2022 Annual Meeting

March 1 – 3

Edgewater Hotel & Conference Center

Gatlinburg, TN

2022 TNAFS Meeting Schedule

Tuesday, March 1	
10:00 – 6:00 EST	Registration Open
1:00 – 4:30	Workshop: Freshwater Mussel ID
6:00 – TBD	Informal Social at Ole Red Gatlinburg
Wednesday, March 2	
7:30 – 5:00 EST	Registration Open
8:00 – 11:30	Student Professional Development Workshop
1:00 – 2:50	Session 1: Student Symposium
3:10 – 4:50	Session 2: Professional Symposium
5:00 – 6:00	Business Meeting
6:00 – 10:00	Banquet, Auction, Awards, and Poster Viewing
Thursday, March 3	
8:30 – 10:20 EST	Session 3: Contributed Presentations
10:40 – 12:00	Session 4: Contributed Presentations Continued
12:00	Closing Remarks and Meeting Adjourned

2022 TNAFS Session Schedule - March 2

1:00 EST		**Welcome & General Information — Cole Harty**
STUDENT SYMPOSIUM *moderator: Cole Harty*		
1:10 EST	1	An Interdisciplinary Approach to Assessing Freshwater Mussel Health and Mortality in the Clinch River - **Jeronimo Da Silva Neto**
1:30 EST	2	Contributions of Stocked and Wild Rainbow Trout to Two Tennessee Tailwater Fisheries - **Connor Ballard**
1:50 EST	3	Development and Application of an eDNA Assay to Delineate the Distribution of the Imperiled Striated Darter (*Etheostoma striatulum*, Page and Braasch 1977) in the Duck River, Tennessee - **Adam Walker**
2:10 EST	4	Age and growth of three important commercially harvested fishes in Tennessee: Skipjack Herring, Silver Carp, and Smallmouth Buffalo - **Wes Wesley**
2:30 EST	5	Habitat associations of Blotchside Logperch (*Percina burtoni*) in the Little River, Tennessee and the suitability of Abrams Creek for reintroduction - **Josh Cary**
BREAK		
PROFESSIONAL SYMPOSIUM *moderator: Mark Rogers*		
3:10 EST	6	Assessing Fish Passage for a Federally Endangered Minnow, the Laurel Dace (*Chrosomus saylori*) - **Shawna Fix**
3:30 EST	7	The High-Definition Stream Survey: A fast, affordable and flexible method to document stream habitat and support management actions - **Jim Parham**
3:50 EST	8	Small Fish Big Impact: A Culvert Replacement Project in Campbell County, TN - **Sally Petre**
4:10 EST	9	For a Few Brookies More: A example of collaboration to improve stream habitat and restore native Brook Trout in Trail Fork, Cocke, Co, TN - **Jeff Wright**
4:30 EST	10	Habitat of the Blue Shiner (*Cyprinella caerulea*) in the Mobile Basin: the Good, the Bad, and the Changing - **Bernie Kuhajda**
BREAK		
5:00 - 6:00 EST		BUSINESS MEETING
6:00 - 10:00 EST		BANQUET, AUCTION, & POSTER VIEWING

2022 TNAFS Session Schedule - March 3		
8:30 EST	**Good Morning Welcome & Announcements — Justin Wolbert**	
CONTRIBUTED PRESENTATIONS *moderator: Justin Wolbert*		
8:40 EST	11	Hydra Impact and Management in Recirculating Aquaculture Systems - **Shannon Murphy**
9:00 EST	12	Lower Food Web Selectivity by Bigheaded Carp in Southeastern Reservoirs - **Ashley Padgett**
9:20 EST	13	Molecular surveillance of fish larvae aimed at investigating the reproductive ecology of *Hypophthalmicthys molitrix* in Tennessee reservoirs - **Robert Paine**
9:40 EST	14	Recruitment, Survival, and Growth of Rainbow Trout in Two East Tennessee Tailwaters - **Tom Flanagan**
10:00 EST	15	West Tennessee Habitat Enhancement - **Brandon French**
BREAK		
CONTRIBUTED PRESENTATIONS cont. *moderator: Sally Petre*		
10:40 EST	16	Overcoming Challenges to Native Fish Restoration in a National Park - **Matt Kulp**
11:00 EST	17	Evaluating Temporal Change in Freshwater Streamfish Communities - **Jen Caudle**
11:20 EST	18	A Collaborative Approach to Prioritizing Stream Habitat Improvement Projects for Brook Trout (*Salvelinus fontinalis*) in Cherokee National Forest, Tennessee **- Jeff Wright**
11:40 EST	19	USFWS National Broodstock Program and Erwin National Fish Hatchery Update - **Tyler Hern**
CLOSING REMARKS		

