2024 SOUTHERN DIVISION OF THE AMERICAN FISHERIES SOCIETY

SDAFS ANNUAL MEETING 2024

CHATTANOOGA, TN

AMERICAN FISHERIES SOCIETY
TENNESSEE CHAPTER

WELCOME SDAFS MEMBERS

SDAFS President’s Welcome

Welcome to Chattanooga for the 2024 Southern Division of the American Fisheries Society (SDAFS) meeting and where it all started back in 1993. Prior to then, SDAFS would meet at the Southeastern Association of Fish and Wildlife Agencies (SEAFWA) annual meeting. SDAFS leaders announced a need for SDAFS Technical Committees and science presentations to have a stand-alone meeting. The Excom’s decisions have evolved into a continuously successful, fisheries-focused conference that is highly attended by agencies, academia, non-profits, students, and others from the Southern Division. Continuing education workshops, technical committee discussions, pertinent science presentations and professional community engagement is why we are here. Everyone should feel welcome, learn, and social network.

If you want to learn more about SDAFS history, check out the “50 Year History of the Southern Division American Fisheries Society” document on the meeting app. I hope you have a look because just as we build on previous work to advance our science and management, our professional society grows from knowing our own history. If this is your first SDAFS meeting, welcome to the family. The more you reach out and engage others, the more rewarding your conference experience will be. Ask about their interests and tell them about yours. Making new professional contacts will benefit your career in ways the you can’t imagine right now. You might meet your next advisor or boss, possibly someone else working on a similar topic and become coauthors or generate new science ideas. SDAFS and AFS are like an external family of professional colleagues and friends that, I believe, all want the best for resource management and conservation through advancing science, education, and collaboration. We might not always completely agree, but that’s part of being a family. Technical Committee meeting dates do not always work out for student travel, but the doors are open to you and fresh faces and ideas are welcome! Don’t be shy. Please fully engage and make the most of your experience while following the AFS Meetings Code of Conduct.

Great thanks to our hosts from Tennessee. The very first SDAFS meeting in Chattanooga was a joint venture between the Tennessee and Georgia Chapters. As an SDAFS Excom member and serving on several meeting-planning committees, I have observed how Chapters share lessons and learn future suggestions for conferences. Doesn’t that sound like how we do science? Thanks to the Virginia Chapter for helping Tennessee this year, and Tennessee will help North Carolina next year. We are a family. We welcome all and desire all to attend the SDAFS Business meeting for important discussions and voting.

Best Regards.
Mark Rogers
President, Southern Division of the American Fisheries Society.

Tennessee Chapter of the AFS President’s Welcome

Hey y'all, and welcome to the 2024 Southern Division meeting of the American Fisheries Society! On behalf of the Tennessee Chapter, we are so excited to be hosting you in the great city of Chattanooga, located right within the biodiversity hotspot of freshwater fishes! We hope you are able to explore the many natural and urban attractions Chattanooga has to offer while you are here. The planning committee has put great effort into making this meeting a success, with an excellent program of talks, workshops, and social events to facilitate networking and education. Enjoy!

Sincerely,
Meredith Harris
President, Tennessee Chapter of the American Fisheries Society

2024 SDAFS ANNUAL MEETING WEBPAGE

DOWNLOAD WHOVA MEETING APP

Local Restaurants
Things to Do
Map of Chattanooga

2024 SDAFS ANNUAL MEETING PLANNING COMMITTEE

Meeting:	Shawna Fix, Cole Harty, Shannon Murphy
Local Arrangements:	Shannon Murphy, Meredith Harris, Sally Petre
Program:	John Hammonds, Cole Harty, Aaron Burch
Program Design:	Aaron Burch
Workshops:	Pat Black
Posters:	Justin Wolbert
Student Affairs:	Keith Gibbs, Amanda Rosenberger
Finance & Registration:	Shawna Fix, Phillip Parsley, Abbey Holsopple
Fundraising:	Ted Alfermann, Alan Beach
Signage:	Teresa Israel
Whova Meeting App:	Aaron Burch
Symposia:	Alex Bybel
AV/Technology:	Julianna Jett
Website/Publicity:	Shannon Murphy
Auction:	Kaylee Clayton, Abbey Holsopple
Tradeshow/Transportation:	Travis Scott

