish, but will not produce quantities of fry, and in the case of *F. nottii*, very few. This is because fry hatch at different times and over the long term, and the adults and a small number of surviving juveniles will consume the vast majority of smaller and newly arriving fry. Although only a few young adult fish will ultimately result, many hobbyists are quite comfortable producing just enough progeny to continue the species.

The more common method involves collecting and incubating eggs outside the breeding aquarium. All the non-floating plants are removed from the aquarium, and one or more artificial spawning mops, constructed of strands of nylon knitting material, are added. The construction of artificial spawning mops is well documented on the internet so they need not be repeated here. The mop should be fitted with a float and made long enough that it spreads a bit across the bottom of the tank. Killifish eggs are easily retrieved for incubation, and if retrieved within days of being spawned, relatively like-sized clutches will result, reducing size disparities, and cannibalism among the fry.

The downside to aquarium husbandry is that the female is always in close proximity to the male, and in these unnat-

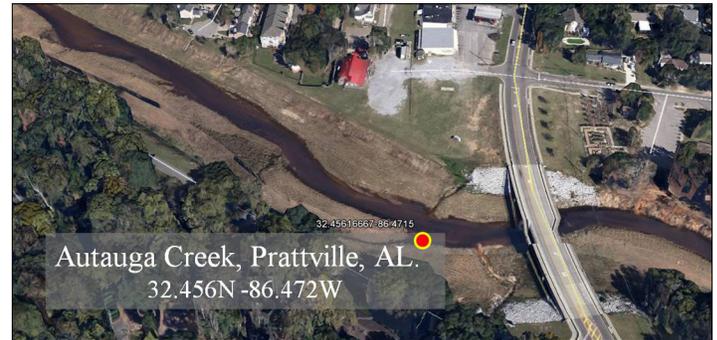


Figure 2. Autauga Creek, Prattville, AL.

ural circumstances, spawning does not necessarily occur at the optimal time, or result in the greatest number of eggs. In the wild, fish breed as nature moves them, an evolved process that likely has the greatest chance of success. Among killifish, females approach a ready male when she has a full complement of eggs, maximizing the probability of producing viable embryos in the shortest and least stressful amount of time. This behavior is not of course exclusive to killifish.

Conditioning the breeders prior to spawning is a strategy that can, in part, counter the shortfalls inherent in the closed aquarium environment, and decades of experience propagating captive fish shows that it does. But because this method requires extra effort and physical resources, it is primarily used in the killifish hobby to propagate new or particularly rare species.

Pre-conditioning is straight forward. Prepare a small tank to specifically house the spawning event, and fit it out with a filter, plants, or spawning mops, and water from the breeder’s tank. Separate the breeding stock and feed generous portions of live or high-quality foods for a week or more. This will bring the pair into peak readiness, and they will begin to spawn shortly after introduction to the spawning tank. Spawning will be vigorous and relatively continuous until the female is emptied of eggs. Remove the adults when spawning activity slackens or when the female seeks cover from the male. Do not feed at all during the spawning process.

***F. NOTTII*: A WILD COLLECTION AND SPAWNING ACCOUNT**

The subject *F. nottii* were collected during a Central Florida Regional Group trip in the Spring of 2016. It was at a wide area of Autauga Creek, in the city of Prattville, north and west of Montgomery, Alabama (32.456N -86.472W. Figure 2) where group members caught several specimens of *F. nottii*. Other species caught there included the ever-present Eastern Mosquitofish (*Gambusia holbrooki*), and the Banded Pygmy Sunfish (*Elassoma zonatum*). This area is at the most northern and eastern limits of the species’ range, representing a rare opportunity for our Florida-based group to obtain this species.



Figure 3. Collecting *F. nottii* at Autauga Creek, Prattville, AL.

The habitat was difficult with deep mud and rancid conditions, presumably due to the slow-moving Autauga at this point and time of year (Figure 3). Several *F. nottii* specimens exhibited fungus-like patches on the body and fins when pulled from the water, a dangerous situation, which required remedial action. All the *F. nottii* were isolated and a few tablets of Furanase® added to their water. Six individuals survived the trip back to my fish room, all thin, with four exhibiting the fungus-like infection. All were treated as noted in the appendix at the end of this article, and all symptoms of the disease were eventually eradicated. Nonetheless, two of the four infected fish died within a few months.

The two that did not show any signs of infection turned out to be a pair; male 2.5 in, female somewhat smaller. They were housed in a standard 10-gallon aquarium, overhead florescent light, sponge filter, a thick layer of large duckweed, patches of Java Moss (*Vesicularia dubyana*), and a typical killifish mop. Water temperatures ranged between 74°F and 80°F, pH 7.8 to 8.2, TDS 550 ppm, and 50% water changes were made every two weeks. As expected, the pair preferred the upper reaches of the aquarium, remaining just below the thick plant layer, and only forayed to the lower levels when searching for food.

Their diet was rich in live foods: brine shrimp, newly hatched and adult; chopped blackworms; and white worms. These feedings were occasionally augmented with frozen bloodworm, daphnia, and adult brine shrimp as well as a mix of high-quality flake and freeze-dried foods.

Although eggs were observed in the mop on several occasions during normal maintenance, they were only collected once to study survival and to obtain rearing incubation and rearing information. The eggs were large and firm, typical for the starhead group, about 2+ mm (.085 in) diameter and clear. The mop was examined to assure that no fish were caught up in the strands, then firmly squeezed to remove

as much water as possible. There is no need to be delicate; healthy eggs are very difficult to break. It is much more difficult to see eggs in a wet mop than a damp one. The mop was splayed flat on an absorbent material, and illuminated from above; eggs will shine and be easily discovered as the strands are separated.

Fundulus eggs are typically found in the upper third of the mop, jammed in the tight areas around the float and even on the float above the water line. However, of the 11 eggs found, 7 were concentrated in the mid-center of the mop, an area not known to be preferred by the species. Two eggs were found in the upper reaches and two eggs at the ends of strands on the bottom. This atypical placement of eggs implies that many other eggs were likely spawned and subsequently consumed.

Eggs were picked with the fingers and placed in a shallow container with water from the spawning tank (Figure 4). The incubating eggs should be checked daily, infertile ones removed, and all the storage water replaced with fresh water from the spawning tank. These daily water changes will eliminate the need for fungus-suppressing chemicals. Note that because the chorion is clear, one can easily observe the entire embryo development process, itself an interesting and educational process. Fertility rates are high and a high percentage of fertilized eggs will hatch.

Most *F. nottii* eggs will hatch in two weeks or less at temperatures in the mid 70's°F. Prepare an aquarium to receive the fry when the eggs are near hatching. It should be no larger than 2.5 gallons and fitted with a small sponge filter with the air source set to low flow. Add live plants for cover

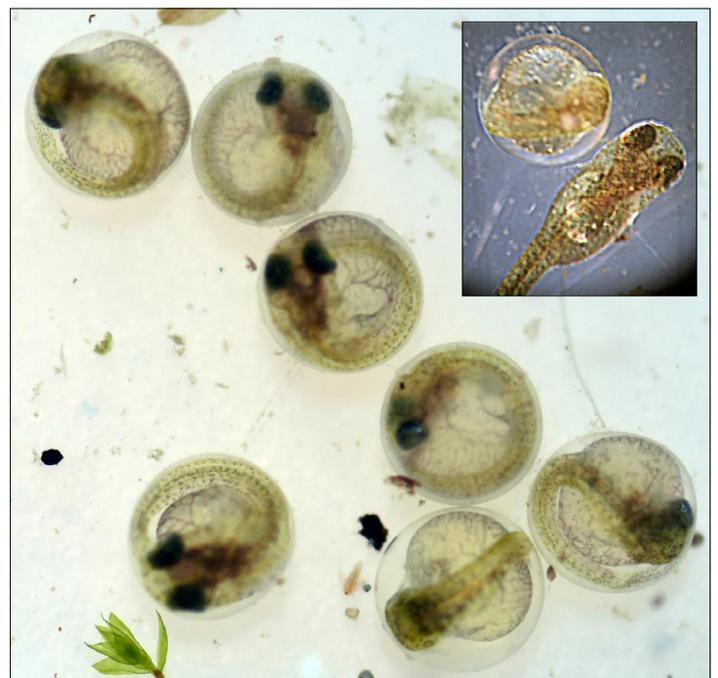


Fig. 4: Incubating *F. nottii* eggs. Inset: Newly hatched fry.

and to keep the water fresh, and add snails to clear away uneaten food. Remove the fry as they hatch with a dropper or pipette, and place them in the prepared aquarium. They are, as expected, quite large, about 0.25 in, silvery and largely transparent, and prefer the upper half of the aquarium. They actively swim about the tank and immediately take all small live foods. Newly hatched brine shrimp is an ideal first food, and for the first few weeks, feed twice a day if possible. Feedings once a day thereafter is adequate. After feeding, the pink stomach filled with shrimp will be noticeable. Finely chopped frozen food can be added to the diet after a month or two. Some breeders introduce a finely crushed high-quality flake at this time, while others rely exclusively on live and frozen foods until the juvenile stage when dry foods are easily taken.

Despite the heavy feeding, growth is relatively slow compared to other killifish, but quite normal for *Fundulus*. As they grow, the fry should be moved into larger and larger quarters to promote a normal growth rate. Raising to adulthood is without challenge, but it will take up to a year for them to reach adult size.

Don't pass up the opportunity to collect *F. nottii*, or one of the other starhead species. They are all elegant, interesting, and although sometimes a challenge to establish, are well worth your effort. Once settled in, you will find them an interesting fish to maintain and propagate. And despite their wide distribution in nature, they may well become the "rarest" fish in your collection.

APPENDIX: COLLECTING-INDUCED INJURIES AND FUNGUS-LIKE INFECTIONS

Virtually all starhead stocks are taken wild, and the collecting process is inherently traumatic, not only because of the enormous change in environment and water quality the fish experience, but also for the physical damage resulting from our handling. One cannot, for example, net a fish without causing at least some minor damage to the mucus layer, fins, or other body parts. Injuries open the fish to disease, and among native fishes, minor wounds, even ones not visible, can blossom with a fungus-like infection within a day or two of capture. These outbreaks are often more prevalent and more severe when specimens are taken from less than pristine conditions, e.g., hypoxic, sediment-filled, low flow, or stagnant sources. In the worst of these environments we sometimes find specimens exhibiting these fungus-like patches when caught.

Some species or groups appear to be more susceptible to these outcomes than others. I've found *Fundulus* species to be among the most sensitive in this regard, with *F. blairae*, in particular, notoriously susceptible to the development of fungus-like infections after capture. The Central

Florida group has collected dozens of *F. blairae* on different collecting trips and in nearly every case, most were lost within weeks to an unidentified fungus-looking infection. Typically, a few individuals survive after a month-long application of Furanase®, as directed. Full vitality never seems to be restored however, and damaged fins most often will not regenerate, leaving the fish permanently disfigured.

The infections are referred to as "fungus-like" because our group does not possess the expertise to diagnose it. But whatever its true identity, it is virulent and contagious. I once inadvertently passed it to a lot of the African annual killifish, *Nothobranchius guentheri*, who all succumbed within weeks. I expect it can be passed to domestic stocks of just about any species in your fish room. As a result, even where there is no evidence of infection, consider all collected native stocks suspect; keep them and the utensils and nets used in their maintenance isolated for a few weeks. Some people therapeutically dose collected fish with Furanase® or similar medication prior to exposing them to other stocks. With these cautions, this disease can be managed and prevented from spreading, and need not interfere with the responsible collecting and husbandry of native fishes.

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Killi-Data: www.killi-data.org. Note that this is a subscriber based service.

Google Earth: <https://www.google.com/earth/>



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PURE COLORADO TROUT SAVED BY CALIFORNIA



Phil Pister

In the early spring of 1953, I was hired as a seasonal aid working out of the California Department of Fish and Game's Bishop Office and I was "all ears" to learn what I could from the wealth of experience represented by my co-workers.

"Listen especially to Lee Talbot," counseled state hatchery supervisor Earl Leitritz, "He's been around longer than we have had fish!"

So listen I did! Leon A. Talbot, then hatchery supervisor for the eastern Sierra, had started his career with the Department (then Division) of Fish and Game in the Owens Valley following Army service in World War I. Virtually his entire period of service was at Mt. Whitney Hatchery, one of the DFG's oldest and proudest installations.

One of Talbot's favorite stories concerned a shipment of 25,000 golden trout eggs to the Colorado Fish Commission, in return for which California received "30,000 black spot eggs—native trout of Colorado." These eggs (Colorado River Cutthroat trout, *Salmo clarki pleuriticus*) were received at

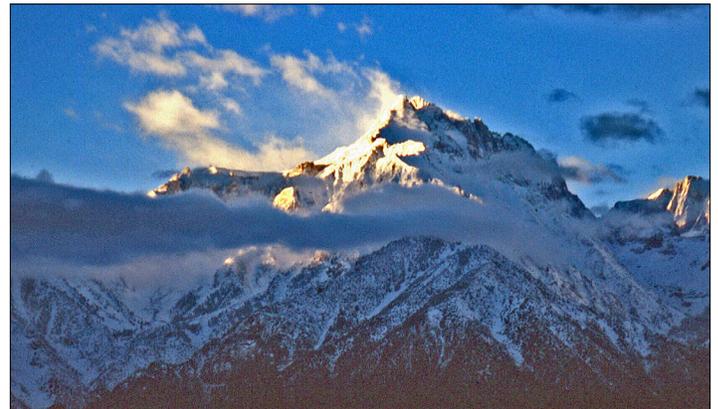
Mt. Whitney Hatchery on July 10, 1931, according to a hatchery log entry in the firm hand and cryptic style of hatchery manager George A. (Jim) McCloud.

"Put the eggs in a part of the hatchery where they won't get mixed up with anything else," ordered California Bureau of Fish Culture Chief J. O. Snyder. "When they are ready to plant, find some lakes where nothing else can be planted to hybridize with them."