Poster Session

Mussels of the Wolf: A Resurvey of Unionids in an Inundated Cumberland Tributary

Jack Fetters[1], A. E. Rosenberger[2], A. Ford[3]

[1]Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505
[2]U.S. Geological Survey, Tennessee Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN 38505
[3]U.S. Fish and Wildlife Service, Tennessee Ecological Services Field Office, Cookeville, TN 38501

jgfetters42@tntech.edu

The Cumberland River system in Tennessee and Kentucky has one of the most diverse assemblages in the world, including several species that are federally listed as endangered. The Obey River system, a large tributary of the Cumberland River, once contained 35 species. Now most of these historical occurrences are inundated by Dale Hollow Reservoir and have been nearly eliminated due to acid mine drainage in the river headwaters. The Wolf River, the largest tributary of the Obey River, remains a critically important stronghold of the remaining Cumberland River mussel fauna. In 2005-2006, the Wolf River was surveyed using visual and tactile methods. They located twelve mussel species, and 24 of 45 sites sampled contained mussels with multiple age classes, indicating recruitment. For this study, we resurveyed all 45 previously investigated sites. Using similar, but more intensive methods, we were able to locate eight of the twelve species found in 2005-2006, with live mussels at 33 of the 45 sites. Moreover, we located several species rich sites with the federally endangered Fluted Kidneyshell, *Ptychobranchus subtentus* as the most abundant species. Future direction for this project will entail returning to areas with high abundances and species richness to determine densities and size-structure with more intensive survey methods. These preliminary findings emphasize the importance of the Wolf River Mussel fauna due to its unique mussel assemblages and high potential for restoration.

Session 1: Student Symposium

1. An Interdisciplinary Approach to Assessing Freshwater Mussel Health and Mortality in the Clinch River

Da Silva Neto, J.[1], M. Dennis[1], J. Wolbert[2], G. Dinkins[3], R. Hardman[4], A. Engman[5]

[1]Biomedical and Diagnostic Sciences, College of Veterinary Medicine, The University of Tennessee, Knoxville, TN
[2]Tennessee Valley Authority, Knoxville, TN
[3]McClung Museum of Natural History and Culture, The University of Tennessee, Knoxville, TN
[4]Florida Wildlife Commission, St. Petersburg, FL
[5]Forestry, Wildlife, and Fisheries, Herbert College of Agriculture, The University of Tennessee, Knoxville, TN

jgsilva@vols.utk.edu

Freshwater mussels are among the most imperiled animal taxa globally and regionally, with around 70% of North American species being classified as endangered or threatened. Population declines across the globe have been associated with habitat degradation and fragmentation caused by dams and pollution. Mussel die-offs have also played a role in population declines. Since 2016, mussel die-offs have been noted in the Clinch River, a freshwater biodiversity hotspot flowing across southwest Virginia into east Tennessee. Although researchers have investigated these events, no study has identified a clear causative factor or mechanism. Our study aims to determine likely causes of die-offs in the Clinch River with a two year long in-situ experiment that measures seasonal changes in health and mortality of hatchery-reared *Actinonaias pectorosa* maintained in silos at two die-off sites. Although an August – November wild mussel die-off event was observed at both sites in the first year of the experiment, no silo mussels presented signs of disease and few mortalities occurred. From May – December 2021 silo mussels grew on average 10.8mm. We have assessed a total of 82 mussels (57 silo mussels and 25 wild mussels). Data on survival and growth, clinical signs of disease, hemolymph indices, histopathology, and bacterial microbiome in free-living and experimental mussels will be paired with historical population demographic and die-off data. These data, in combination with environmental data (i.e., river flow, temperature), will be used to build models that explore likely causes of die-off events and make predictions considering climate change scenarios.

2. Contributions of Stocked and Wild Rainbow Trout to Two Tennessee Tailwater Fisheries

Ballard, C. E.[1] and M. W. Rogers[2]