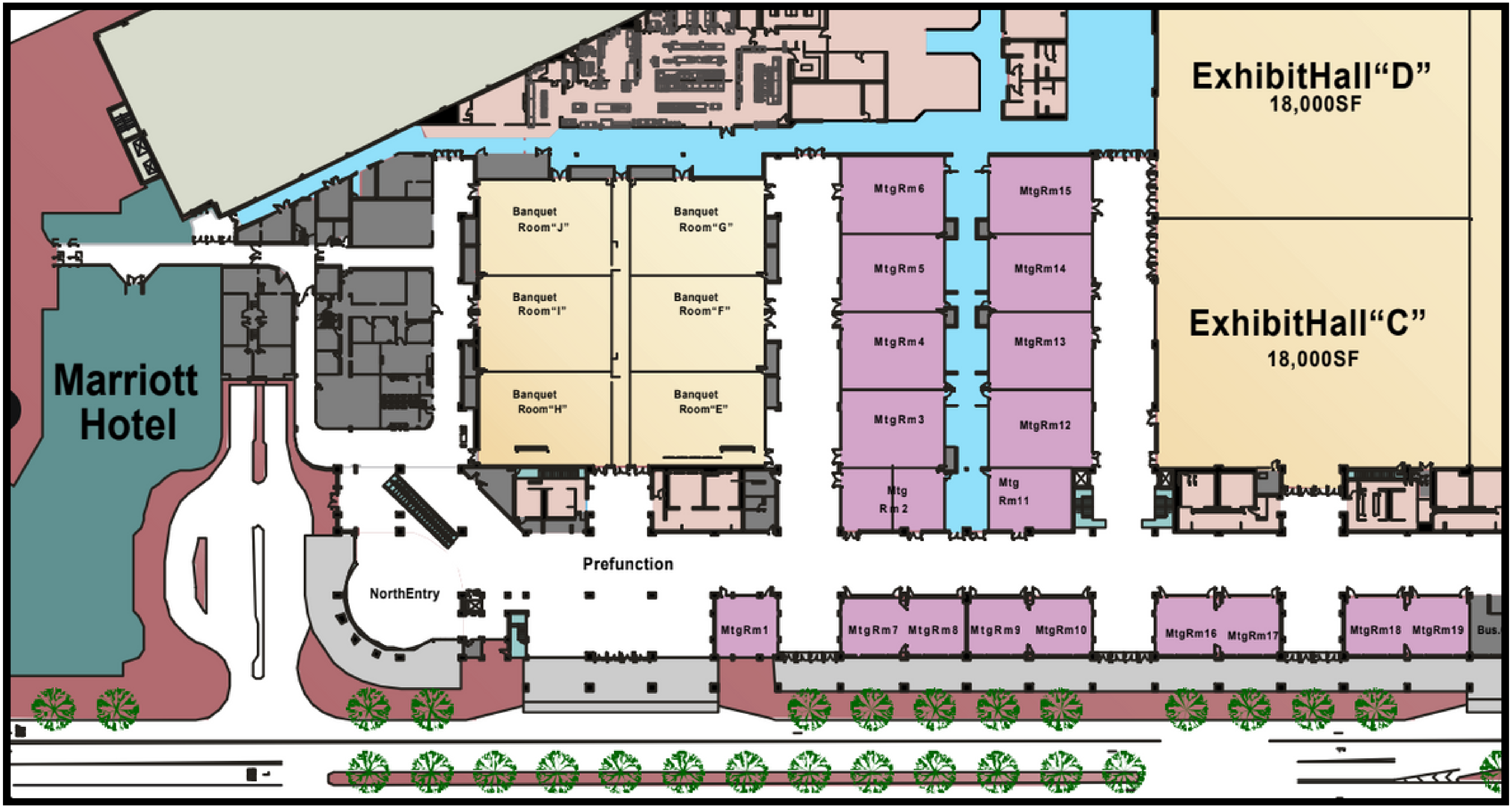
2023–24 SDAFS OFFICERS

President:	Mark Rogers
President-Elect	Anthony Overton
Vice President	Jessica Baumann
Past President:	Jason Olive
Secretary/Treasurer:	Brandon Peoples