One of the most inaccessible and ruggedly beautiful areas of the southern Sierra Nevada is found in the upper Williamson Creek drainage, southeast of 12,000-foot Shepherd

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Edwin P. (Phil) Pister was a fishery biologist with California Department of Fish and Game supervising research and management of waters of the eastern slope Sierra Nevada mountains through Death Valley to the Nevada border. Phil became deeply involved in desert fish conservation issues during the mid-1960's, largely motivated by the near extinction of the Owens pupfish during the latter part of the decade. His association with Carl L. Hubbs and Robert Rush Miller significantly influenced his entrance into the field of native fish management and conservation which includes the rescue of the Owens Pupfish and founding the Desert Fishes Council (DFC). However, Phil humbly downplays his role as second fiddle to Carl Hubbs and Bob Miller in these landmark achievements. He served as DFC Chairman from 1969-1972 and since as Executive Secretary, handling most of the Council's administrative affairs, a position he continues in today. He was also deeply involved in events at Devils Hole leading to a court hearing that began in July 1972 and culminated in the U.S Supreme Court decision four years later. Phil completed his graduate work under A.S. Leopold, P.R. Needham, and R.L. Usinger at the University of California (Berkeley).



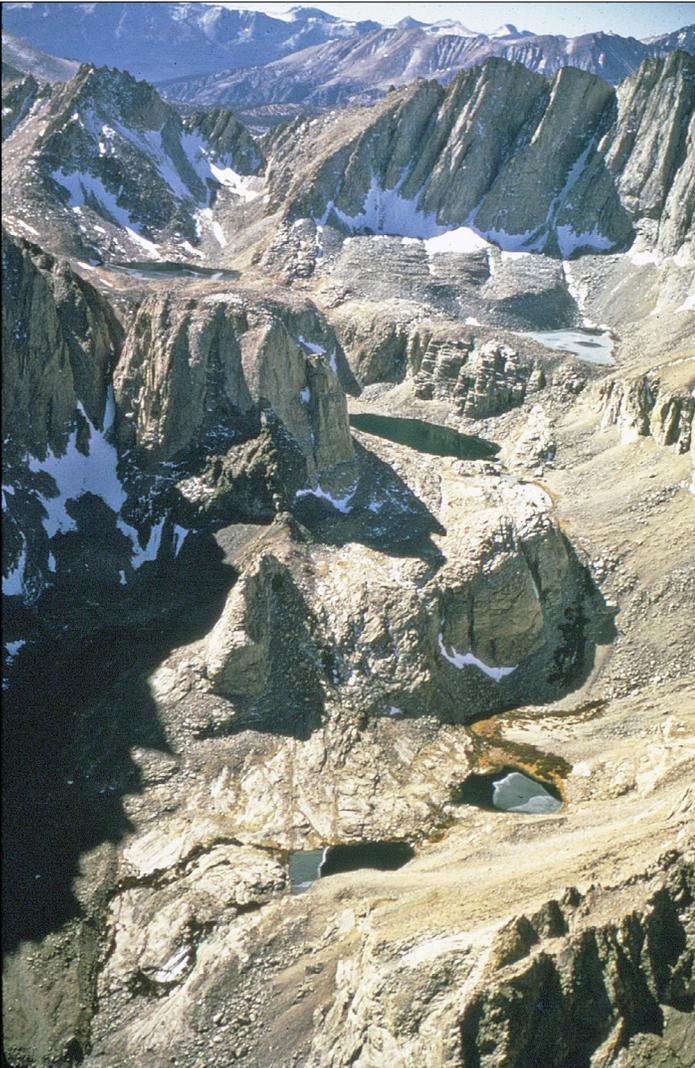
Mt. Williamson, elevation 14,375'



Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*)



Aerial photo of Williamson Lakes 3–6.



Aerial photo of Williamson Lakes 1–3. These are the lakes planted in 1931. California numbers its lakes in a drainage from the bottom upwards, in this case from lakes 1 and 2, at 11,200 feet, to lake 3 at 12,000 feet.

Pass, where seven lakes—ranging in elevation from 11,200 to 12,515 feet—are enclosed by a ring of peaks dominated by Mt. Tyndall (14,018 feet) and Mt. Williamson (14,375 feet).

Second in elevation only to Mt. Whitney (14,495 feet), Mt. Williamson stands apart from the main crest of the Sierra Nevada and dominates the entire Owens Valley. The lower Williamson lakes were chosen to receive the plant of Colorado Cutthroat.

Early on the brisk, clear morning of October 8, 1931, four saddle horses bearing Mt. Whitney Hatchery employees Talbot and Bud Harper, Independence dentist Doc Baxter and one of Allie Robinson's packers, left the trailhead at Symmes Creek. They led a string of trout-laden pack mules headed for their first night's destination at 10,200-foot Anvil Camp, where they "creeked" the fish cans (a hatchery term for placing the cans in a creek, with screen-covered openings heading into the current to allow fresh water to continually flow into them).

At dawn on the next morning, the crew again loaded the cans onto the mules, and they headed for the 12,600-foot ridge lying beyond Shepherd Pass. From this ridge the fingerling trout would be carried in backpacks down an 840-foot cliff and through a treacherous boulder field to 11,760-foot Williamson Lake No. 3.

According to the Sierra Club's "Classification of Climbs" this cliff would be placed in Class 3—requiring the use of hands. In other words, one does not just walk down this cliff; one must use the hands and climb down, in this instance carrying heavy rubber backpacks laden with fingerling trout. Since 30,000 fish were involved, several trips had to be made up and down the cliff while the packer "walked the mules" at the top to keep the water aerated.

Toward the end of the day, Talbot recognized that 30,000 trout would be too many for a lake so typically sterile as most High Sierra waters, so he and Harper made an additional trip to Lake No. 2, which lies another mile, and 560 feet, below Lake No. 3! They then climbed the 1,400 feet back to the top of the ridge only to find that their companions, assuming they had decided to hike down Williamson Creek to the hatchery, had long since left the area, taking horses, food and coats with them.

It was late that evening and edging into the night that Talbot and Harper stumbled, shivering and hungry, to the welcome fire built by their companions at Anvil Camp. This required an additional hike of more than five miles—following a day of climbing up and down a cliff carrying heavy, wet backpacks at elevations approaching 13,000 feet!

In July, 1974, I tape recorded Talbot's account of the episode. When I marveled at the physical prowess involved, his typically humble response was, "Of course, I was much younger then!"

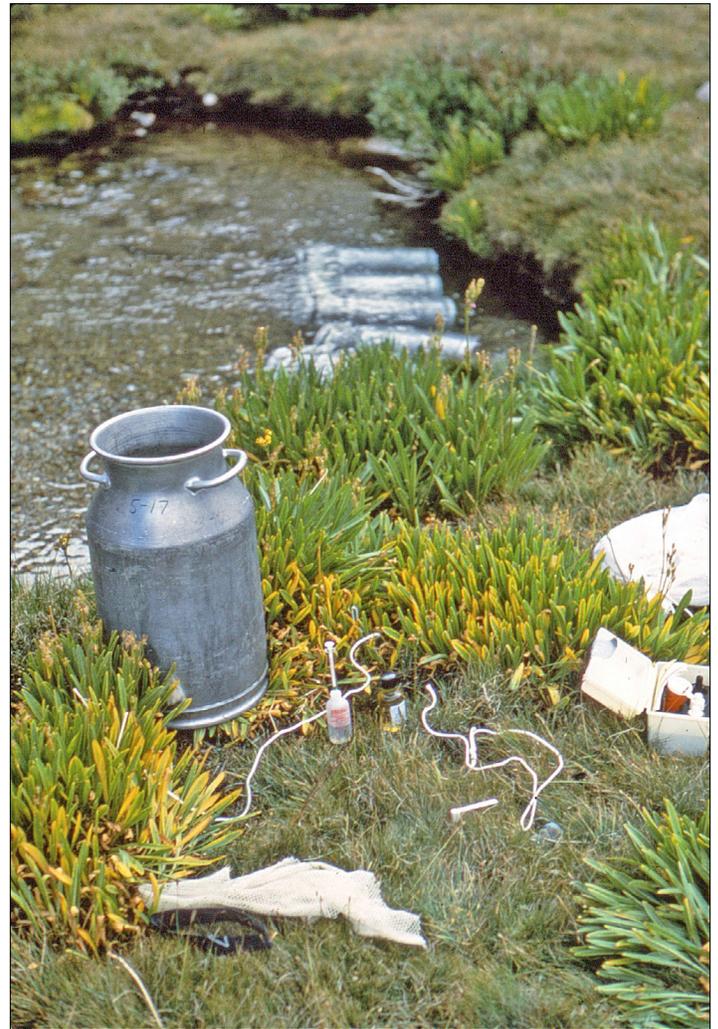


Helicopter at Williamson Lake 3. Mt. Tyndall (elevation 14,018 feet) rises above.

My first visit to the area later that year confirmed the accuracy of Talbot's legendary memory. If anything, he had understated the facts. The trout were superb, rivaling California's golden trout for sheer beauty, and the cliffs we had to climb up and down were steeper and higher than Talbot had remembered. I am certain he had no idea of the accuracy of his prophetic statement when referring to that October day 58 years ago: "Them little fellers may be valuable to someone someday."

In 1931, no one could foresee that a half-century later, Colorado's native Cutthroat stocks would need a "shot in the arm" from that gene resource so prudently hidden away on the other side of the Great Basin, nearly 700 miles distant.

For more than 20 years, I had been fascinated by this situation—to have such a resource as genetically pure Colorado River Cutthroat trout located so nearby—about 45 miles from my home in Bishop and only 12 miles from Mt. Whitney Hatchery—yet locked up in a vault secured by its physical and legal inaccessibility. For in addition to its remote location, it is also located within the Bighorn Sheep Zoological Area of the Inyo National Forest's John Muir Wilderness!



Creek cans.

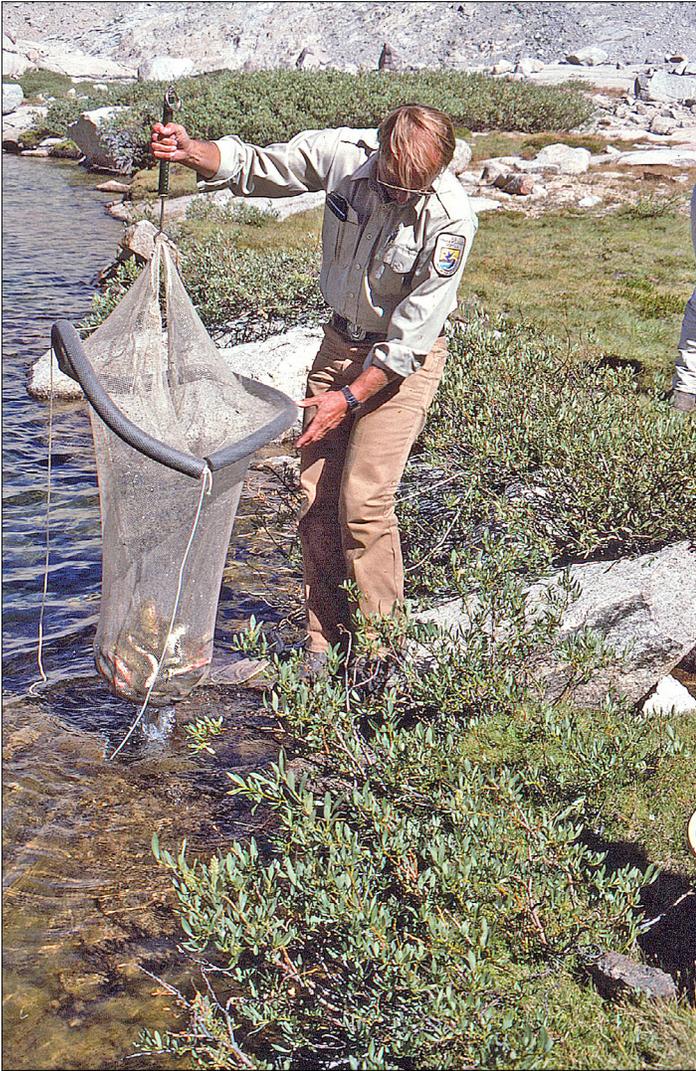
In 1974, I prepared a short paper, "Prophets of Species Preservation," and presented it at a meeting of the Desert Fishes Council. In the paper, I used three examples of early foresight that had left us a legacy of genetic purity—Barton Warren Everman (1905) with the California golden trout, Elden H. Vestal (1947) with the Paiute Cutthroat trout, and John O. Snyder with the Colorado River Cutthroat.

In the audience was Bruce Rosenlund, a US Fish and Wildlife Service biologist now located at Golden, Colorado and affiliated with Rocky Mountain National Park.

The entire matter lay dormant until 1986 when Rosenlund phoned to ask me if the pure population still existed in the Williamson Lakes, and if it would be possible to export about 300 to Colorado. Questions were being raised concerning the genetic purity of some of Colorado's native stocks.

My response was that it would be difficult, but surely not impossible. We then began to plan a venture which, toward the end, approached the complexity of a military operation.