[1]Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505
[2]U.S. Geological Survey, Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505

ceballard42@tntech.edu

Rainbow Trout *Oncorhynchus mykiss* make up 74% of the 2 million trout stocked annually by the Tennessee Wildlife Resources Agency (TWRA). Cold hypolimnetic releases from 13 hydropower dams in Tennessee provide suitable tailwater trout habitat. Natural reproduction of Rainbow Trout is uncommon in Tennessee tailwaters and most tailwater Rainbow Trout fisheries are dependent on hatchery stocking. Norris and Fort Patrick Henry tailwaters are both popular Rainbow Trout fisheries and are supplemented by hatchery trout. In recent years however, wild young-of-the-year Rainbow Trout have been observed in both tailwaters. The objective of this research is to better understand how stocked fingerling (TL<150), stocked catchable-size (TL >200mm) and wild Rainbow Trout all contribute to these fisheries. We will estimate survival, recruitment, abundance, and growth rates of stocked and wild Rainbow Trout cohorts. Since 2019, all hatchery Rainbow Trout stocked into the Fort Patrick Henry tailwater have been marked. Since 2019 all fingerling Rainbow Trout stocked in the Norris tailwater have been marked. By marking hatchery Rainbow Trout, they can be distinguished from wild Rainbow Trout and other cohorts of stocked Rainbow Trout. Marks include a combination of coded wire tag locations and/or fin clips. After stocking, these tailwaters will be sampled periodically using backpack and boat electrofishing gear. Primary and secondary mark-recapture sampling events will follow a mark-recapture sampling design, using PIT tags as unique identifiers. By understanding how these different Rainbow Trout cohorts contribute to the fisheries, TWRA can adapt stocking to maximize return to creel and angler satisfaction

3. Development and Application of an eDNA Assay to Delineate the Distribution of the Imperiled Striated Darter (*Etheostoma striatulum*, Page and Braasch 1977) in the Duck River, Tennessee

Walker, A. L.[1], C. Wheeler[1], and C. R. Hurt[1]

[1]Department of Biology, Tennessee Technological University, Cookeville, TN 38505

44adamwalker@gmail.com

Effective conservation of rare or imperiled species relies on efficient monitoring and accurate information regarding distribution, critical habitat locations, and occupancy. However, most imperiled species are inherently cryptic and difficult to capture due to patchy distributions and low population densities. To avoid these obstacles, environmental DNA (eDNA) detection techniques have been developed to provide a more sensitive and economical solution for species monitoring. Striated Darters (*Etheostoma striatulum*) are small, uncommon darters endemic to the middle-to-upper regions of the Duck River, Tennessee. Since their description in 1977, they have become increasingly rare throughout their range; as of 2011, their distribution had declined to nine of the 16 historically occupied tributaries. Due to this documented decline, Striated Darters are currently in review for federal listing under the Endangered Species Act and are currently listed as state threatened in Tennessee. Because of their reclusive and cryptic behavior, conventional techniques tend to be less effective for detection, requiring more sensitive methods. Our study aimed to develop an eDNA surveillance assay and protocol to detect presence of the Striated Darter at 30 historical sampling sites and to delineate their current distribution. Data were analyzed using a hierarchical occupancy model approach to estimate occurrence and detection probability at the scales of sites, sample replicates, and qPCR reaction replicates.

4. Age and growth of three important commercially harvested fishes in Tennessee: Skipjack Herring, Silver Carp, and Smallmouth Buffalo

Wesley, V.[1] and M. Rogers[2]

[1]Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505
[2]U.S. Geological Survey, Tennessee Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN 38505

vpwesley42@tntech.edu

This presentation will discuss the age and growth of three important commercially harvested fishes in Tennessee: Skipjack Herring, Silver Carp, and Smallmouth Buffalo. The project is current, and aims to inform on what commercial fishing is, why it is important, inform management on population characteristic factors such as age structure, maturation, and growth rate. As well as environmental factors or drivers of age structure and the potential for overfishing and underfishing these species.

5. Habitat associations of Blotchside Logperch (*Percina burtoni*) in the Little River, Tennessee and the suitability of Abrams Creek for reintroduction

Cary, J.B.[1] and A. E. Rosenberger[2]

[1]Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505
[2]U.S. Geological Survey, Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505

jcary42@tntech.edu

Great Smoky Mountains National Park is seeking to reintroduce Blotchside Logperch *Percina burtoni* into Abrams Creek, a tributary to the Little Tennessee River; where they, along with thirty other fish species, were extirpated in 1957 as part of a failed attempt to establish a trout fishery. Efforts to reestablish other extirpated fishes in Abrams Creek met with varied success, likely because the creek's lower reaches are inundated by Chillhowee Reservoir, limiting the availability of mid- to large-sized river habitat. This study seeks to identify the habitat associations of Blotchside Logperch in the nearby Little River and determine if comparable habitats are present in Abrams Creek and to what extent they are present. Using a tiered environmental-filters approach, we analyzed habitat associations of Blotchside Logperch and the suitability of Abrams Creek using Maxent models (landscape-scale), occupancy models (reach-scale), and random forest models (microhabitat-scale). Fifty-nine Blotchside Logperch (thirty-two adults and twenty-seven juveniles) were observed across thirty-one sites in Little River during the 2020 field season. Initial modeling indicates that Blotchside Logperch select for streams with a wetted width of twenty-five to forty meters and areas with unimbedded substrate small enough to manipulate while foraging. During the 2021 field season, we measured habitat characteristics at 30 random sites throughout Abrams Creek to determine the presence of suitable habitat configurations for the species based on our 2020 results. Results indicate that Abrams Creek, though marginal for the species in landscape-scale features, contain sites and microhabitat suitable for subadult and adult Blotchside logperch.