2023–24 TENNESSEE CHAPTER AFS OFFICERS

President:	Meredith Harris
President-Elect:	Sally Petre
Past President:	Justin Wolbert
Secretary/Treasurer:	Shawna Fix

CONVENTION CENTER LAYOUT



Registration located in the Foyer Thursday 8:00AM-6:00PM
Friday 7:30AM-6:00PM Saturday 8:00AM-5:00PM

SCHEDULE AT A GLANCE

Thursday, February 1st		Location
9:00 AM - NOON	Technical Committee Meetings	Mtg. Rooms 3-10
NOON - 1:00 PM	Lunch	On Your Own
1:00 PM - 4:00 PM	Technical Committee Meetings	3, 5, & 6
4:00 PM - 6:00 PM	SDAFS EXCOM Meeting	Mtg. Room 3
6:30 PM - 10:00 PM	Welcome Social	Naked River Brewing

- The Welcome Social is sponsored by Tennessee Valley Authority & Transportation is available

Friday, February 2nd		
8:00 AM - 6:00 PM	Trade Show & Auction	Ballrooms E-J
8:00 AM - NOON	Morning Workshops	4, 11, 16, & 17
10:00 AM - 10:30 AM	Break	Ballrooms E-J
NOON - 1:00 PM	Lunch	On Your Own
NOON - 6:30 PM	Trade Show	Ballrooms E-J
1:00 PM - 5:00 PM	Afternoon Workshops	4, 8, & 11
1:00 PM - 6:00 PM	Poster Set-up	Ballrooms E-J
3:00 PM - 3:30 PM	Break	Ballrooms E-J
5:15 PM - 6:45 PM	SDAFS Business Meeting	13-15
7:00 PM - 11:00 PM	Poster Social	Ballrooms E-J

- The Poster Social is sponsored by Tennessee Wildlife Resources Agency

Saturday, February 3rd		
8:30 AM - 5:30 PM	Trade Show & Auction	Ballrooms E-J
8:20 AM - 9:30 AM	Plenary Session	Mtg. Rooms 13-15
9:30 AM - 9:50 AM	Break	Ballrooms E-J
9:50 AM - 11:30 AM	Technical Sessions	3-6, 8-12, & 16-18
11:30 AM - 1:00 PM	Student/Mentor Lunch	On Your Own
11:30 AM - 1:00 PM	Lunch	On Your Own
NOON - 1:30 PM	TNAFS Retirees Luncheon	Mtg. Room 7
1:00 PM - 5:00 PM	Technical Sessions	3-6, 8-12, 16-18
3:00 PM - 3:20 PM	Break	Ballrooms E-J
5:30 PM	Silent Auction Closes	Ballrooms E-J
6:00 PM - 10:00 PM	Grand Social	TN Aquarium
7:00PM	Student Awards	TN Aquarium

- Transportation for the Grand Social will be provided

Sunday, February 4th		
8:00AM - NOON	Auction Item Pick-up	Ballrooms E-J
8:30AM - NOON	Technical Sessions	3-6, 8-12, & 16-18
10:20 AM - 10:40 AM	Break	Ballrooms E-J

*For details, see schedules for Workshops, Symposia, and Technical Sessions Below.

WORKSHOPS

FRIDAY, FEBRUARY 2ND

All-day Workshops (8:00 AM-NOON; 1:00 PM-5:00 PM)
Getting Hired/Into Grad School **Meeting Room 9** Instructors: Amanda Rosenberger and Kevin Dockendorf
Fish Photography **Meeting Room 3** Instructors: Todd Amacker, Jon Michael Mollish, and Derek Wheaton
R Workshop/Intro to Fisheries Data Analysis **Meeting Room 12** Instructors: Adam L. Walker, Emma Jones, and Jason Hill
Teamwork Makes the Dream Work: Aquatic Connectivity Teams in the Southeast **Meeting Room 6** Instructors: Kat Hoenke, Shawna Fix, Tate Wentz, Daniel West, and Tim Burnley
Fish Kill Investigation Methodology **Meeting Room 10** Instructor: Travis Tidwell