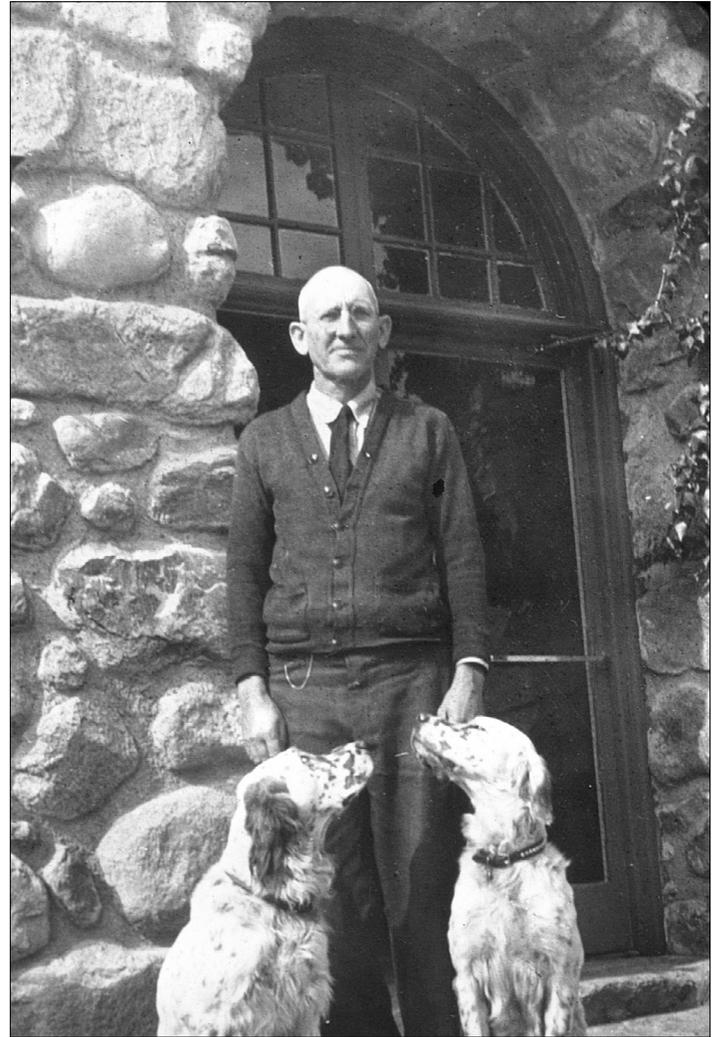
Although the plan seemed simply to move approximately 300 Colorado River Cutthroat trout from California to Colorado, each step was like a maze.



Bruce Rosenlund with floating live cage.

Foremost of the technical problems was the difficulty of transporting live fish even under the best of circumstances. Moving 300 fish with the 450 pounds of water and oxygen necessary, across four states and into a remote area within 12 hours would require more planning than most fish stocking operations.

Other obstacles included state boundaries, agency responsibilities, fish disease laws, equipment and funding. As the plans for the operation were analyzed, it became evident that successful completion of the project would require personnel, support, permission and equipment from the California Department of Fish and Game, Colorado Division of Wildlife, Inyo National Forest, the National Park Service, the US Fish and Wildlife Service and volunteers. Funding for items not under agency control was provided by Rocky Mountain National Park and a grant from Exxon Corporation through the Colorado Division of Wildlife. Fish disease certification was provided by California Fish and Game, and fish taxonomy and consultations by Anita Martinez, Colorado Division of Wildlife and Dr. Bob Behnke, Colorado State University.



Leon A. Talbot in front of Mt. Whitney hatchery. Lee made the initial plant into the lower three lakes in 1931.

From January through July 1987, the operation was welded together. The last problem to *overcome* was the movement of the fish some 700 miles from California to Colorado. The logical solution was to use the California Department of Fish and Game's Beechcraft King Air, which alternately serves as both a California executive limo and a fish truck. The King Air was capable of moving the fish from Bishop, California to Kremmling, Colorado, in about two and a half hours. With the use of this plane, a plan was developed to capture the fish, helicopter them to Independence, California, truck them to Bishop and then fly them to Kremmling. At Kremmling, a truck from the federal fish hatchery at Leadville would transport the fish to Rocky Mountain National Park where another helicopter would move the fish into the release site, Bench Lake. That lake's exotic fish population had been removed in preparation for the transplant and the establishment of a new population of Colorado River Cutthroats.

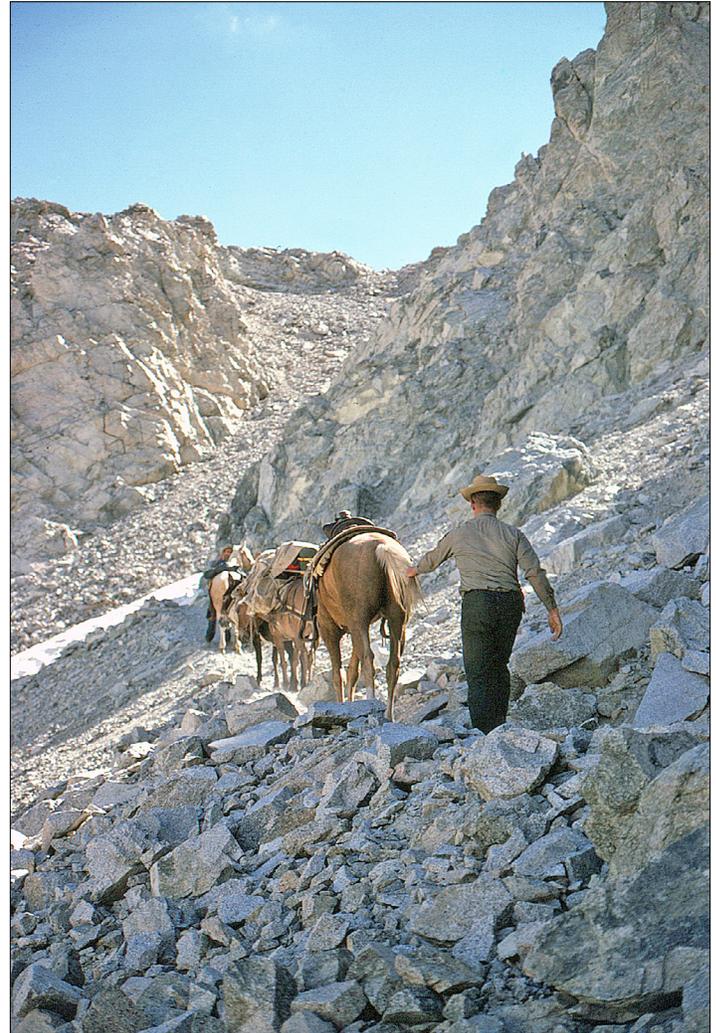
The morning of August 17, a 10-man interagency team assembled in Bishop at 5:00a.m. But, best-laid plans often go astray. The horses failed to arrive at the trailhead until 10:00



At Rocky Mountain National Park, loading Alouette helicopter prior to flying fish into Bench Lake in Ptarmigan Creek drainage.



Loading chopper at Williamson Lake 3 prior to flying fish to waiting fish truck in Independence, CA in Owens Valley, 8,000 feet lower in elevation



USFS biologist Harold Hunter approaching top of 12,000' Shepherd Pass.

a.m.—three hours late. A bad omen for a project whose last day had to run flawlessly.

Despite the late start, the camp was pitched by late afternoon. In the morning we dealt with the next step.

Since the Upper Shepherd Pass trail is no longer traversable by packstock, we donned our backpacks, climbed up to 12,000-foot Shepherd Pass and descended down the cliff and through the boulder field into Williamson Lakes.

All trout collecting was done with angling gear—principally fly rods and barbless flies. Good work if you can get it! The crew collected smaller trout because of space limitation. Smaller trout are also generally younger and bear a higher reproductive potential for a longer period of time.

By early afternoon, we had over 300 trout stored in nylon mesh cages for the night. On Wednesday, we descended again to the lower two lakes to sort the fish into milk cans in preparation for their helicopter flight to Independence on the following morning. A total of 246 fish, averaging almost eight inches each, were placed in 11 cans fitted with nylon mesh covers and “creeked” (as in 1931) overnight in the

43-degree inlet of Lake 2. Rosenlund remained at the lake that evening to tend the fish, prepare the oxygen systems for the next morning’s helicopter flight and accompany the fish back to Colorado. The remainder of the crew ascended their now familiar cliff back to camp and prepared another 50 fish out of Lake 3 for shipment.

That evening, I climbed to the top of a ridge to make a final check by radio. The weather forecast was good, only a few high clouds and no wind. The Beechcraft would be on the ground at Bishop awaiting the Mt. Whitney Hatchery truck that would transfer the fish from the helicopter at Independence for the trip to Bishop Airport.

More hitches developed that night as the all-important helicopter needed to lift the fish from the lakes to Independence was grounded with a bad fuel pump.

The next morning I arose in the predawn chill and switched on the radio, fully expecting a call that the helicopter would not be operating. The first rays of sunlight were just touching the peaks when I heard the sounds of the helicopter laboring its way up the mountain.



Beechcraft King Aire and project crew (left to right): pilot Bob Cole; co-pilot Ron Van; Mt. Whitney hatcheryman Jerry Eskew; USFS biologist Bruce Rosenlund. Bruce worked closely with National Park Service personnel in making the transplant back to Bench Lake in Rocky Mountain National Park. Jerry handled the fish following their arrival at Independence, CA airport, which was too short to allow the loaded Beechcraft to take off. They were trucked 40 miles to Bishop Airport, where 7,500-foot runways solved the problem. The 700 mile flight across four states consumed 2.5 hours.

In a frenzy of activity, Rosenlund and the fish cans were loaded in the copter, the engine revved up and our precious cargo was launched off the side of Mt. Williamson. In minutes, the helicopter was at the Independence Airstrip, and as planned, the hatchery truck was waiting.

Within an hour the truck arrived at Bishop and the fish and Rosenlund were transferred to the plane. By 9:30 a.m. they were leaving California. The temperature of the water in the fish tanks had been reduced to 34–36° F to reduce oxygen consumption and salt was added to the water to reduce handling stress.

Two and half hours later the King Air was circling Kremmling, and, as planned, the hatchery truck from Leadville was waiting. As the fish were unloaded from the plane to the truck, Rosenlund called Dave Stevens, research biologist at Rocky Mountain National Park, to confirm that the fish would be at the Park within one and a half hours. Stevens said that the helicopter was ready, but the weather was deteriorating and could preclude its use.

Rosenlund was confident, however, that the aging hatchery truck could beat the storm to the Park. Unfortunately, less than 30 minutes from Kremmling, highway work was causing major delays. While the fish truck sat for an hour in a traffic jam, rain began to fall on our parade. The delay prompted thoughts of “creeking” the fish for more nights, increasing the risk to the fish.

When the fish finally arrived at the Park, the weather was actually improving and a crew of three park rangers was flown into Bench Lake. The fish were loaded into a fish

tank that could be carried in a sling below the helicopter. The sling was attached and the fish flown to the rangers for release into Bench Lake and Ptarmigan Creek.

By 4:30 that afternoon, the fish were stocked, with a loss of only five, and the park rangers and equipment were back at park headquarters.

Descendants of the Colorado River Cutthroats taken from their native waters in 1931 were now back home, representing the second reintroduction within Rocky Mountain National Park since 1979. In the future, eggs will be taken from these fish and used to reestablish other populations within Colorado.

Although Lee Talbot passed away in 1980 and now rests in a cemetery in the shadow of Mt. Williamson, he surely lives on through the legacy that he left us. Lee’s prophecy concerning this 56-year old project had been realized: “Them little fellers may be valuable to someone someday.”

UPDATE

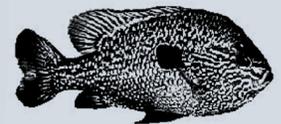
Phil added access to the lower three lakes is very difficult, and the entire basin was closed to public access during much of the year to protect a population of endangered Bighorn Sheep. The closure rule was rescinded in 2011, but there have been no surveys or monitoring of the California population. However, reports from anglers continue to speak of the beauty of the Colorado Cutthroat, and their relative abundance. Fragmentary information received from Colorado Division of Fish & Wildlife report the transplant into the Ptarmigan Lakes was successful and the fish are doing (and looking) well.

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FRESHWATER SNORKELING: WHY AND HOW TO GET MORE PEOPLE INTO THE WATER

Jim Herrig

Forest Aquatic Biologist (Retired), USDA Forest Service, Cherokee National Forest

THE BEGINNING

During the 1990s, I had the distinct pleasure of getting to know and work with Pat Rakes and JR Shute, the founders of Conservation Fisheries, Inc. (Figure 1). Their non-profit organization is dedicated to the preservation of aquatic biodiversity in streams and rivers particularly in the southeastern United States. As their webpage (<http://www.conservationfisheries.org/>) tells you, they have worked with over 70 species of fishes; many of these species are federally listed as Threatened or Endangered under the Endangered Species Act. Pat and JR helped me a lot with monitoring and managing the aquatic Threatened and Endangered species found in the Cherokee National Forest.

When I moved to the Cherokee National Forest in Tennessee in 1988. I had a lot of experience monitoring fish populations, especially trout, using the standard technique of a three-pass electrofishing effort. This technique gives a relatively precise estimate of the population size for trout within the stream sampled. However, because the fish being monitored in Tennessee are threatened and endangered and there may be some mortality associated with electrofishing, we could not use that technique to monitor these populations. That was the basis for the Forest Service establishing a snorkeling program in the Cherokee National Forest. I had no idea what a wonderful experience it would prove to be.

The National Outdoors Writers Association's annual meeting was held in Chattanooga in 1999. They requested a field trip to see some of the wildlife work in the Cherokee National Forest. One of the stops was a visit to the Conasauga River to

discuss threatened and endangered fisheries management. I asked Pat and JR to participate by talking about their organization and showing the writers some of our native fishes. We were all surprised when they were able to capture a Conasauga Logperch (Figure 2) under the Jack's River Bridge. This endangered fish had never been found that far upstream and would be very special to show the writers. We carefully put it into a viewing aquarium and showed it the writers. As all 30 of them were taking turns looking at the rare fish and taking pictures, it occurred to me that there were more people looking at these



Figure 1. JR Shute and Pat Rakes talk to reporters about the Spotfin Chubs (*Erimonax monachus*) they are about to reintroduce into the Tellico River.



Figure 2. Endangered Conasauga Logperch (*Percina jenkinsi*) and Threatened Blue Shiner (*Cyprinella caerulea*).

Photos by the author unless otherwise indicated.