Session 2: Professional Symposium

6. Assessing Fish Passage for a Federally Endangered Minnow, the Laurel Dace (*Chrosomus saylori*)

Fix, S. M.[1], and A. Kennon[1]

[1]Tennessee Aquarium Conservation Institute, 175 Baylor School Rd, Chattanooga, TN 37405

sfix@tnaqua.org

The Laurel Dace (*Chrosomus saylori*) is a federally endangered minnow that is currently only found in three streams on Walden Ridge, in east-central TN. Only ever known from eight stream systems, their genetic diversity is threatened by habitat fragmentation, pathogens, invasive species, environmental pollution, and global climate change. Recent studies have investigated life history characteristics, habitat requirements and interactions with invasive centrarchids. However, habitat fragmentation has been understudied and continues to be an issue for this species. We investigated the severity of habitat fragmentation within the critical habitat for Laurel Dace utilizing the Southeast Aquatic Regional Partnership (SARP) culvert assessment protocol. Barriers assessed within their critical habitat ranged from “insignificant” to “severe”. Many of the crossings were not accessible due to being on private property and crossings that were deemed intermittent streams were not analyzed as they would not provide habitat for the Laurel Dace if replaced. From this survey, one crossing that was deemed a “moderate” barrier has been targeted for replacement. This crossing is on Moccasin Creek and could reopen gene flow between populations of Laurel Dace in Bumbee, Youngs and Moccasin Creeks. We are currently in the process of seeking funding to replace this barrier as well as a barrier on Duskin Creek which holds the state vulnerable Tennessee Dace and hope to accomplish both replacements by 2024.

7. The High-Definition Stream Survey: A fast, affordable and flexible method to document stream habitat and support management actions

Parham, J.[1]

[1]Trutta Environmental Solutions, LLC., Hendersonville, TN 37075

Jim.Parham@TruttaSolutions.com

The High-Definition Stream Survey (HDSS) system was designed to rapidly collect a broad suite of geo-referenced stream habitat data over many miles in a single day. Fundamental to the effective management of streams and rivers is understanding the distribution and quality of habitat throughout the system. Unfortunately, collecting high-quality data using traditional sampling techniques is expensive, time-consuming and rarely at a scale appropriate to address the multitude of concerns within a river or stream system. The different assessments required for stream restoration, habitat suitability modeling or mitigation assessment are poorly captured by any single, general survey protocol and this requires additional costly surveys as management objectives change. HDSS was created to overcome many of these problems. The broad suite of HDSS instream habitat data can be classified using flexible, user-driven methods that allows the field data to be appropriately applied to different management objectives. The classified data then flow easily into powerful suitability models that support informative maps, graphics and statistics. The results are easily used and understood, making them ideal for strategic planning and as decision support tools. Additionally, archived field data are easily reviewable for additional analysis to support other stream-related activities such as permitting, compliance, watershed planning, impact and habitat assessments and predictive modeling, providing an excellent way to increase collaboration, decrease costs and improve conservation outcomes. We will discuss the results from numerous rivers and streams to show how the HDSS approach can be applied to a wide range of aquatic management issues.

8. Small Fish Big Impact: A Culvert Replacement Project in Campbell County, TN

Petre, S.J.[1], E. Granstaff[2], B. Carter[1], D. Boles[2], and R. Dilbeck[3]

[1]Tennessee Wildlife Resources Agency, 3030 Wildlife Way, Morristown, TN 37814
[2]U.S. Fish and Wildlife Service, 446 Neal Street Cookeville, TN 38501
[3]Campbell County Road Department, 136 Mt. Paran Road Jacksboro, TN 37757