Morning Workshops (8:00 AM-NOON)	Afternoon Workshops (1:00 PM-5:00 PM)
Improving Science Communication with the Policymakers, the Public, and Peers **Meeting Room 11** Instructors: Aaron Bunch and Steve Lochmann	**Innovasea Acoustic Telemetry** **Meeting Room 8** Instructor: Courtney MacSween
Microsoft Excel For Fisheries Professionals **Meeting Room 4** Instructor: Jack Van DeVenter	**Atlantic and Gulf Sturgeon Aging** **Meeting Room 16 & 17** Instructors: Fred Scharf, Bill Post, Adam Fox, Marty Hamel, and Adam Kaeser
Atlantic and Gulf Sturgeon Recovery **Meeting Room 16 & 17** Instructors: Bill Post, Adam Kaeser, Adam Fox, Dewayne Fox, Fred Scharf Marty Hamel, Ellen Waldrop and Joe Heublein	**Futurecasting- An AFS-wide Adaptive Planning Framework for a Successful Future** **Meeting Room 11** Instructor: Marlis R Douglas

SYMPOSIA

ATLANTIC AND GULF STURGEON STATUS, CONSERVATION, AND MANAGEMENT

Saturday, February 3rd; 9:50 AM - 5:00 PM
Sunday, February 4th; 8:30 AM- NOON
Location: Meeting Room 3
Organizers/Moderators: Fred Scharf, Bill Post, Adam Fox, Marty Hamel, Adam Kaeser, Dewayne Fox

A LOOK AT TROPHY BASS MANAGEMENT AND RESEARCH THROUGHOUT THE SOUTHEAST

Saturday, February 3rd; 9:50 AM - 4:20 PM
Sunday, February 4th; 8:30 AM - 10:10 PM
Location: Meeting Room 4
Organizers/Moderators:Allen Martin, Drew Dutterer, Jeremy Risley

CRAYFISH CONSERVATION, NATURAL HISTORY, AND SYSTEMATICS OF THE SOUTHEASTERN UNITED STATES

Saturday, February 3rd; 9:50 AM - 5:00 PM
Sunday, February 4th; 8:30 AM - NOON
Location: Meeting Room 18
Organizers/Moderators: Jacob Westhoff, Zachary Loughman, Christopher Bonvillain

CONSEQUENCES OF THE TENNESSEE-TOMBIGBEE WATERWAY AND ADJACENT WATERS ON BIOLOGICAL ASSEMBLAGES

Saturday, February 4th; 1pm-3pm
Location: Meeting Room 17
Organizers/Moderators: Wesley Daniel, Caleb Aldridge, Jim Williams, Patrick Kroboth

CONSERVATION, SUCCESSES, AND CURRENT STATUS OF RARE AND NON-GAME FISHES

Saturday, February 3rd; 9:50 AM - 5:00 PM
Sunday, February 4th; 8:50 AM - NOON
Location: Meeting Room 5
Organizers/Moderators: Bo Baxter, Kit Wheeler

BEYOND THE BORDERS: CHALLENGES IN RESERVOIR MANAGEMENT IN THE NORTH-CENTRAL AND SOUTHERN DIVISIONS

Saturday, February 3rd; 9:50 AM - 5:00 PM
Sunday, February 4th; 8:30 AM - NOON
Location: Meeting Room 6
Organizers/Moderators: Steve Sammons, Rebecca Krogman, Melissa Wuellner

MORONE BIOLOGY AND MANAGEMENT

Saturday; February 3rd; 9:50 AM - 2:40 PM
Location: Meeting Room 9
Organizers: Sean Lusk

INVASIVE CARP IN SOUTHEASTERN WATERS

Saturday, February 3rd;
Sunday, February 4th;
Location: Meeting Room 16
Organizers/Moderators: Caleb Aldridge, Joshua Tompkins, Matthew Dollenbacher, Robby Maxwell

SMALL LAKE MANAGEMENT

Sunday, February 4th; 8:30 AM -10:10 AM
Location: Meeting Room 11
Organizers/Moderators: Jason Henegar, Troy Goldsby

THE SCIENCE BEHIND THE DECISIONS: AQUATIC ORGANISM PASSAGE RESEARCH

Saturday, February 3rd; 1:00 PM- 5:00 PM
Location: Meeting Room 8
Organizers/Moderators: Shawna Fix, Kat Hoenke, Tate Wentz, Daniel West, Tim Burnley