Jim Herrig was raised in Brookings, South Dakota. He received his BS Degree in Wildlife and Fisheries Science from South Dakota State University and his MS Degree in Fisheries Science from Colorado State University. He began his career as a wildlife biologist for South Dakota Game, Fish, and Parks. However, he switched to fisheries working for several national forests in Colorado and retired in January, 2017, after 30 years with the Cherokee National Forest in Tennessee.



Figure 3. What are you seeing?

species right now then had ever seen it in all of history! That was not only a staggering insight but also a troublesome fact. Why haven't more people seen these fish? Lots of vacationers spend time fishing, floating, and swimming in our freshwater streams but few poke their heads below the surface to see what is there (Figure 3). They don't realize there is a magnificent freshwater "aquarium" right at their feet. The public needed to be educated about the aquatic resource they were not just overlooking but neglecting. If we could get people to appreciate the incredible diversity in our freshwater streams, they would be more inclined to clean up and protect these waters in the long term.

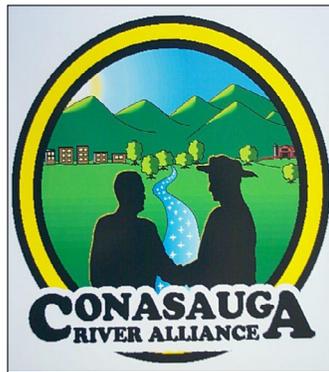


Figure 4. Conasauga River Alliance.

The Conasauga River Alliance was formed in the late 1990s with over 30 local, state, and federal agencies; universities; and non-governmental agencies (Figure 4). They were united under the common goals of: 1) maintaining and improving the quality of the Conasauga River watershed while respecting landowner rights; 2) raising people's awareness, knowledge, and appreciation for the importance of how the watershed affects the quality of their lives; 3) instilling a sense of responsibility in all people for their role in how they treat the watershed and our environment; and 4) changing the way people affect the watershed to improve the quality and quantity of water. To accomplish these goals, the Conasauga River Alliance organized a two-day field trip in 2000 and held a second event in 2001 highlighting the work that was being done in the watershed. This included: 1) riparian buffer protection; 2) road mainte-



Figure 5. Conasauga River landowners get their first look below the surface of the river



Figure 6. Early snorkeling group at the Conasauga River snorkel hole

nance and design for sediment control; 3) chicken farm waste control; and 4) timber and prescribed burning management for wildlife. Additionally, the folks who attended were introduced to freshwater snorkeling and the amazing aquatic diversity that was theirs to see. Eighty-year old farmers who had lived their entire lives on the shores of the Conasauga River told me they were astounded when they saw what was in their river (Figure 5). Children squealed with excitement when they were handed a large tadpole or a stinkpot turtle. Our goals had been met; the first freshwater watchable wildlife site that featured snorkeling was born.

Immediately following the second year of field trips, groups began requesting guided tours in the Conasauga River (Figure 6). The Cherokee National Forest organized snorkeling programs to meet this demand and was able to accommodate the requests at no charge until 2010 when demand sharply increased. In 2010 the number of snorkeling programs increased significantly with weather and stream flows being our only limiting factors. Guides and safety people were hired to lead the programs with a modest fee charged to the snorkelers to cover these costs. The fees did not discourage people from

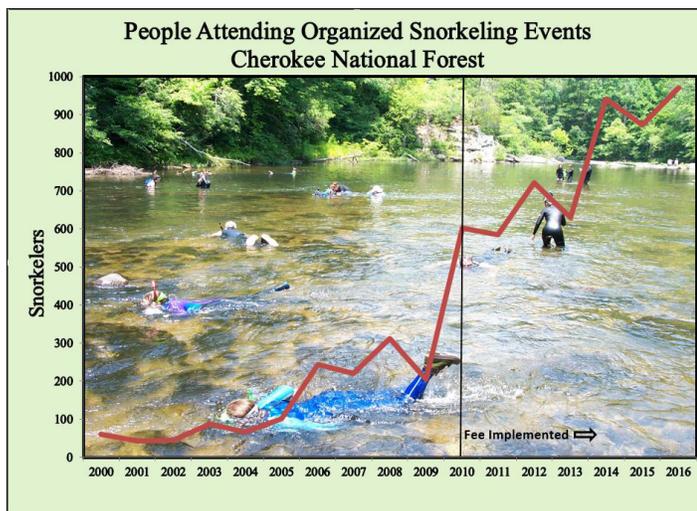


Figure 7. Trend in the number of snorkelers coming to the Cherokee National Forest

coming to the snorkeling programs. The World Wildlife Fund, Southeast Tennessee Resource Conservation and Development Council, and Tennessee Valley Authority have stepped forward to ensure that underserved kids are able to attend snorkeling events by underwriting their fees. Almost 7,000 people have experienced our freshwater snorkeling events in the 17 years it has existed; in the past three years, the average is over 900 per year (Figure 7). There is a great demand for freshwater snorkeling and I encourage those of you with the enthusiasm for this developing sport to establish your own programs. The benefits go far beyond the recreational aspects. People will have a greater understanding of watersheds; they will be better informed on clean water issues; they will develop an intense desire to clean up waterways and protect them from damage; and they will discover a new and fun experience they can have when they visit the outdoors.

WHAT MAKES FOR A GOOD SNORKELING SITE FOR FIRST-TIME FRESHWATER SNORKELERS?

Clean water. The body of water that you choose for your snorkeling programs needs to be clean. That is to say it should be reasonably clear and not heavily impacted with harmful chemicals and/or bacteria (Figure 8). If the stream you want to take people snorkeling in is impacted, you need to go elsewhere and get your snorkelers to help you clean up the impacted stream.

Freshwater snorkeling can be done in ponds, lakes, and reservoirs but these waters often have lots of floating algae that limits visibility. Also, these open bodies of water do not have reliable concentrations of fishes for snorkelers to see. Nesting sunfish and game species associated with manmade structures such as docks are some of the exceptions.

Tailwaters below dams often have exceptional clarity and good concentrations of fishes, but water conditions may be quite variable on a daily or even hourly basis; volume of flow

and water temperatures can change suddenly to the point of being extremely dangerous. US Geological Survey gaging stations are a good reference for anticipating stream flows on both regulated and free-flowing streams.

Free-flowing streams whose watersheds encompass generally undisturbed uplands are likely to provide the most consistent clean water conditions. Other considerations for selecting a site for first-time snorkelers with wetsuits on should include: 1) fairly warm water (>65° F); 2) slow-flowing water without cascades; 3) a diversity of habitats—pools, runs/glides, and riffles; and 4) good numbers and variety of fishes, other vertebrates, and invertebrates. There should be a restroom, picnic tables, and a place to change clothes at the site. The best time of day to maximize sunlight on the water is between the hours of 10 am and 2 pm.

FIRST-TIME SNORKELERS: MAKE THEM AS COMFORTABLE AS POSSIBLE

I have found from my personal experience and from assisting hundreds of first-time snorkelers that the most difficult part of the trip is putting your face into the water and breathing through the snorkel. It is well worth the time to spend a few extra minutes with anyone who shows the least bit of anxiety. My approach to this challenge is to get into the water and kneel down in about a foot of water facing the shore. I tell the new snorkelers to get on their knees in the water facing away from shore. Together we practice breathing in and out of the snorkel emphasizing that no air should go through the nose (Figure 9). When they are comfortable being mouth breathers, I have them bend over, put their hands on the stream bottom, and slowly put their faces into the water continuing to breath. This step may take several attempts. Once they can breathe in the water, I tell them to stretch their feet out behind them and let their bodies float with only their hands touching the bottom. Using their hands, they can crawl out to where the fishes are. If the water is too deep to reach the bottom, they should breast stroke



Figure 8. Conasauga River near the snorkel hole



Figure 9. Author instructs first-time snorkelers

or dog paddle to move around. No splashing or kicking the feet is tolerated as this always scares the fishes. For non-swimmers who want the experience, I will get them to the floating stage, then holding on to one of their arms, I will walk them out to deep water. The wetsuit allows everyone to float motionless as they look down on the large fishes in the deeper pools. In more shallow waters where the smaller fishes are more abundant, the wetsuit provides knee and elbow protection.

The scariest situation I have seen is when a person gets vertical in the water and cannot touch the bottom with their feet. The person (especially a non-swimmer) starts to panic and splash. Water will get into their mouth increasing their panic. They don't know that the wetsuit will keep their head above the water level. Talk to the person and reach out with a lifeguard float or a stick and pull them to shallower water. The person will usually be embarrassed but will often be ready to try snorkeling again in a few minutes—in shallower water.

Once your snorkelers are all comfortable in the water and are starting to see critters, assist them in identifying what they



Figure 10. Greenbreast Darters (*Etheostoma jordani*)



Figure 11. Smallmouth Bass (*Micropterus dolomieu*) and Bluegill (*Lepomis macrochirus*) associated with large woody debris.

are seeing. It is not important that they be able to identify down to species level—telling a darter from a minnow or a bass from a trout is good enough (Figures 10). Teach them to associate different fishes with different microhabitats. Bass, drum, gar, and redhorse suckers are large fishes found in big deep pools; darters are found in shallow, fast riffles. Eddies with rooted vegetation harbor different species than eddies with large woody debris (Figure 11). After about an hour, or sooner if water temperatures are cooler than 65°F, everyone should get out of the water, use the restroom, and eat something. It is always amazing to me how tired I am after snorkeling. You burn up a lot of calories in the water no matter how relaxed you are.

SAFETY, SAFETY, SAFETY

Freshwater snorkeling is a sport with many potential hazards. When people put their trust in your leadership or their children's wellbeing into your hands, nothing is more important than safety. Don't ever encourage or allow new snorkelers to be more than a few swimming strokes from the lifeguard. The "buddy system" is a great way to increase your comfort level with younger kids. Wetsuits provide a limited amount of flotation but they are not life preservers (Figure 12).



Figure 12. Casper Cox (Guide) and Alison Lang (Lifeguard) give their Aquatic Ecology and Safety briefings to a group of eager snorkelers



Figure 13 Relaxed snorkelers



Figure 14. Snorkelers happy with a cooperative River Cooter (*Chrysemys floridana*)



Figure 15. Bumper Sticker.

Snorkelers who have spent a considerable amount of time in streams under differing conditions tend to forget how intimidating it can be to enter a stream for the first time. Floating nearly motionless over a deep pool filled with large drum or buffalo is both relaxing and exhilarating—if you are comfortable in the water. It takes time for first time snorkelers to relax and get comfortable (Figure 13). Be patient and don't push new snorkelers too fast.

Hypothermia, characterized by intense shivering, confusion and loss of coordination, may occur even with a wetsuit; but a poorly fitting wetsuit and low air or water temperatures accelerate its onset. I follow these guidelines for new snorkelers with wetsuits (Table 1):

Table 1. Snorkeling with wetsuit guidelines.

Water Temperature	Time in the Water
Below 55° F	No snorkeling
55° to 65° F	20 to 30 minutes
65° to 70° F	1 hour
Over 70° F	More than 1 hour

Anyone observed shivering uncontrollably should leave the water and get warmed up.

Lightning is always a cause for getting everyone out of the water. Keep an eye on cloud movements and listen for thunder.

Sudden increases in stream flows may be hazardous. They occur frequently below dams but may happen in any stream. Telltale signs of flow increases may include sudden, strong downstream breeze; more debris on the water surface; and a change in turbidity.

A great variety of animals are associated with aquatic systems and many of them are dangerous. Sighting a bear or other predator should be cause enough to get everyone out of the water and into vehicles. Wasps, bees, horseflies, and a host of other insects abound near streams. Look for nests and point them out so people may avoid them. Snakes are common in streams and along stream sides. Whether poisonous or not, most will try to bite if agitated. Look at and admire them but do not handle or harm them. The same advice is given for snapping turtles; other turtles tend to be more docile and people will get a real thrill out of seeing and touching them, but they all bite (Figure 14).

Tadpoles, salamanders, crayfish, and other aquatic invertebrates are fairly harmless. I am surprised by the number of kids that have never held a tadpole and are afraid of it. Kids need to hold tadpoles.

Finally, polluted water is not a place to take first-time snorkelers. Streams with industrial chemicals or high bacteria loads should be avoided. Know what is going on in the watershed above your snorkeling site. Snorkeling in clean streams may encourage people to seek environmental solutions for polluted streams.

THE NEXT LEVEL

First-time freshwater snorkelers are usually overwhelmed by the incredible sights they see once they put their faces below the water surface. Excited squeals, shouts of “Did you see that fish?” and other “snorkel speak” tell you that they are getting it. When they overcome their initial amazement, be prepared to explain all the interactions going on in the giant aquarium they have entered. Feeding strategies, escape mechanisms, and spawning rituals that the various aquatic critters engage in are happening right before their eyes.

Freshwater stream snorkeling should become the new family activity associated with camping, picnicking, and swimming (Figure 15).

SOME OBSERVATIONS OF SHORTNOSE GAR (*LEPISOSTEUS PLATOSTOMUS*) BEHAVIORS IN THE MISSISSIPPI RIVER AND BOWFIN (*AMIA CALVA*) FEEDING



Ray Katula

Onalaska Wisconsin

Growing up literally on the Mississippi River, afforded the author many opportunities to interact with, and sometimes make observations that have provided insight on the behavior of the resident fishes. When I was very young, I dip netted a very small fish, took him home, and noting the heterocercal caudal fin and long snout, I was sure I had caught a Paddlefish (*Polyodon spathula*). I fed it cultured daphnia and it grew and I soon realized this was not a Paddlefish but rather a gar. Wishful thinking for sure, but afterwards I thought possessing a gar was pretty cool too! Such is the cases of the observations listed in this article. Upon reading *Freshwater Fishes of North America*, Volume 1 (Warren and Burr, 2014), I realized this very good book synthesizes most documented behaviors of North American fishes so it has enabled me to quickly analyze observations that I felt were not completely previously documented.