Sally.Petre@tn.gov

Poorly designed road/stream crossing structures such as culverts negatively affect stream habitat, fishes, and the surrounding community. These poorly designed culverts negatively affect the community when flooding occurs because they can back up water onto roads, private residences, or the culvert could wash out entirely, leaving people stranded on either side. These crossings also degrade stream habitat and fragment fish habitat and recently there has been a nationwide push to replace these crossings with aquatic passage structures. Here is a case study of a completed culvert replacement project in Hatfield Creek, Campbell County, TN, a tributary to the upper Cumberland River. This stream contains federally endangered Cumberland Darter *Etheostoma susanae*, federally threatened Blackside Dace *Chrosomus cumberlandensis* and state listed in need of management Cumberland Arrow Darter *E. sagitta* and a severe rated barrier (poorly designed multiple culvert crossing) according to the Southeastern Aquatic Restoration Partnership Barrier Assessment Protocol. This crossing, not only impaired fish passage, but washed away multiple times a year costing thousands of dollars each time. TWRA partnered with USFWS (Partners for Fish and Wildlife and Southeast Aquatic Resources Partnership programs), Campbell County Roads Department and TDOT to replace the culverts with a bottomless arch bridge engineered to pass flood waters easily and has a natural stream bottom for fish and other aquatic organisms to move freely through. Pre and post monitoring of fish and stream bottom elevations were conducted. This was a win-win-win for the fish and habitat, the local residents, and the county.

9. For a Few Brookies More: A example of collaboration to improve stream habitat and restore native Brook Trout in Trail Fork, Cocke, Co, TN

Wright, J.D.[1], B.D. Carter[2], M.S. Carter[3], S.J. Petre[2] and A.R. Williams[3]

[1]Trout Unlimited, 1777 N Kent St #100, Arlington, VA 22209
[2]Tennessee Wildlife Resources Agency, 3030 Wildlife Way, Morristown, TN 37814
[3]Cherokee National Forest, 2800 North Ocoee St, Cleveland, TN 37312

jeff.wright@tu.org

Native Brook Trout (Salvelinus fontinalis) faced significant population declines across the southern Appalachian Mountains throughout the 19th and early 20th centuries due to logging and habitat degradation. The Tennessee Wildlife Resources Agency (TWRA) and Cherokee National Forest (CNF) have restored or enhanced over 40 streams with Brook Trout since the 1980's, however, residual effects from prior landcover alterations could potentially hinder Brook Trout population growth and recolonization. Recently, Trout Unlimited (TU), TWRA, CNF and others took a holistic approach to incorporate habitat restoration into Brook Trout restoration at Trail Fork on Round Mountain in Cocke County, TN. Habitat surveys and analysis (e.g. wood density, temperature, aquatic barrier) were conducted. Results demonstrated that summer stream temperatures never exceed 18.5C, found a low density of habitat-forming wood within the 100-m stretch below the culvert and identified the collapsing, double-culvert crossing as a moderate passage barrier according to SARP protocol. Habitat restoration included barrier replacement, reconstruction of the stream bed using stream simulation design and in-stream wood placement. Concurrent with the habitat restoration components, Rainbow Trout (*Oncorhynchus mykiss*) were removed, and brook trout were translocated into the stream from a nearby source. TU, TWRA, and CNF were successful in engaging community volunteers to participate in surveys and project fundraising, reducing the staff input required for successful completion. Future work includes monitoring the habitat and reintroduction work to compare these to planned outcomes and determine additional needs.

10. Habitat of the Blue Shiner (*Cyprinella caerulea*) in the Mobile Basin: the Good, the Bad, and the Changing

Fix, S. M.[1], and B. R. Kuhajda[1]

[1]Tennessee Aquarium Conservation Institute, 175 Baylor School Road, Chattanooga, TN 37405

brk@tnaqua.org

Twenty-three species of fishes are endemic to the Coosa and/or Cahaba River drainage, with eight of these federally listed and several others under review for listing. The Blue Shiner (*Cyprinella caerulea*) is a federally threatened minnow endemic to the Mobile Basin in Tennessee, Georgia, and Alabama. This species was formally widespread in the Cahaba and Coosa river basins, but currently has fragmented populations in the Coosa basin and is absent in the Cahaba River since 1971. Declines are attributed to habitat fragmentation, degraded water quality from urbanization, pollution, and sedimentation. Watersheds with good habitat and high Blue Shiner abundance are in Tennessee (Conasauga River) and one Alabama watershed (Choccolocco Creek). Other Alabama and most Georgia watersheds have bad or changing habitat and no, low, or changing Blue Shiner abundance (Weogufka and Holly creeks, Cahaba, Little, middle Conasauga, and Coosawattee rivers). In Weogufka Creek, where Blue Shiners are in low abundance, threat assessments include determining potential sediment inputs using GIS, fish passage assessments, and comparison of habitats with healthy populations in Choccolocco Creek. In the Coosawattee River, where Blue Shiners may be extirpated, reintroduction potential will be assessed using seining and eDNA surveys and comparison of habitat availability with healthy populations in the Conasauga River. If data indicates Blue Shiners are extirpated and appropriate habitat is available at historical sites, a reintroduction program could be implemented. All of these data are crucial for USFWS, Georgia DNR and Alabama DCNR to develop effective management for these imperiled species.