MENU

CONFERENCE CENTER DAILY BEVERAGES

Friday & Saturday from 9:30 AM – 4 PM & Sunday from 9:30 AM – 11:30 AM include:
Iced Water Station
Iced Tea Station with simple syrup & assorted sweeteners
Freshly Brewed Regular & Decaf Coffee Station with cream & assorted sweeteners

FRIDAY

MORNING SESSION BREAK:

Chattanooga Signature Trail Mix
Assorted Granola Bars with Vegan/Gluten Free Fig Bars available upon request
Assorted Muffins with Gluten Free Muffins available upon request

AFTERNOON SESSION BREAK:

Jumbo Pretzel Bites with Beer Cheese
Cinnamon Sugar Pretzel Bites with Brown Sugar Cream Cheese
*Dietary Restriction snacks available upon request

SATURDAY

MORNING SESSION BREAK:

Assorted Yogurt Covered Pretzels
Assorted Granola Bars with Vegan/Gluten Free Fig Bars available upon request
Assorted Pastries with Gluten Free Muffins available upon request

AFTERNOON SESSION BREAK:

Assorted Chips & Pretzels in Individual Bags
An assortment of Chocolate Chip, Snickerdoodle, & Oatmeal Raisin cookies with Dietary Restricted Cookies available upon request
An Assortment of Triple Chocolate Brownies, Rockslide Brownies, Toffee Crunch Blondies

SUNDAY

MORNING SESSION BREAK:

Assorted Muffins with Gluten Free Muffins available upon request
Assorted Pastries

WELCOME SOCIAL @ NAKED RIVER BREWING

TACO BAR

- Pork
- Chicken
- Jackfruit
- Taco shells
- Pickled onions
- Salsa
- Shredded cheese
- Slaw
- House fried torts
- Sour cream
- Mac & Cheese
- Garden Salad

POSTER SOCIAL: SOUTH OF THE BORDER

FAJITA BAR

- Southwest Salad with corn & black bean salsa
- Tortilla strips
- Cucumber
- Tomato
- Cheddar
- Chipotle Ranch
- Cilantro Lime Vinaigrette ***
- Salsa & Queso with warm corn chips
- Spanish Rice & Beans
- Ancho Marinated Chicken Fajitas
- Pork Carnitas
- Churros with melted chocolate

Fajita Toppings including flour tortillas, pico de gallo, jalapenos, shredded cheese, sour cream, & salsa roja

***cheese and vinaigrette will be on the side for guests who may be vegan or avoiding dairy.

Each guest will receive 2 drink tickets. Additional beverages will be available for purchase from the bar.

GRAND SOCIAL @ THE TENNESSEE AQUARIUM

Station #1 - Delta Country

- Mississippi Tamale Bites - Red Chili
- Fried Green Tomatoes - Comeback Sauce
- Catfish BLT Tacos
- Mississippi Mud Pie

Station #2 - Rivers of the World (Amazon)

- Arepas Con Queso
- Beef Empanadas
- Feijoada with Rice
- Brigadiero (brazilian truffles)

Station #3 - Rivers of the World (Nickajack)

- Iron Skillet Fried Chicken Lollipops
- Three Cheese Mac & Cheese
- Corn and Black Eyed Pea Salad
- Bourbon Pecan Bars

Station #4 Lobby - (Ridges to Rivers - Appalachia)

- West Virginia Pepperoni Rolls
- Cornbread Salad
- Buttermilk Biscuit - Fried Pork Chop, Blackberry Preserves
- Blueberry Custard Tarts

Station #5 - Ocean Journey (Penguins)

- Fried Rice
- Chicken Satay - Peanut Sauce
- Vegetable Egg Roll
- Asian Donuts

Each guest will receive 2 drink tickets. Additional beverages will be available for purchase from the bar.