NANFA Fellow (and past president) Ray Katula is an R&D Technician at Celanese Corporation. He has a degree in Business Management from Minnesota Southeastern Technical College. He had his first exposure to North American fishes while growing up literally on the banks of the Mississippi River. Ray is a charter member of NANFA (he joined at age 11). At 13, he attended the first NANFA meeting with founder John Bondhus, who flew them in his private plane. In the 1970s, he dabbled in selling fish for the aquarium trade. Ray also lived for several years in California and Oregon, where he collected and studied native fishes of the West Coast and traded when possible for eastern species. He has written several scientific publications and contributed articles to *Tropical Fish Hobbyist*, *Freshwater and Marine Aquarium Magazine*, and last, but not least, *American Currents*. He has kept fish for 47 years and was John Bondhus' fish hatchery manager in southeastern Minnesota. Ray's primary focus is studying behavior and breeding native fishes.

The aforementioned book discusses Shortnose Gar feeding on cicadas. Gars "will patrol actively for food, as, for example, in a situation in Missouri where Shortnose Gars were patrolling the water surface for dying cicadas caught in the stream flow during an emergence of 13- and 17-year periodic cicadas (Vokoun, 2000)." I made somewhat similar observations in mid-July 2000 with a lot of help from my then young son Zachary.

My daughter Brittney was playing in a softball game in Stoddard Park, Vernon County, Wisconsin, where the baseball diamond was situated next to the Mississippi River. My son Zack wandered down a short road opening up to the Mississippi River water's edge, basically a primitive boat landing. Upon returning he informed me that several gars were swimming next to the shoreline. Curious of course, I left the game to see what he was talking about. Upon approaching the shoreline, I noticed some movement at the water's surface so we crouched down as to not disturb the gars. Most of the gars that I have observed over the years outside of spawning season do not approach the shore so closely, not to mention so shallow that some of their dorsal fins were above the water. This period also coincided with the mayfly hatch so there were mayflies everywhere and with a little discernment we could tell a gar would occasionally snatch up one as they fell onto the water's surface. At this spot, there were trees overhanging the water so I decided to give Mother Nature some help and started to shake a branch, disturbing the mayflies and then watching the subsequent feeding frenzy taking place as they fell to the water. The fish were gluttons as evidenced by their distended abdomens. Their occupation of such shallow water seemed unnatural. Spawning season was long over so I knew their rotund condition was from feeding alone. Anywhere from 10 to 12



Shortnose Gar (*Lepisosteus platostomus*). Loon Lake, Jackson County, MN. (Photo by Konrad Schmidt)



Male Bowfin (*Amia calva*) in spawning colors. Long Meadow Lake, Hennepin County, MN. (Photo by Konrad Schmidt)

fish were seen at this shallow/constrained area and averaged about 18 to 20 inches in length. The fish finally noticed us and took off to deeper waters. Gars are opportunistic feeders as suggested in the literature and in aquarium observations so this feeding frenzy does not surprise me, just not sure if this behavior has been reported previously. Apparently Shortnose Gar do enjoy a shore lunch once in a while too.

Another topic discussed in the *Freshwater Fishes of North America* is gar movements. In areas that I have frequented there does seem to be a shift in habitat preference by Shortnose Gar, moving from the Mississippi River into flooded backwaters. In one instance, they migrated from either the main channel or downstream backwaters up into the upper backwater of a creek. For several years in the early 1990s I speared fish with my friend, Randy, in Waumandee Creek, Buffalo County, Wisconsin, in mid-May. An upper pond drained into a creek, which flowed under the Highway 35 bridge and into another pond, which also drained back into a stream channel and backwaters not too far upstream from the Mississippi River. At one point where the flow goes under a railroad track, the flow is quite intense. Standing on the shore ready to spear fish, we would see a steady movement of three species of fishes, moving upstream. Common Carp (*Cyprinus carpio*) were the most common, but we also saw and speared buffalo (*Ictiobus* spp.) and Shortnose Gar, and Randy would smoke the gar in his smokehouse.

Another place where gars would transition to different habitats was a place called Lizzy Paul's Pond. The pond fed directly into the Mississippi River. At a road crossing that went over a culvert leading to an upper pond, at the right time of year, you could sit and watch Shortnose Gar move into the upper pond for spawning. When wading the shoreline of this pond looking for Bowfin fry, I found that the thrashing of my waders was quite an attractant for mostly male gar, albeit there would be an occasional female attracted to this noise. Undoubtedly the noise caused by the waders was similar to the thrashing made by the spawning Shortnose in the shallows. The gar would come within close proximity to participate in the presumed spawning frenzy and could be easily dip netted.

As an aside I will mention an observation I made on Bowfin while visiting the same pond. In the warmer sum-

mer months, this was a favorite spot of mine to either fish or just enjoy observing fish. One afternoon, I watched a Bowfin seemingly waiting patiently by the outflow below the lower pond culvert. Occasionally a bullhead would get washed down the culvert and the Bowfin would swim out and grab it. He would chomp down on it and munch on it like it was popcorn, spines and all, and he would quickly return to his spot awaiting his next meal.

The known predators of gar were also discussed in *Freshwater Fishes of North America*, but it did not mention an activity that I observed near the outlet of Coon Creek, Vernon County, Wisconsin, where it flows into the Mississippi River. At this location, there used to be a myriad of old tree stumps that were likely remnants left behind when dams were constructed on the Mississippi River in the 1930s forming pools. As the pools formed eventually the trees were flooded and died (or perhaps foresters cut down the trees in advance of the flooding). In any case, I would drive by this site several times a day and Bald Eagles were easily visible consuming fish on the emergent stumps. I was always curious what the eagles were eating and several subsequent canoeing forays would provide the evidence. Around the many stumps were numerous gar remnants, e.g., scales, bodies, and skeletons. From my quick field observations, most were Shortnose Gar but Longnose Gar (*L. osseus*) were also likely on the menu, since both species are common in the area. Most often the tough ganoid scales were left behind. Apparently, the eagles did not need this much roughage in their diet. Recently the US Army Corps of Engineers did some stream improvements that removed the stump field and also altered the backwaters near the ball field such that the prior habitats have changed from their previous conditions. I'm sure the gar's surface breathing habits make them vulnerable targets for eagles.

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A SOUTHERN ILLINOIS OUTING



Lance Merry

Champaign, Illinois

Southern Illinois is home to three large darter species in the *Catonotus* subgenus that do not occur elsewhere in the state: Spottail Darter (*Etheostoma squamiceps*), Stripetail Darter (*E. kennicotti*), and Fringed Darter (*E. crossopterygum*). I wanted to photograph them and Ben Cantrell (Illinois NANFA rep, from Peoria) also wanted to catch this trio. My friend, Sarah Wood, happens to have a friend nearby she wanted to see. Win-win all around, so we decided to make a weekend trip. We all drove as far as we could Friday after work. Sarah and I crashed in Benton, while Ben made it all the way to Cave-In-Rock. The plan was to convene bright and early Saturday morning around Iron Furnace. Iron Furnace is a massive stone iron smelting structure hidden within the Shawnee Forest, a mini-Mayan temple of sorts within the Shawnee. It's hard to miss.

I have caught large *Catonotus* relatives within the highland rim of Tennessee in the past. They were easily seined in riffles with large flat cover stones. These fish have egg mimics and are cavity nesters. In March, males find room under these cover stones, form a nest, and keep guard. Females deposit eggs on the underside of the nests' cover stone. This trip, the streams were chert-filled, Ozarkian-like streams lacking riffles with the key cover stone ingredient. The only large rock was along bridge embankments for stabilization. It's less than kickable, but Ben had this figured out already. A tiny hook and bait dropped at the edge of each rock would determine if one was hiding underneath. If occupied, a curious male would dart out and grab the bait. Ben makes it look easy. He's also a ninja with a dipnet, somehow managing to capture a tuberculate Creek Chubsucker (*Erimyzon oblongus*).

Fringed and Spottail darters are nearly identical. In fact, it was thought both populations in Illinois were Spottail Darters

until 1998. The two are only differentiated by the egg mimic growths occurring on the soft dorsal fin of males during the spawning season.

At one location Ben and Sarah went off and fished further downstream while I photographed. They ran into a mess of redhorse, catching both Golden (*Moxostoma erythrurum*) and Black (*M. duquesnei*). They were even tuberculate! Good thing I had packed the medium photo tank, just in case. A Golden Redhorse was photographed, knobby snout and all.



Creek Chubsucker



Fringed Darter



Spottail Darter

Photos by the author.

Lance Merry is a commercial truck driver by night and conservation blogger by day, and loves ecology of native fishes, orchids, and salamanders. He is the photographer for the upcoming *Fishes of Missouri*, 3rd ed., and created the booklet *Orchids of Macon County, Illinois*. His work has been featured in many publications (and illegally poached all over the web). His dream of viable conservation employment with his degree in biology has led to a career of new careers: yard maintenance, lab technician, photographer, fermentation technician, retail vendor, truck driver. See more of the journey at earthgaffection.com



Sarah and Golden Redhorse.



Ben and a Fringed Darter.

Ben was after a Black Redhorse for his fishing life-list. (Follow Ben at his fishing blog: bencantrellfish.blogspot.com.)

That evening we camped at Horseshoe Lake State Fish and Wildlife Area. We arrived at dusk and setup shop. Ben pulled out his camping stovetop and we pulled out our travel cookware. I got to chopping and Sarah started cooking whatever was grabbed from the kitchen on the way out...potatoes, onions, celery, asparagus, bouillon cubes, flour, eggs, and chorizo. Final result: A gourmet, savory dumpling stew. Illuminated by headlamp. Enjoyed by all.

Ben split for Kentucky the following morning. Sarah and I meandered northward, stopping to capture Slender Madtoms (*Noturus exilis*) and visit with a friend, Amber. Slender Madtoms were easily found, along with a bounty of Orangethroats (*E. spectabile*), Rainbows (*E. caeruleum*), and strange darter hybrids of the two. Up the road was a small strip from a remnant logging community that is now a hippie's dream of random art and exceptional custom craft stores. The girls did a little browsing, soaking up the local creativity then tried their hand at seining which ended up being a lot of splashing and catching up on life.



Orangethroat Darter (top) and two hybrids.



Slender Madtom

FISH IN FOCUS: KEEPING THE YUCATAN SAILFIN MOLLY (*POECILIA VELIFERA*)


Greg Sage

Select Aquatics (selectaquatics.com), Erie, Colorado

Although its accepted common name is Yucatan Molly, and other variations are used, it should not be confused with the Sailfin Molly (*P. latipinna*) of the southeastern US. Everyone would like to keep this striking giant sailfin molly which hails from the Yucatan Peninsula. It is the iconic livebearer, the symbol of the American Livebearer Association, with a huge fan dorsal covered with fine, bright and crisp blue, red, and orange markings over its body (Figure 1). It is not easy to find in the hobby, and for those able to obtain it, they soon find out that this is no pet shop molly.



Male and Female (image provided by Konrad Schmidt)

Nothing else looks like this fish, and a large male doing his high-energy display for a female, opening up that huge dorsal, where the first dorsal ray comes all the way forward so that it points straight ahead, will take your breath away (Figure 2). They are also fairly prolific, so that when you get their care dialed in, they generally do very well. They are also well behaved, non-aggressive to one another and other species, and generally do not eat their fry (see the basic care guide for this species at http://selectaquatics.com/care_guide_P_velifera.htm)

Large bull males will sometimes reach 5.5 inches, and it is not necessary to grow these out in outdoor ponds or large tanks for them to develop their sail dorsal, as was once believed. A few can be kept fairly comfortably in a 40-gallon tank, but most are kept in 55-gallon tanks at Select Aquatics.

Nor do they require salt in their water. This line has never been kept with salt, and does fine without it. However, particularly when I have acclimated them here, I will use salt to ease their transition when coming from a different water source. They respond well to salt, and it does come in handy whenever they may not look their best. A quick medicinal dose will always perk them up. (e.g., one tablespoon per every five gallons of water).

Photos by the author unless otherwise indicated.

Greg Sage MEd., has been keeping fishrooms of various sizes for 45 years, always with an emphasis on livebearers. As an IFGA Guppy breeder for a number of years, those clean and organized practices were well suited to the wild swordtails and goodeids that have come into the hobby over the past 25 years. Select Aquatics was begun in 2009 to study, maintain, and breed many of these rare species, help others to keep them, and distribute them out into the hobby.

Mexico is now restricting export, and many of these species are disappearing, both in the wild and in the hobby. Greg writes customers daily with fishkeeping issues, and has documented and posted much of what has been learned at the selectaquatics.com website. He resides in Colorado with his patient wife, Laura, and Ripley, the Cavalier King Charles spaniel. If you would like to contact Greg for any reason, simply email selectaquatics@gmail.com, and he will get right back to you.

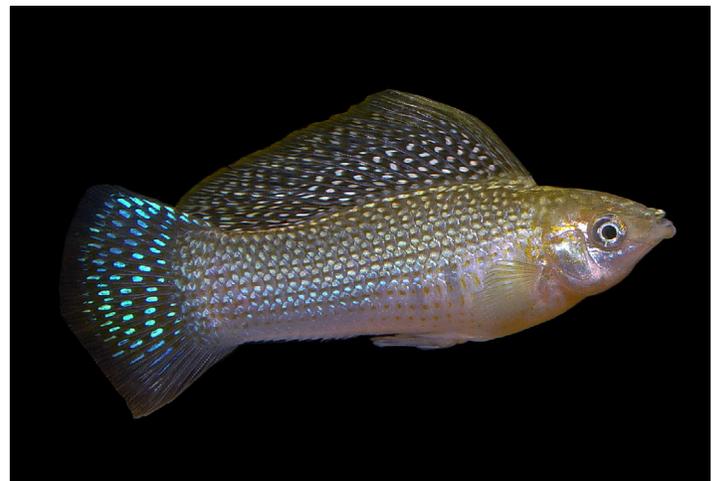


Figure 1. Male Yucatan Sailfin Molly. (Photo provided by Konrad Schmidt)

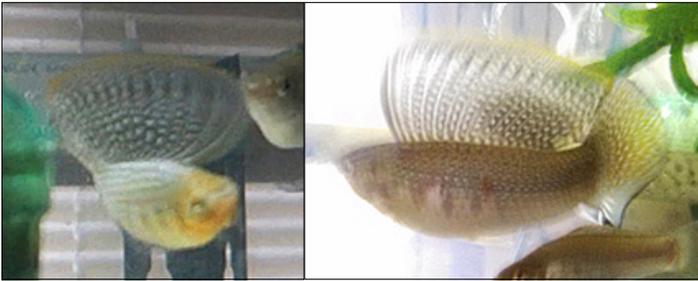


Figure 2. Examples of male’s full extension of dorsal fin (Photos by Greg Sage)

Continued selective breeding has kept this line large, with frequent, spectacularly colored, large males being produced.