Session 3: Contributed Presentations

11. Hydra Impact and Management in Recirculating Aquaculture Systems

Murphy, S.[1]

[1]Conservation Fisheries, Inc. 3424 Division Street, Knoxville, TN 37919

shannonpaulettemurphy@gmail.com

On its own, Hydra, a genus of freshwater cnidarian, are impressive organisms due to their regenerative ability. However, in conservation aquaculture, it has proven to be a challenging pest. Hydra have been observed to have a negative impact on the growth of larval fishes. Hydra will sting larval fishes causing stress and a decrease in growth rate. A large presence of Hydra will impact a larval fish's interest in feeding. Fish prefer to stay under a cover object in an area free of Hydra, if available, rather than expose themselves to contact with Hydra. After continuous observation of Hydra in recirculating systems for propagation of imperiled species, where overall production of fishes has suffered due to the presence of Hydra, several methods had been used in efforts to eliminate or diminish the negative impacts of Hydra on our propagation efforts. Experimental treatments included salt, copper, formalin, fenbendazole, and bleach to suppress or eliminate Hydra in tanks and recirculating systems that either were inhabited by fish or uninhabited by fish at the time of treatment. Salt, copper, and formalin were all found to be effective as a suppressant. Fenbendazole was found to eliminate Hydra in most cases but caused mortalities in several benthic fish species, even when the tanks were uninhabited by fish at the time of the treatment. Bleach, used as a sanitation protocol before starting over the nitrogen cycle in tanks and recirculating systems, has shown to have the most success eliminating Hydra permanently.

12. Lower Food Web Selectivity by Bigheaded Carp in Southeastern Reservoirs

Padgett, A.N.[1] and M.W. Rogers[2]

[1]Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505
[2]U.S. Geological Survey, Tennessee Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN 38505

anpadgett@tntech.edu

Silver Carp *Hypophthalmichthys molitrix* and Bighead Carp *H. nobilis* (bigheaded carp, collectively) have established populations in Kentucky Reservoir of the Tennessee River and Barkley Reservoir of the Cumberland River. Due to similar planktivorous feeding habits, there are rising concerns of dietary overlap between bigheaded carp and native, filter-feeding Gizzard Shad *Dorosoma cepedianum*, a dominant prey item for many sport fishes. I collected plankton from gill rakers of bigheaded carp and Gizzard Shad across three seasons in Kentucky Reservoir and Barkley Reservoir, and water column samples where fish were collected. Plankton composition within gill rakers differed among season and species, and there was a significant season x species interaction. Despite seasonal changes in planktonic availability, bigheaded carp gill rakers contained more filamentous particles than Gizzard Shad in every season. Bigheaded carp gill rakers also contained a larger size range of selected particles, but preferred smaller particles than Gizzard Shad in each season. With sufficient nutrient inputs supporting planktonic growth and little dietary overlap in the spring season, a crucial time period for successful Gizzard Shad spawning, bigheaded carp may not adversely affect Gizzard Shad.

13. Molecular surveillance of fish larvae aimed at investigating the reproductive ecology of *Hypophthalmicthys molitrix* in Tennessee reservoirs

Paine, R. T. R.[1], A. L. Jared[2], and M. W. Rogers[3]

[1]Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, TN 38505
[2]Biology Department, Tennessee Technological University, Cookeville, TN, United States
[3]U.S. Geological Survey, Tennessee Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN 38505

rtpaine@tntech.edu

Silver carp (*Hypophthalmichthys molitrix*) is a well-known invasive fish species in the U.S, which has rapidly expanded into Tennessee rivers and reservoirs causing significant threats to native biodiversity, loss of ecological function and resources, and negative impacts to human economies. While adult and juveniles (year-of-young) are easy to capture and identify, larval stages have yet to be captured or identified in Tennessee rivers or reservoirs. Capture and identification of larval carp could assist resource managers in targeting key spawning times and areas, and ultimately help create more effective removal efforts to reduce population abundance. However, identification of larval fishes is time consuming and requires taxonomic expertise. The application of molecular tools to larval fish samples may provide an accurate and cost-effective method for carp larva surveillance. We have created an experimental block design set up to a quantify the total DNA concentration of increasing biomasses of carp larva. This experimental block designed will theoretically serve to create a standard curve from which realistic biological samples can be compared against to detect and quantify carp larva in the wild. Furthermore, if successful, our molecular protocol has the potential to be paired with current ecological models (e.g., Fluegg) and environmental variables to create new predictive modelling for the occurrence and timing of *H. molitrix* spawning.