Saturday Sessions

SDAFS ANNUAL MEETING 2024

CHATTANOOGA, TN

AMERICAN FISHERIES SOCIETY

TENNESSEE CHAPTER

Saturday	Room 3	Room 4	Room 5	Room 6	Room 8	Room 9
Start Time	**SYMPOSIUM: Atlantic and Gulf Sturgeon Status, Conservation, and Management** *Mod: Fred Scharf*	**SYMPOSIUM: Trophy Bass Management and Research Throughout the Southeast** *Mod: Allen Martin*	**SYMPOSIUM: Conservation, Successes, and Current Status of Rare and Non-Game Fishes** *Mod: Bo Baxter*	**SYMPOSIUM: Beyond Borders - Challenges in Reservoir Management** *Mod: Matt Catalano*	**General Session - Freshwater Mussels** *Mod: Justin Spaulding*	**SYMPOSIUM: Morone Biology and Management** *Mod: Sean Lusk*
9:50 AM	Coming to fruition: advancing our understanding of Acipenser oxyrinchus through decades of data, new tools, and coastwide collaborations *David Kazyak and Brian Kreiser*	Micropterus Rising: A Short History of the Bass Boom *Ken Duke*	Quantitative Analysis of Pearl Darter, Percina aurora, habitat in the Pascagoula River Watershed *Malia Davidson*	An industry perspective on the challenges -- and opportunities -- from the growth of tournament bass fishing *Gene Gilliland*	Emerging patterns from the Mussel Host Database: strengths, weaknesses, opportunities and threats for freshwater fish and mussel conservation *Garrett Hopper*	Evaluating daytime and nighttime hydroacoustics for assessing shad abundance in reservoirs *Dan Shoup*
10:10 AM		Creating Trophy Fisheries *David Beasley*	Clarification of Candy Darter (Etheostoma osburni) distribution and exploration of the comparability of electrofishing, snorkeling, and eDNA methods on the Monongahela National Forest *Chad Landress*	Estimating mortality components in a high effort Black Bass fishery using reward tags and radio telemetry *Max Rubino*	Efficacy and Effects of Internally Placed PIT Tags in Freshwater Mussels *Kendall Moles*	Hybrid Striped Bass *Morone saxatilis* x *M. chrysops* and Largemouth Bass Interactions in DeGray Lake, Arkansas *Steve Lochmann*
10:30 AM	Maximizing learning opportunities through data workflow modernization: a case history of Gulf Sturgeon monitoring *Stephen Parker*	If You Renovate It, They Will Come - The Story of Louisiana's Trophy Bass Fishery *Ryan Daniel*	Assessment of the status and distribution of Swainia darters in Arkansas, with emphasis on Percina nasuta *Jeff Quinn*	Catch-and-release angling effects on two black bass populations at an Alabama Reservoir *TJ Pullen*	Where Sleeping Clams Lie: Multivariate Analyses Examining Freshwater Mussel (Bivalvia: Unionidae) Bed Habitat Use *Susan Geda*	Using Radio Telemetry to Identify Seasonal Habitat for Striped Bass in Lake Talquin and the Lower Ochlockonee River *Stephen Stang*
10:50 AM	Use of trace elements in pectoral fin spines of juvenile Gulf Sturgeon (Acipenser oxyrhynchus desotoi) to identify early age habitat use and movement patterns in the Pearl and Pascagoula River systems *Matthew Olson*	Evaluating a Trophy Florida Bass Regulation on Lake Phelps, a Naturally-Formed Coastal North Carolina Lake *Christopher Smith*	Evaluation of Redfin Darter as a Species of Conservation Need in Oklahoma *Drew Wallace*	Simulating Tradeoffs Between Fishing Quality and Economic Performance of a Reservoir Black Bass Fishery with High Tournament Effort *Natalie Coash*	One Fish, Two Fish, or Maybe Nine? Confirmation of Host Fishes for the Federally Endangered Choctaw Bean, Obovaria choctawensis (Bivalvia: Unionidae) *Lauren Patterson*	Seasonal movement and habitat use of Striped Bass in the Edisto River *Joshua Cary*
11:10 AM	Coastal migratory behavior of juvenile Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) natal to the South Atlantic Distinct Population Segment *Joseph Nolan*	Bass management at Kentucky and Barkley Lakes: Attempts to understand and reduce the inconsistency in trophy bass production at two major reservoirs *Adam Martin*	A Case Study in Reintroducing the Critically Imperiled Magnificent Ramshorn Snail *Emilia Omerberg*	Movement and tournament dispersal of Largemouth Micropterus salmoides and Alabama Micropterus henshalli Bass in Neely Henry Reservoir, Alabama *Marcus Prull*	Habitat assessment on peripheral populations of two imperiled aquatic species within the Colorado River (TX) basin *Elibardo Leal*	Untangling Angler Opinions: North Carolina Reservoir Striped Bass Fisheries *Casey Joubert*
11:30 AM	**Student Mentor Lunch 11:30 - 1:00**					