However, this fish has a number of requirements that must be provided for them to do well. I will carefully explain how we keep them here so that if you wish to keep them they should be at their best for you. Their needs come down to a few specific physical characteristics that need to be understood, and these issues dictate the care they require.

Anyone can keep this fish, but it is not a “beginner fish”. Their care is not difficult to provide, but some may still decide that this is not the fish for them. It is currently kept by few fishkeepers, so hopefully with the information here, more can keep this fish successfully and bring them back into the hobby. I understand that this information is not easy to find, so I will do my best to describe their care requirements here.

These are not a difficult fish to keep properly, you simply have to set out to create a tank that meets their needs. Nor are they fragile in any way—when kept correctly they are an active, hardy, prolific fish. The issue, as I will address, involves appropriate filtration, and their need to be fed more than once per day.

Like any fish with special needs, until you get their care dialed in, these should be kept in species-only tanks, this large and prolific fish should have the tank to themselves.

Before I go further, some customers have asked about putting these into a standard, reasonably well-kept community tank, and how well will they do? Assuming we are talking about a moderate stocking level with one to two feedings per day of a quality vegetable-based dry food, with good filtration and aeration, and a pH of about 8.0, they should do OK for a while, and may even reach adulthood when kept in reasonably clean conditions. But if you want the glory these fish are capable of, it is best to start off giving them the conditions they require to do their best. Today, these have become a rare fish in the hobby, yet are possibly the most spectacular fish you can keep. Learn to keep them so they do well, and here will always be hobbyists looking for them!

Their tanks are set up as described throughout my website, bottom with a thin layer of pea gravel over a minimum of one-third to one-half of the tank bottom (Table 1). However, they do need to be at a pH of about 8.0, so instead of pea gravel, about one-half of the tank bottom is covered with crushed oyster shell to bring up the hardness and pH (my pH is about 7.4). They are also a slightly warmer-water fish, and do best here at 77 to 80°, though some keep these routinely as warm as 82 to 83°. To keep oxygen and filtration as high as possible, I do not go higher than 78/79°. Cooler water holds more oxygen.

The problem with this fish, the reason it is not more widely kept, is that it has two aspects to its care required for its survival, and they conflict with one another. Before you get this fish, you must provide a setup that solves this problem, and getting on top of it will guarantee that they will do well for you.



Female Yucatan Sailfin Molly. (Photo provided by Konrad Schmidt)

TANK SIZE: 29 gallons or larger	BEHAVIOR: Peaceful but active
pH: 7.6–8.4	JUMPERS: No
HARDNESS: Moderately hard +	COVERED TANK: Yes
FILTRATION: Heavy	SUBSTRATE: Minimal
AERATION: Moderate to heavy	LIVE PLANTS: Yes
WATER MOVEMENT: Yes	GESTATION: 30–40 days
NITRATE TOLERANCE: Low	BROOD SIZE: 10–30+ young
FEED: 80% vegetable, 20% protein	PREDATE YOUNG: No
FEEDING FREQUENCY: 2–5x/day	RAISE YOUNG SEPARATELY: Yes
LIVE FOOD: Not essential	RAISING FRY: Easy
SIZE: 4–5 inches+	DIFFICULTY on scale of 1 (easiest) to 5 (hardest): 2
COMMUNITY FISH: Yes	

Table 1. Basic Stats of the Yucatan Sailfin Molly

HERE IS THE ISSUE

This fish is a “grazer,” eating fairly constantly in the wild. While preferring a vegetable-heavy diet, they possess a relatively short digestive tract. Normally, an animal with a vegetarian diet has a longer digestive system as plant material is more difficult to process and takes longer to digest. With a short digestive tract, they digest what they take in inefficiently, releasing more waste than most fish we keep. Because of this, they must be fed smaller amounts throughout the day. With a schedule where you must be gone during the day, they will survive with a feeding in the morning, and then two more times before nightfall. Ideally, the tank should be located where they can be fed a small amount each time someone walks past. Here, they are fed five to six times per day. And with each feeding they act as if they are starving, yet may be stuffing themselves with their bodies already well rounded! Because I am in the fish room all day, I am able to feed each time I walk past the tank, but obtaining a quality automatic feeder would be a consideration.

The conflicting issue is that they are also somewhat nitrate intolerant, and their health will decline when water quality is inconsistent or is allowed to deteriorate. And of course, with all that feeding, water quality will deteriorate quickly. This is not a deal breaker, appropriate filtration and water changes will take care of that, but you need to first set up a tank of at least 29 gallons with heavy filtration and water changes at least two times per week of at least 30% each time to maintain them, depending on the number of fish in the aquarium. The more fish, the greater the need for extra filtration. Full-sized adult fish will need to be moved to at least a 40-gallon aquarium.

At Select Aquatics, two breeder groups are maintained, about 25 of the largest fish are in a 100-gallon tank, and a second group of 10–12 large, but not the biggest fish, are in another 55-gallon tank. Early maturing males are removed. The tanks are filtered with three and four box filters, and each tank also has a 250 HOT Magnum Hang-On-Back (HOB) filter with the micro cartridge to keep water quality up. An automatic water change system changes the water 15% per day. You

should be able to maintain them with weekly 50–75% water changes. If stocking levels get high, occasionally doing a 20–30% change whenever the water appears the least bit cloudy is advised. You must provide filtration that removes the majority of waste from the water. Because they are nitrate intolerant, a sponge filter that is cleaned regularly (weekly) can be used in conjunction with box or HOB filters, but are never to be used as the sole source of filtration (as any sponge-based filter leaves the organic debris and decaying matter in the tank).

Obviously, you will not need the HOB filter with a few smaller fish in a 40-gallon aquarium, but you will need that extra filtration as they reach 3.5 inches plus. Through observation you can come to understand what they look like at their healthiest, and add filtration or make changes to the water quality as necessary.

The box filters provide robust aeration, and the Yucatan Mollies do not seem to bother the live Java and Bolbitis ferns provided in the tanks. They do not eat their fry, which hide in the plants and are easily caught and moved to grow out tanks where they are fed baby brine shrimp, and three to four times (or more) per day feedings of a fortified vegetable flake.

Though fed a vegetable-based dry flake throughout the day, they must also be fed one feeding a day of a higher protein food. Here we feed a carnivorous flake, or frozen bloodworms, white worms, or chopped earthworms. Frozen brine shrimp is also excellent for them.

Raising the fry is not entirely what you would expect. Fortunately, when well fed they generally do not bother their fry, born only slightly larger than a swordtail or guppy fry. It is best to put them into a net breeder, and for the first month or so of growth there are no real signs that they will grow into the large four- to five-inch fish we are hoping for. The growth is fairly slow, and they are only about the size of a swordtail or platy fry until about five to six weeks. At this point, with frequent feedings and good water quality, their growth begins to take off.

At about three-quarters of an inch in size, I move the fry into a 40-breeder tank, where their growth is encouraged, after they are old enough to be feeding confidently and swimming throughout the tank. At this point they all look like smaller females. It will take a good five to six months before you will start to see firm signs of males beginning to mature. The problem is that those maturing first are generally the “early maturing males” that will sex out at a very small size, and you want to separate those, so they do not breed with your stock, or the line will diminish in size. Eventually, the big bull males will begin to mature, and those are the fish you want to use as breeders. Keep in mind when raising these fry, if possible, feed small amounts of food throughout the day. Here they get baby brine shrimp once a day, and numerous smaller feedings of a spirulina-based flake.



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Until the males begin to develop color and their big sailfin, they are fairly indistinct, chunky silverish-white fish. Overall, it will take a male about 8 to 12 months to become full sized, and it will take 5 to 6 months before they can be sexed. Once secondary sexual characteristics start to develop, the males will grow quickly, with the sailfin growing daily. At this point the sexes should be separated, so that your largest fish are bred toward the next generation.

For the experienced fishkeeper looking for a modest challenge with a big payoff, and a show tank that people will not be able to look away from, this may be the fish for you! Though water quality can be tricky to get dialed in, once that is established, they are a very well-behaved, peaceful, and large colorful fish that do not eat their fry.

HOW OFTEN DO THE MALES FLARE, AND CAN YOU ENCOURAGE THEM TO SHOW OFF?

At Select Aquatics there are two tanks of adult fish, a 55-gal and a 100-gal. The 55-gal tank has approximately five males, two that are full adults, and eight to nine females. The domi-

nant male will flare four to five times a day with casual observation, primarily after feedings and water changes (and that is when I am most often there to observe them). As the males mature, and are in the same tank together with females, the amount of flaring is frequent enough that it can be seen a few times per day.

The 100-gallon tank has a big bull male of about 5 inches with about 15 larger females. He rarely flares—in fact I have only seen him flare on a couple occasions—yet that tank consistently produces many fry. I think that flaring is for both the females and competing males, and having both together in the same tank will increase the amount of flaring going on.

They can also be encouraged to flare by separating the males from the females for a day or two, and reintroducing them followed by a water change and/or feeding.

Currently, breeder groups are producing fry that are sold at two to three months of age. Over time, sexed young adults will be offered as they become available. Availability of fry groups and sexed adults will be posted on the Select Aquatics homepage: <http://selectaquatics.com/index.htm>



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2012 NANFA GERALD C. CORCORAN EDUCATION GRANT FINAL REPORT



BRUKNER NATURE CENTER'S SNORKELING THE STILLWATER RIVER PROJECT

Deb Oexmann

Troy, Ohio

www.bruknernaturecenter.com

PROJECT SUMMARY

Brokner Nature Center (BNC) in Ohio is known for its vision of wildlife conservation through environmental education, providing unforgettable wildlife encounters to educate, inspire, and encourage outdoor exploration. We are driven to provide unique wildlife experiences for children of all ages. Thanks to NANFA's support, we were able to purchase the necessary equipment and to increase the scope of our educational offerings with an innovative new program, Snorkeling the Stillwater River!

GOALS AND OBJECTIVES

The primary goal of the project was to develop an innovative and hands-on wildlife program that is unique to the area, is appealing to teens and young adults, and educates the public about the native fishes of the Scenic Stillwater River.

Working with our local dive shop, Aquatic Realm, we researched the most appropriate snorkels and masks for our intended junior high to adult audience. They were extremely helpful, providing a group discount, and advice on storage and use. We decided to get 13 sets best utilized with smaller

faces (women and teens) and one set for our Wildlife Educator, Brian Ayres, the coordinator of the program. In May, Brian and his wife attended a snorkeling class at Aquatic Realm to learn the basics of equipment use, tips to instruct others, and gear care.

In June, we held our first trial “Snorkeling the Stillwater River” with our Junior Volunteers, local 12–18-year-olds who work closely with our staff to care for BNC’s Wildlife Ambassadors and assist with special events and educational programs as needed. Several of them have been participating in our programs since they were preschoolers! These young adults are interested in nature and conservation and were excited to be included in this new adventure! We had nine eager participants and were able to work out the best way to teach them:

1. how to use the equipment: we demonstrated putting the equipment on another staff member, showing the students how to adjust the straps, and attach the snorkels. Then individual help was given as each student put on the equipment.
2. how to keep them in a designated area: Brian then demonstrated how the students were supposed to look for fishes and other creatures underwater by lying flat and using their hands to pull themselves upstream, careful to look under rocks, and around vegetation. He tied orange tape to overhanging trees in the designated area, asking each student to occasionally look up and make sure they stayed in sight.
3. how to communicate with them while they were snorkeling: Brian used a whistle to get the students’ attention when he wanted them to gather together.

Students worked in teams of two to explore different areas of the river within the designated area. They used the dip nets to try to capture any fish they saw (we only captured one—a Western Blacknose Dace, *Rhinichthys obtusus*). I think seeing below the surface was a revelation for many of them. We had a hard time getting them to stop when the time was up! We put our Blacknose Dace in a bucket for the trip back up the trail to the Center where we added it to the aquarium we had set up previously.

In July, we held our first official Snorkeling the Stillwater program for our Wednesdays with Wildlife Summer Camp adventure for 6th–12th graders. This has historically been a difficult age group for us to entice into our programs but Brian had developed such an engaging set of topics and lessons we had 16 students attend at least one of the sessions. The most popular session was the Snorkeling the Stillwater with 11 students signed up. Final evaluations of the camp showed that 10 of the 11 students who attended the snorkel-

ing programs listed it as their favorite activity of the month! The only negative was that it was only about 60 degrees that day and it was a pretty chilly experience!

EVALUATION

We couldn’t be more pleased with the way this project developed! It gave our staff a chance to be trained in a new skill, was an exciting way to engage staff family members and provided an adventure to an underserved population that was unique for our area! One downfall that we have as a staff is the habit of not taking pictures of our programs. Staff will often forget the BNC camera and instead take photos on their phones. However, with this program all cell phones were left at the center for fear of getting water-logged!

One of the coolest outcomes of this project is that not only did it engage our clientele, but it inspired our staff to learn more and challenge themselves professionally. We have already begun creating a plan to market the program to the public in 2016. We plan to develop a partnership with area Junior and Senior High School clubs, further challenge and engage our Junior Volunteers, and provide training and opportunities to area naturalists and BNC Volunteer Trail Guides.