14. Recruitment, Survival, and Growth of Rainbow Trout in Two East Tennessee Tailwaters

Flanagan, T. J.[1]

[1]Tennessee Wildlife Resources Agency, 200 Lowell Thomas Dr. Jackson TN 38305

tom.j.flanagan@tn.gov

The Norris and Fort Patrick Henry tailwater are two popular trout fisheries. The Norris tailwater is stocked with fingerling Rainbow Trout whereas the Fort Patrick Henry tailwater is stocked with both fingerling and adult Rainbow Trout annually. Although both systems have documented natural reproduction, the contribution of naturally reproduced and hatchery reared Rainbow Trout have not been evaluated in nearly two decades. All hatchery reared Rainbow Trout were individually marked to distinguish between cohorts and track age and growth over time. All captured Rainbow Trout received PIT tags to determine incremental growth. PIT tagged fish had low recapture rates in both tailwater systems, but hatchery marked fish gave insight on recruitment and survival. In the Norris tailwater, stocked fingerlings had low survival and recruitment, and the catchable population was supported by naturally reproduced native Rainbow Trout. In the Fort Patrick Henry tailwater, both naturally reproduced and stocked fingerlings had low survival and recruitment. The adult stocked Rainbow Trout in the Fort Patrick Henry tailwater had high survival and recruitment into the catchable population. Growth rates for hatchery reared adults in the Fort Patrick Henry tailwater were two-fold higher than fingerlings stocked in the Norris tailwater. Fingerling stocking has little influence within the Norris tailwater, suggesting that naturally reproduced Rainbow Trout support the fishery. Stocked adult Rainbow Trout had high survival and recruitment into the Fort Patrick Henry tailwater fishery, suggesting that stocked adult Rainbow Trout support the fishery

Session 4: Contributed Presentations cont.

15. West Tennessee Habitat Enhancement

French, B.[1]

[1]Tennessee Wildlife Resources Agency, 190 Brook Ln. Camden, TN 38222

Brandon.french@tn.gov

Due to reservoir aging and siltation, fish shelter and spawning habitat have been declining for decades in water bodies in Region 1. To improve habitat, artificial structures are being constructed and placed in strategic locations to benefit fish populations and angling success. These structures include deep and shallow water fish attractors constructed from a variety of plastic materials, and spawning habitat to increase suitable spawning locations for bass. In Kentucky, Barkley, and Pickwick reservoirs, there are deep water and shallow water fish attractors. Each one of these are marked with TWRA logos and are mapped on the TWRA On The Go App for anglers. In Reelfoot Lake, there are 50 spawning structures placed in 2021. Spawning structures were placed in Reelfoot Lake to increase spawning habitat. These structures will be monitored with underwater cameras this spring to evaluate success. TWRA is working with Kentucky Department of Fish and Wildlife Resources on a federally funded grant to increase habitat in Barkley Reservoir. This project will be completed before July 2022.

16. Overcoming Challenges to Native Fish Restoration in a National Park

Kulp, M.A.[1] and S.E. Moore[2]

[1]National Park Service, GRSM, 107 Park Headquarters Road, Gatlinburg, TN 37738
[2]Retired National Park Service

Matt_Kulp@nps.gov

Historic land management and stocking of non-native Rainbow Trout in Great Smoky Mountains National Park (GRSM) resulted in native Brook Trout losing approximately 75% of their historic range since the early 1900's. In 1976, GRSM successfully initiated a program to remove Rainbow Trout from six small streams using annual backpack electrofishing. In 2000, public meetings were held around the park outlining the need to use the fish toxicant Fintrol® to restore larger streams. In September 2008, Fintrol® was used to renovate 12.8 km of upper Lynn Camp Prong. Roughly 2,000 native Brook Trout from 9 source stocks were reintroduced in 2009 but monitoring efforts in 2010 revealed the presence of illegally-stocked Rainbow Trout roughly 3.3 km above the barrier. Although retreatment was an option, the quandary was how to prevent future illegal stockings. Several public hearings were successfully held around the park to educate local residents about the purpose of the Lynn Camp Prong project. Approximately 4.6 km of the project area was successfully retreated in 2011 to remove the re-introduced Rainbow Trout. Monitoring efforts during 2012–2015 showed that the Brook Trout population increased steadily, with abundance ultimately exceeding that of Rainbow Trout prior to restoration. Lessons learned are: 1) Public education, buy-in, and involvement are crucial to success; 2) Partnerships with state and federal agencies, local conservation groups and the local community are essential; 3) Fisheries professionals must be steadfastly committed to success and adaptable to changing conditions and 4) Restoration of native species can be controversial.