Saturday Start Time	Room 10 **General Session - Streams I** *Mod: Alex Bybel*	Room 11 **Best Student Presentation Competition - PhD** *Mod: Pat Black*	Room 12 **Best Student Presentation Competition - Graduate** *Mod: Darrell Bernd*	Room 16 **SYMPOSIUM: Invasive Carp in Southeastern Waters** *Mod: Robby Maxwell*	Room 17 **General Session** *Mod: Tom Flanagan*	Room 18 **SYMPOSIUM: Crayfish Conservation, Natural History, and Systematics** *Mod: Jacob Westhoff*
9:50 AM	Deposited sediment influences occurrence of functional traits of stream fishes *Paul Angermeier*	Density and Body Size influence Emigration Patterns of Stream Fish *Ashley LaRoque*	Variation in Fine-Scale Water Table Depth Drives Abundance of a Unique Semi-Terrestrial Species *Molly Carlson*	Shifts in native species trophic structure associated with Silver Carp invasion in a complex river system *Justin Kowalski*	Fishing For Science: Using hook and line sampling methods to target Trophy Bass and Stripers in the Florida Panhandle *Bradford Warland*	An Integrative Approach to Species Delimitation of Hobbseus Crayfishes (Decapoda: Cambaridae) *Patrick F. Allison Jr.*
10:10 AM		Automated Mapping of Gulf Sturgeon Spawning Substrates in the Pearl and Pascagoula River Basins *Cameron S. Bodine*	Bigheaded carp distribution patterns in oxbow lakes of the Lower Mississippi Alluvial Valley *Michaela Palmieri*	Metabarcoding Diet Analysis of Grass Carp (Ctenopharyngodon idella) in the Great Lakes *Clay Raines*	Microplastics as a vector for endocrine-disrupting chemicals and its effects on the reproductive social behavior of fathead minnows *Grace Carter*	The Reticulate Crayfish complex: an example of shifting perspective on crayfish morphology and taxonomy *Brooke Grubb*
10:30 AM	Hierarchical relationship between regional and local environmental on stream fish life history *Joseph Mruzek*	Environmental factors driving fine-scale, non-migratory movement of Gulf Sturgeon (Acipenser desotoi) size classes within the Pascagoula River holding reach *Elizabeth Greenheck*	Combining biotracer and stomach contents analysis to improve understanding of trophic dynamics in the northern Gulf of Mexico *Calvin Chee*	Lightning Talks: Invasive Carp in Alabama: Current distribution, monitoring, and management actions in state waters - *Dave Armstrong* Status of Invasive Carp in TN - *Cole Harty*		Bridging the gap with RAD-seq: population structure across the range of the narrowly endemic Big Sandy Crayfish (Cambarus callainus) *Nicole Garrison*
10:50 AM	Stream fish assemblage and functional trait responses to dam removal *Luke Bower*	The Carpiodes Conundrum: Molecular and Morphological Patterns of a Putative Undescribed Catostomid, the Llano River Carpsucker *Hayden Roberts*	Long term historical fish assemblage analysis in the Red River, Louisiana shows assemblage change attributable to lock and dam construction; a multi-metric approach elucidates underlying causes *Thomas Dodson*	Lightning Talks: Status of Invasive Carp in Kentucky and Management Actions Update - *Josh Tompkins* Status of Invasive Carp and their Control in Arkansas - *Jimmy Barnett*		DNA-nacing with the Devil: phylogenetics of a primary burrowing species complex in Illinois *Christopher A. Taylor*
11:10 AM	West Tennessee Native Species Initiative: Nature-based is the Solution *Kayla Key*	A range-wide assessment of Gulf Sturgeon population viability using a metapopulation approach *Stephen Parker*	A tale of two dams: evaluating efficacy of modified barrier operations on Silver Carp movements *Josh Stafford*	Lightning Talks: Status of Invasive Carp in Louisiana - *Rob Bourgeois* Notorious Bighead Carp in a Disconnected Oklahoma System - *Elaine Gainer*		Digging Deep: Distribution and Habitat Dynamics of Burrowing Crayfish in Illinois *Dusty Swedberg*
11:30 AM	**Student Mentor Lunch 11:30 - 1:00**					