We can’t thank you enough for this opportunity to engage the next generation with a hands-on program focusing on native fishes, their habitat, and the conservation of both. These students live in the Miami Valley, an area rich with water resources and this program really opened their eyes to what lies beneath the surface of the water! (The Ohio Department of Natural Resources recently published a free guide to native fishes that we were able to pass out to all participants.)

FINANCIAL REPORT

We made slight changes to the proposed budget we submitted. Snorkel sets prices had gone up and we needed extra sets for staff. After transporting fish in a 5-gallon bucket during our relatively long hike back to the center, we decided to purchase a battery-powered aerator bait bucket so future catches could be kept alive until we put them in the aquarium. Due to these added expenses, we did not purchase a kick net.

GLASSWORMS
(aka Phantom Midge Larvae)

- ▶ Excellent and irresistible live or frozen food for native fish.
- ▶ Swims throughout water column (does not sink).
- ▶ Last for months at 35 - 45 F with weekly water changes.

Jenny Kruckenberg
jennyk@usfamily.net
 651-230-5415

REGIONAL REPRESENTATIVE REPORTS, 2016

California, submitted by Josh Porter

Conservation: Over the past year the East Bay Regional Park District (EBRPD) has been working with California Division of Fish and Wildlife (CADFW), Yolo County Resource Conservation District, Contra Costa County Mosquito Vector Control, and concerned Yolo County farmers on the conservation of the only native sunfish west of the Rockies, the Sacramento Perch (*Archoplites interruptus*). The EBRPD manages a large pond, Jewel Lake, which is home to a genetically unique strain of Sacramento Perch. The California drought, sedimentation, and competition from introduced Green Sunfish (*Lepomis cyanellus*) have caused a steady decline in both the Jewel Lake strain of Sacramento Perch and the quality of the lake itself. With the perch already extirpated from most of its native range, it has become important to monitor and conserve all of the small populations of perch that have been established throughout lakes and reservoirs across the state. Furthermore, CADFW hopes that these isolated populations can one day help to establish programs that will reestablish the Sacramento Perch to its original, native range.



Sacramento Perch (Photo by Josh Porter)

An early step in this process was to address the Sacramento Perch issues associated with the Jewel Lake strain. Attempting to continue studying this population would serve as a useful guide for future Sacramento Perch endeavors. During a period of particularly low water levels in Jewel Lake, several perch were rescued from the lake and held in captivity. Some of these specimens were placed into a broodstock program. After the initial rescue, several successful spawning events took place, and the larval fish were relocated to private ponds. Other individuals from the initial fish rescue were relocated directly into a refuge pond specifically set aside for them. It is with great pleasure that I report successful results in all of the ponds. The relocated adults have successfully spawned naturally, and young-of-the-year perch are now present in the refuge pond. Equally exciting was that the ponds where only larval fish were introduced are now yielding perch as large as 100 mm! The process is still very much in its early stages. However, we are hopeful that this is the beginning of a native fish restoration success story. Anyone in the SF Bay area or Yolo County that is interested in getting involved in this project can contact me

(see inside front cover for contact information) for more information.

NANFA assists in native aquariums: I am also happy to report that I am now consulting on behalf of NANFA for a very interesting native fish aquarium project. The Bishop Paiute Tribe of California is in the process of displaying several sensitive species in their tribal center aquariums. The tribe hopes to bring awareness and understanding about some of the unique California natives in their area including the Owens Sucker (*Catostomus fumeiventris*), Owens Tui Chub (*Siphatales bicolor snyderi*), and the Owens pupfish (*Cyprinodon raudiosus*). Initially I have offered a laundry list of suggestions in aquarium husbandry and field collection to aid them in successfully displaying fish. We are hoping to create a long-lasting relationship between the tribe and NANFA. They may even be applying to some of the future NANFA grant opportunities. Their message and goals greatly match those of NANFA, and I hope that this is the beginning of a great relationship. As with the Sacramento Perch project, anyone near the area of Bishop California that wants to get involved with this project can contact me for more information.

Mobile Fish Exhibit: For those of you that attended the Oklahoma NANFA convention, you are aware that fellow California NANFA James Frank and I are involved in the East Bay Regional Park District's Mobile Fish Exhibit. This exhibit travels to elementary schools throughout Alameda and Contra Costa counties and educates kids on the importance of litter prevention, the value of native fish, and the repercussions of releasing pets and other nonnatives into the wild. We also attend other unique events like special needs kids fishing derbies. This program takes place on most Thursdays throughout the fall and spring seasons. I'd like to extend an invitation to any visiting or California NANFAs to volunteer with the program. Involvement could include assisting with loading and unloading of the fish from our aquarium lab to actually being involved at the event. Please feel free to contact me at jporter@ebparks.org if you have any interest. I know California is a large state with members spread out far and wide. So it is sometimes difficult to coordinate group activities. As always, I will be more than happy to help assist you in promoting any NANFA activities or ideas you might have for the Golden State. Don't hesitate to reach out!

Florida, submitted by Charlie Nunziata

Several members of the Central Florida Region spent a wonderful 2016 Spring weekend catching fishes and visiting friends from north Florida to central Alabama. We covered 1,600 miles in just under 4 days, and fished 12 sites, 9 of

which produced an impressive array of native fishes. We are pleased that the vast majority of the collection were successfully acclimated to our fish rooms and ponds.

Ken Normandin and Doug Stuber of Jacksonville met Tampa Bay area members Charlie Nunziata, Bill Shields, and Brian Skidmore at Panacea, Florida just south of Tallahassee to start the trip. The target here was an oddly located pond within rock-throwing distance of the Gulf of Mexico. This site held a colorful population of Flagfish (*Jordanella floridae*), the farthest north we have ever caught this species, and both normal and melanistic forms of Golden Topminnow (*Fundulus chrysotus*). The typical occurrence of the melanistic form is a few percent at best, but they constituted well over 10% of the fish taken at this site. We also found species common to most Florida sites; Least Killifish (*Heterandria formosa*), Mosquitofish (*Gambusia aff. holbrooki*), and Warmouth (*Lepomis gulosus*).

Other sites in this region yielded a brightly colored population of Banded Topminnow (*Fundulus cingulatus*), a very yellow Pygmy Killifish (*Leptolucania ommata*), the always popular Bluespotted Sunfish (*Enneacanthus gloriosus*) and Gulf Coast Pygmy Sunfish (*Elassoma gilberti*). There was the occasional Chain Pickerel (*Esox niger*), Pirate Perch (*Aphredoderus sayanus*), Gulf Darter (*Etheostoma swaini*), and from the Wacissa system, a population of *Lucania goodei* that is one of the most intensely colored populations in the state. We stopped by the Hosford Bog to view and photograph a plethora of carnivorous plants, both state-protected natives as well as a few exotic species.

Our main focus was Alabama where we had the great pleasure of visiting and collecting with Dr. Joe and Maurice Scanlan. Our target species included the spectacular Rainbow Shiner (*Notropis chrosomus*), the large and impressive Tricolor Shiner (*Cyprinella trichroistia*), and for our killifish contingent, Bayou Topminnow (*Fundulus nottii*), whose location north and east of Montgomery represents the eastern limit of the species' range. We found the first two at the Little Schultz Creek where we also viewed the antics of the Creek Chub (*Semotilus atromaculatus*) and an unidentified Stoneroller, probably Bluefin Stoneroller (*Camptostoma pauciradii*). The Autauga Creek in Prattville produced *Fundulus nottii*, a starhead topminnow that was very welcomed by the killifish specialists among us. A few of the rarely seen Southern Studfish (*Fundulus stellifer*) were found at Swamp Creek, along with Speckled Darter (*Etheostoma stigmaeum*). Hillabee Creek yielded Blackbanded Darter (*Percina nigrofasciata*), Tallapoosa Darter (*Etheostoma tallapoosae*), and Speckled Darter.

All in all, a very productive trip with great friends, great fishes, and better memories. Not much more one can ask for from a weekend in April.

Kentucky, submitted by Josh Blaylock

In mid-July Ohio Representative Matt De La Vega and Kentucky Representative Josh Blaylock hosted a collecting weekend in Kentucky. Three days of collecting in three different drainages got kicked off on Friday July 15th. The group assembled in Somerset, Kentucky, around 2pm to visit some spots in the Cumberland River Drainage. Matt and I met with Rolf Wilhelm, his son, and Frank O'Neil from North Carolina and Mike Toole, a native Kentuckian, who now lives in Texas.



Buck Creek tributary

We had a smaller group than what we would have on Saturday and Sunday so we made a quick change to the plan and stopped at a smaller stream to see something special, the newly described Buck Darter, *Etheostoma nebra* before visiting Buck Creek. This species was once known throughout the entire Buck Creek system, but is now confined to two tributaries to Buck Creek. We caught 3–4 of these at this location, and saw a few more. Because of their habitat, they were a little easier to sight than to net. All were returned to the creek.



Buck Creek

After this stop, we went to Buck Creek proper. This larger creek produced many fish, though the water was up a little for this time of year. Notable species here were: Bloodfin Darter (*E. sanguifluum*), Bluebreast Darter (*E. camurum*), Spangled Darter (*E. obama*), Banded Darter (*E. zonale*), Rainbow Darter (*E. caeruleum*), Greenside Darter (*E. blennioides*), Fantail Darter (*E. flabellare*), Longear Sunfish (*Lepomis megalotis*), and Northern Hog Sucker (*Hypentelium*

nigricans). We caught a ton of shiners here too: Whitetail (*Cyprinella galatufa*), Spottfin (*C. spiloptera*), Silver (*Notropis photogenis*), Tennessee (*N. leuciodus*), and more.

After Buck Creek, we moved to a location on Fishing Creek. Fishing Creek is a smaller creek within the Cumberland Drainage. We caught Redline Darters (*E. rufilineatum*) and Eastrim Darters (*E. orientale*) here, along with several shiner species.



Longhead Darter

On Saturday, we were joined by two more members of Rolf's North Carolina crew, along with Jared Burson from Ohio and John Belcik from Illinois. We traveled west to the Green River drainage. Our first location was Russell Creek, a larger tributary to the Green River. The water levels were quite high, but we were able to make our way to a workable riffle. The highlights here were a few state listed/concern species: the Longhead Darter (*Percina macrocephala*), Spotted Darter (*E. maculatum*), and Stargazing Minnow (*Phenacobius uranops*).

After lunch, we went to the Green River proper in Greensburg, Kentucky, but due to rain and lake drainage, the water was past flood stage. We visited another tributary, Pittman Creek. This location offered easy access with a large number of species, including: Scarlet Shiner (*Lythrurus fasciolaris*), Elegant Madtom (*Noturus elegans*), Northern Studfish (*Fundulus catenatus*), Orange-fin Darter (*E. bellum*), and Kentucky Darter (*E. rafinesquei*). There was still daylight to burn and Rolf wanted to visit the location we went to during the 2013 Kentucky Convention, so we loaded up and headed east toward the upper portion of the Green River. We found a few more Stargazing Minnows and quite a few more Elegant Madtoms, along with the other Green River species. After this location, the group split up, some heading back to Somerset and a few going to the Green River headwaters. In the upper reaches, we found Teardrop Darters (*E. barbouri*) and Headwater Darters (*E. lawrencei*).

One Sunday, we assembled and headed to the Red River Gorge. The Red River Gorge is located in the Daniel Boone National Forest and designated as a National Natural Landmark. We were joined by Mike Toole's son and Art Parola from Louisville, Kentucky. We parked at Wolfpen Creek and worked our way upstream. In this headwater creek we found lots and lots of Southern Redbelly Dace, along with

a couple Redside Dace (*Clinostomus elongatus*). Also present here was the Rainbow Darter (*E. caeruleum*) and Creek Chub (*Semotilus atromaculatus*). Following Wolfpen Creek downstream we went into the Red River. On the way to the river, we found a few Frecklebelly Darters (*P. stictogaster*). In the mainstem river, lots of Variegated Darters (*E. variatum*) were found, along with Banded Darters (*E. zonale*), Rainbow Darters, and Emerald Darters (*E. baileyi*). Art Parola also managed to catch a small Longnose Gar (*Lepisosteus osseus*) in the river. After these two locations the group dispersed and headed home and to the hotel after three days of the working the waters.



Wolfpen Creek

I was very encouraged by this outing and the people from all over that showed up and wanted to see the fishes. We had two from Ohio, five from North Carolina, one from Illinois, two from Texas, and two from Kentucky: five states coming together to enjoy native fishes in Kentucky. I think I'm going to make this a yearly event. Be on the lookout for the Kentucky Collecting Weekend in 2017, when we will visit different creeks and drainages. I will schedule the weekend different from the NANFA Convention as to not compete with that event.

Maryland, submitted by Bob Bock

Maryland Representative Bob Bock drove out to Pittsburgh to give his talk: "Are sunfish bizzarro cichlids, or are cichlids bizzarro sunfish." The first weekend in September, he's giving a new talk "Keeping and breeding cyprinids." The new talk will focus on what scientists have learned from spawning studies of European and North American cyprinids, and how to apply that information to breeding Asian and African cyprinids that are new to the hobby and haven't been bred before. In mid-October, he's leading the collecting trip at the Potomac Valley Aquarium Society's All Aquarium Catfish Convention to the Rivanna River, outside Charlottesville, for madtoms, cyprinids, and small sunfish. Bob has led the trip every convention, since the first one in 2004.

Minnesota, submitted by Jenny Kruckenberg

On August 9, 2016, Konrad Schmidt, Minnesota NANFA Representative Jenny Kruckenberg, and Saber (the Water Wonder Dog) went looking for five sensitive fish species that were re-introduced from their pristine home in Fish Lake, near the small town of Elysian in Le Sueur County to Lake Elmo in Washington County. Most of our efforts to collect and transport these fishes occurred during the summers of 2011–2013. A small but dedicated group of NANFAns had put forth the effort, including Bryan Stefansky, Greenwood Champ, and Dr. Jay Hatch.



Kon and Saber at Lake Elmo.