17. Evaluating Temporal Change in Freshwater Streamfish Communities

Caudle, J.[1] and C. Wheeler[1]

[1]Tennessee Tech University, Biology Department, 1100 N. Dixie Ave., Cookeville, TN 38505

jjcaudle@tntech.edu

Resource managers benefit from temporally repeated surveys that permit evaluation of community changes. In lotic ecosystems, samples of individual assemblages (e.g., fishes) can provide an indication of overall stream health through application of the Index of Biotic Integrity (IBI). Here, we describe a study involving comparison of stream fish communities from 12 sites located on Arnold Air Force Base (AAFB) in Tullahoma, TN. Initial surveys were completed in 1999 and sites were surveyed again in 2019 to assess potential changes in community structure and thus stream health.
We found little evidence of community changes between the survey periods, with the biological condition of the sites rating as very poor to good during both surveys. Based on ordinations, we observed little visual separation between 1999 and 2019 communities. Furthermore, analysis of similarity indicated that almost all of our community-level comparisons between surveys were insignificant. In the case where significant differences did exist, our indicator species analysis suggested that Creek Chub (*Semotilus atromaculatus*), Blackfin Darter (*Etheostoma nigripinne*), Western Mosquitofish (*Gambusia affinis*), and Fantail Darter (*E. flabellare*) were more common in 2019 than in 1999 stream sites. Collectively, these results suggest relatively stable fish communities in AAFB streams and highlight the utility of IBI approaches to assess potential changes in stream integrity.

18. A Collaborative Approach to Prioritizing Stream Habitat Improvement Projects for Brook Trout (*Salvelinus fontinalis*) in Cherokee National Forest, Tennessee

Wright, J.D.[1], and M.A. Grove[2]

[1]Trout Unlimited, 1777 N Kent St #100, Arlington, VA 22209
[2]Cherokee National Forest, 2800 North Ocoee St, Cleveland, TN 37312

jeff.wright@tu.org

The distribution of native Brook Trout (*Salvelinus fontinalis*) in Tennessee is limited to a fraction of its historic range. The Tennessee Wildlife Resources Agency, Cherokee National Forest (CNF) and partners, such as Trout Unlimited (TU), have been active in conserving existing populations and reintroducing populations into streams where they once historically occurred. For a variety of reasons, key habitat metrics in streams targeted for work are often not well known. To address these types of data gaps, increase efficiency and generate priorities, TU and CNF staff worked together to adapt the coarse woody material portion of CNF's "Stream Habitat Monitoring Protocol" for use on ESRI's Survey123. Beginning in December 2020, TU piloted a Community Science program in the North Zone of CNF. To date, 11 volunteers have been trained in the protocol. These volunteers surveyed 7-km of stream to document coarse woody material and generated $2,842.40 of in-kind labor. CNF staff followed up in two streams, identified as being deficient in coarse woody material (Trail Fork and Little Jacobs Creek) and completed additional habitat monitoring, including stream channel inventory and substrate composition. Data from Trail Fork was used to guide wood addition below a recently replaced crossing structure, while data from Little Jacobs Creek is being used to create a plan for an upcoming coarse wood habitat enhancement project. TU intends to host additional trainings in 2022 so that a larger prioritization effort can take place.

19. USFWS National Broodstock Program and Erwin National Fish Hatchery Update

Hern, T.R.[1]

[1]United States Fish and Wildlife Service – Erwin National Fish Hatchery, 520 Federal Hatchery Road, Erwin, TN, 37650

tyler_hern@fws.gov

The U.S. Fish and Wildlife Service (USFWS) National Broodstock Program (NBP) works to provide USFWS hatcheries and their partners with disease-free salmonid eggs by developing and maintaining a variety of disease-free broodstocks. The NBP provides valuable support for salmonid population management by producing fish to restore imperiled populations and for mitigation and recreational purposes throughout the United States. The NBP includes three primary facilities specializing in rainbow trout and 11 facilities that maintain other species of trout. Several of these facilities also maintain propagation programs for other endangered animals in addition to their broodstock responsibilities. Altogether, the NBP produces 24 strains of nine salmonid species for recovery and recreational uses. The three primary broodstock USFWS National Fish Hatcheries (Ennis NFH in Montana, Erwin NFH in Tennessee, and White Sulphur Springs NFH in West Virginia) provide more than 40 million certified disease-free Rainbow Trout eggs annually to USFWS facilities and partners. Erwin National Fish Hatchery serves as one of the largest inland salmonid egg producers in the United States. They maintain four captive broodstock populations (rainbow and brook trout) and participate in a variety of other programs aimed at recovery and restoration of imperiled species. This is a review of the operations of the National Broodstock Program and Erwin National Fish Hatchery.