Jenny snorkeling.

In 2016 we used seine, dip nets, and snorkeling to search for the fishes. I'm happy to report that we found all five species: Blackchin Shiner (*Notropis heterodon*), Blacknose Shiner (*N. heterolepis*), Pugnose Shiner (*N. anogenus*), Banded Killifish (*Fundulus diaphanus*), and Least Darter (*Etheostoma micropera*). Although we found only one Blacknose Shiner, Kon likes to say "Where there is one, there are more." The water clarity was a lovely 15'11" using the Secchi disk. Vegetation was abundant. While snorkeling a curious sunfish caught my eye. We stared at one another as I wiggled my finger, when suddenly, out of nowhere, Saber dog-paddled by and spoiled the moment. That boy!!

North Carolina, submitted by Gerald Pottern

Coastal Plain: Saturday Aug 6, Scott Smith and Fritz Rohde (NANFA President) took 15 members (10 adults and 5 children) on a primarily freshwater collecting trip in the nearby Croatan National Forest in eastern NC near New Bern. I had done this about five years ago at the request of retired fisheries biologist, Gene Huntsman. Since I and most of the group had gotten older, I enlisted the help of my younger friend, Scott Smith (of ncfishes.com fame).

We have had a considerable amount of rain recently so my expectations were low. Our first stop was the turbid and over its banks Tucker Creek, just outside Havelock. It is the site of the oldest (and, for a long time, only) North Carolina record of the Bridle Shiner (*Notropis bifrenatus*). Taken in 1962 and never seen again, the fish has subsequently been found at several locations in eastern North Carolina, especially when sought in its preferred habitat: deep water with lush vegetation. Alas, we did not find it here but Scott did net a large Redfin Pickerel (*Esox americanus*) and we both caught Pirate Perch (*Aphredoderus sayanus*) whose Latin name amused everyone, as well as Blue-spotted Sunfish (*Enneacanthus gloriosus*), Warmouth (*Lepomis gulosus*), and a Sawcheek Darter (*Etheostoma serrifer*).



Scott and Fritz in Brice Creek.

We then headed to Brice Creek in the National Forest. Beautiful blackwater stream but not much in it. Got a beautiful Brown Water Snake (*Nerodia taxispilota*).

On to Island Creek, also in the Forest. It is unique in having exposed limestone outcrops. I was very optimistic as we jumped in but very few fish were to be seen. The one that got the group excited was an American Eel (*Anguilla rostrata*). But what got my heart pumping was a Cottonmouth (*Agkistrodon piscivorus*) in the water with us and not very happy with our presence. We quietly slunk downstream and got out.

We decided to end the day on western Bogue Bank in the town of Emerald Isle. Scott had discovered the northernmost population of Sailfin Molly (*Poecilia latipinna*) in pools adjacent to a public boat ramp. In addition to mollies, we caught mojarra (*Eucinostomus* sp.), Spot (*Leiostomus xanthurus*),

Pinfish (*Lagodon rhomboides*), Fat Sleeper (*Dormitator maculatus*), Sheepshead Minnow (*Cyprinodon variegatus*), Mummichog (*Fundulus heteroclitus*), shrimp, and crabs.



The Gang.

Piedmont: Phil Cox and Gerald Potters (North Carolina Representative) led a chub-watching expedition in June to the Rocky River between Siler City and Pittsboro, NC, along with 15+ members and guests of the Rocky River Heritage Foundation (RRHF). This Rocky River (there are many in NC) historically supported a high biodiversity of fishes, mussels, snails, and dragonflies, and is the type-locality for the endangered Cape Fear Shiner (*Notropis mekistocholas*). Over the past three decades the Cape Fear Shiner and several rare invertebrate species have declined or disappeared from this river. RRHF is working to protect and restore this river and its watershed, and to educate Chatham County residents on the special biological and cultural importance of this waterway.



Estuarine collecting.



Inspecting the catch.

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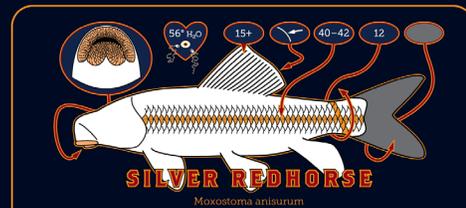


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NANFA'S 2017 CALENDAR
Twelve months of beautiful native fish photography by NANFA's own Isaac Szabo.
<https://goo.gl/afZT59>



Knobloch Scuba, Cuttle Inmammatus, Cotter Spring, AR

F E B R U A R Y 2 0 1 7						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29	30	31	1	2	3	4
	5	6	7	8	9	10
	11	12	13	14	15	16
	17	18	19	20	21	22
	23	24	25	26	27	28
	29	30	1	2	3	4



Did you know that NANFA founder John Bondus was born on March 17, 1944, or that ichthyologist David Starr Jordan was born on January 19, 1851? Casper Cox added these and many more dates of ichthyological interest throughout the year, making the calendar both beautiful and educational. The calendar costs \$16.00 (plus shipping), of which a \$5 profit goes to NANFA. Calendars are manufactured by a print-on-demand service, so they are printed only when ordered. This means less waste & more benefit to NANFA.

Compiled by Matt Knepley

RIFFLES

NOTES ON CAPTIVE HUSBANDRY, BIOLOGY, CONSERVATION,
NOMENCLATURE, AND RECENT PUBLICATIONS

NO LAMPREY LOVIN' ALLOWED



Lady's Man! (Photo by T. Lawrence, Great Lakes Fishery Commission)

If you're a female Sea Lamprey (*Petromyzon marinus*) in the northern-most reaches of Michigan's Lower Peninsula you might want to be a little extra selective during upcoming breeding seasons. It seems your invasive type is not wanted there and a new approach is being put forth to eliminate you and yours.

On January 12, 2017, the Michigan Departments of Environmental Quality, Natural Resources and Agriculture and Rural Development announced the winners of several grants whose goal it is to check the advance of invasive species. The only fish-specific award went to the US Geological Survey, Hammond Bay Biological Station, which will receive \$122,100 for a project to release sterilized male Sea Lamprey into the Pigeon, Sturgeon, and Maple rivers.

It is hoped that female lampreys will find the sterile males as viable mates, thus reducing spawning success, if not actual spawning. Should the program go well the next scheduled application of lampricide in the Pigeon, Sturgeon, and Maple rivers can be cancelled, lamprey numbers and eradi-

cation costs will decrease, and the remainder of the target ecosystems will suffer less collateral damage from lamprey eradication efforts.

For more information, see <http://www.michigan.gov/invasives/0,5664,7-324--402136--,00.html>

and http://www.michigan.gov/documents/dnr/2016_MISGP_Funded_Projects_548042_7.pdf

DEEPWATER SCULPIN COMING BACK!



Deepwater Sculpin. (Photo by JG Mycheck-Londer and S. John, USGS Great Lakes Science Center, Ann Arbor, MI)

A fascinating and hopeful study of the Deepwater Sculpin (*Myoxocephalus thompsonii*) has been published in the *Journal of Great Lakes Research*. In the mid-1990s, Deepwater Sculpin populations in Lake Ontario plummeted so dramatically that some speculated the fish had actually died out in that body of water. Fortunately, a twenty-year investigation into *M. thompsonii*'s situation there has shown evidence that this funky freshwater sculpin's population is improving substantially.

Beginning in 1996, the USGS Great Lakes Science Center, Lake Ontario Biological Station in Oswego; the New York Department of Environmental Conservation, Lake Ontario

Research Unit, Cape Vincent; and the Ontario Ministry of Natural Resources and Forestry, Lake Ontario Management Unit, Glenora Fisheries Station, Picton combined forces to conduct, record, and analyze well over 8,000 sampling trawls of Lake Ontario's depths. They found that not only are there now more Deepwater Sculpin than were present in 1996, there is also a wider age range as well. The data show that this increase has been consistent over time, and populations are made up of different generations. So it appears they are living longer, eating better, and reproducing more! While perhaps not occurring in numbers great enough for them to reclaim their "nuisance" status (given them by commercial gill netters), it is quite likely they are on par with populations in the other Great Lakes.

On a personal note, being an unschooled ichthyological layman, I quite often find scientific studies "over my head." It takes a concentrated effort to grasp much of their content. This paper, while clearly professional, is more readable than many others, and I encourage others like me who have access to it to read it.

For the whole work, see Weidel, B.C., et al., Deepwater sculpin status and recovery in Lake Ontario, *J. Great Lakes Res.* (2016), <http://dx.doi.org/10.1016/j.jglr.2016.12.011>

NEW STUDY FINDS SAMPLING MAY NOT HARM FISH POPULATIONS



(Photo by Fritz Rohde)

Dr. Steven L. Powers of Roanoke University recently investigated whether or not it could be demonstrated that sampling, especially via electroshocking, could be expected to have measurably detrimental effects on fish populations. He concluded that it could not. The abstract of his paper follows:

Recent publications and restrictions on collecting by state fish and game managers indicate a growing concern regarding the impact of field sampling on native fish populations. To evaluate the validity

of these concerns, data from five life-history studies conducted in Cherokee County, Georgia were examined to test the hypothesis that regular sampling has a negative impact on fish populations. Number of individuals collected was divided by time collecting to calculate catch per unit effort (CPUE) as an indicator of relative abundance for each species. The collecting sequence (i.e. the number of times a species had previously been sampled) was regressed against CPUE for each of the five species. Despite monthly electrofishing and removing up to hundreds of individuals of each species, there was no significant relationship between CPUE and the collecting sequence ($r^2 = 0.1\%$, $P = 0.82$). Only one species, the imperiled *Etheostoma scotti*, Cherokee Darter, showed a negative correlation (-0.1) between CPUE and collecting sequence, but the association was weak ($r^2 = 0.1\%$) and not significant ($P = 0.76$). These data suggest that even intensive, regular sampling and removal of modest numbers of individuals from the same reach of a small stream (< 10 m wide) had no measurable long-term impact on stream fish populations. Therefore, concerns regarding the impact of collectors on stream fish populations may not be consistent with the actual impact of collectors.

The entire paper is worthy of review, and many considerations not specifically included in the abstract are brought to bear. Especially interesting in this regard are the insights provided regarding the rather inapplicable nature of the science being used to encourage limitations on sampling. The work is well-researched and documented throughout and should act to assuage the fears of any wondering if collecting fishes for study is harming their numbers.

Powers, Steven L. (2016) "Intensive, Regular Sampling and Removal of Modest Numbers of Fishes Shows No Measurable Impact on Fish Populations in Three Streams of North Georgia," *Southeastern Fishes Council Proceedings*: No. 56.

The original research article is available in *Southeastern Fishes Council Proceedings*: <http://trace.tennessee.edu/sfcproceedings/vol1/iss56/1>

PENOBSCOT RIVER BYPASS OPEN TO FISH
NANFA's annual convention in New Hampshire wasn't the only big fish-related news out of New England last June. One state over, in Maine, fish are now able to swim around Howland Dam in the Penobscot River.

A USFWS press release says, "Today, federal, state, local, and tribal representatives, and project partners gathered in Howland, Maine, to mark and celebrate the completion of

the last major milestone in the Penobscot River Restoration Project: the newly constructed fish bypass around the dam in Howland.

“Completion of this large stream-like channel will allow American Shad, river herring, and Atlantic Salmon to swim freely around the dam to and from important historic breeding, rearing, and nursery habitat for the first time in more than a century. The Howland fish bypass fulfills the Penobscot Project’s goal of significantly improving access to nearly 1,000 miles of Maine’s largest river for eleven species of native sea-run fish, while maintaining energy through increased hydro-power generation at other dams in the watershed.”

The entire press release is available at

www.fws.gov/news/ShowNews.cfm?ID=4F928157-CED5-9E63-1D41C23A5AC7707F

WELCOME, NEW MEMBERS!

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Douglas Bishop, VT
Meriel Brooks, NY
Dave Catterson, WA
Noah Daun, WI
Daniel Dutton, VA
Gary Edelman, NY
William Estes, PA
Theodore Gifford, NY

Andrea Kakuda, CA
Lawrence Kent, WA
Christi Kruse, CA
Alton Livingstone, AZ
Jennifer Loftus, IN
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FISHES OF WISCONSIN POSTERS



The University of Wisconsin Zoological Museum has some amazing fish posters for sale. The 13-foot canvas poster shows all 183 species found in the state, at life size, and costs \$150. Nine smaller posters, each depicting a subset (eight show families: the sunfishes,

the pikes, the perches, the gars, the suckers, the salmonids, the catfishes, and the minnows; “The Little Fishes of Wisconsin” includes 16 families) are also available. The excellent art is by Kandis Elliot, UW-Senior Artist Emerita, and reference photos were provided by NANFA member John Lyons. See <https://charge.wisc.edu/zoology/items.aspx> for more info.



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MEMBER BENEFITS

- **AMERICAN CURRENTS**, a quarterly publication featuring articles and news items on collecting, keeping, observing, conserving, and breeding North American fishes.
- **REGIONAL NANFA CHAPTERS**. State and regional aquarium groups where members may get together to collect and discuss native fishes, remove exotics, and perform conservation and stream restoration work.
- **NEW MEMBER PACKET**. An 8-page newsletter that's sent to new NANFA members introducing them to NANFA, and to the fascinating world of collecting, keeping and conserving North America's native fishes.
- **ANNUAL CONVENTION**. Where NANFA members from around the country meet for lectures, collecting trips, auctions, fun and finship. Missouri will host the 2017 convention.
- **GRANT FUNDING**. Only NANFA members can apply for NANFA's Conservation Research Grant and Gerald C. Corcoran Education Grant programs. For details, see NANFA's website (www.nanfa.org), or contact Dr. Bruce Stallsmith, Conservation Grant Chair, 256-890-6992, fundulus@hotmail.com, or Scott Schlueter, Education Grant Chair, scott_schlueter@fws.gov.

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Fishes likely to be seen during the 2017 NANFA convention in Missouri. (See Contents page for details.)