Saturday	Room 3	Room 4	Room 5	Room 6	Room 8	Room 9
Start Time	**SYMPOSIUM: Atlantic and Gulf Sturgeon Status, Conservation, and Management** *Mod: Dewayne Fox*	**SYMPOSIUM: Trophy Bass Management and Research Throughout the Southeast** *Mod: Jeremy Risley*	**SYMPOSIUM: Conservation, Successes, and Current Status of Rare and Non-Game Fishes** *Mod: Kit Wheeler*	**SYMPOSIUM: Beyond Borders - Challenges in Reservoir Management** *Mod: Sam Delaney*	**SYMPOSIUM: The Science Behind the Decisions: Aquatic Organism Passage Research** *Mod: Daniel West*	**SYMPOSIUM: Morone Biology and Management** *Mod: Sean Lusk*
1:00 PM	O Sturgeon, Where Art Thou? Movement and Habitat use of Juvenile Gulf Sturgeon in a non-natal river *Caden Perry*	Balancing nonnative trophy Smallmouth Bass management with the conservation of endemic Neosho Bass in the Ozark Highlands *Anthony Rodger*	Seasonal Movements of Yellow and Silver American Eels within the Pensacola Bay Complex *Chelsea Myles-McBurney*	Long-Term Trends and Demographics of Spotted Bass in Table Rock Lake *Quinton Phelps*	Using high resolution spatial data to identify potential in-stream barriers at a landscape scale *Jeff Wright*	Utilizing Recreational Catch Data to Evaluate One of Arkansas Premier Striped Bass Fisheries: Where Are We Now? *Andrew Yung*
1:20 PM	Modeling Juvenile Gulf Sturgeon Survival in the Apalachicola River *Russell Wilson*	Florida: Trophy Bass Fishing Capital of the World? *Jason Dotson*	Movement characteristics of endemic Sandhills Chub Semotilus lumbee in headwater streams of the Sandhills ecoregion of North Carolina *Zachary Ramsey*	Largemouth Bass movement, mortality, and habitat use within the Little River and Millwood Lake *Katie Thomsen*	Prioritization of HUC12 Sub-watersheds for Road Stream Crossing Field Surveys *Lesley Twiner*	Exploitation and harvest characteristics of the Striped Bass fishery in Arkansas *Eric Gates*
1:40 PM	Delaware River juvenile Atlantic Sturgeon: An unforeseen result of long term monitoring *Ian Park*	The Florida Trophy Bass Project *Allen Martin*	Where the River Chubs spawn: A study of Nocomis micropogon nesting habitats *Joelle Ciriacy*	Evaluating the Statewide Largemouth Bass Regulation Change in Florida *Daniel Nelson*	Effects of Morphology on Darter Swimming Speeds *Ridge Sliger*	Age and Growth Comparison of White Bass Among Three Southeastern U.S. River-Reservoir Systems *Thomas Miles*
2:00 PM	Population growth of threatened Gulf Sturgeon may be limited by frequency of adult episodic mortality events *Bill Pine*	Intensive trophy Florida Bass management in Suwannee Lake, FL *Steve Beck*	Evaluating the Habitat Suitability Index for Bluenose Shiner Populations in Panhandle Florida Rivers *Kallie Thornhill*	The New Oklahoma Bass Tournament Exemption and Reporting Program *Cliff Sager*	Assessing the Multi-Scale Impact of Culverts on Stream Fish Communities *Langston Haden*	A Case History of Striped Bass Management at Lake Texoma *Matt Mauck*
2:20 PM	A massive collaboration to characterize coastwide Sturgeon migrations, merging genotyping and telemetry *Matt Breece*	Experimental Use of Rainbow Trout as Trophy Bass Forage in Florida *Drew Dutterer*	Habitat use by buffalofishes Ictiobus bubalus, I. cyprinellus, and I. niger in the lower Red River catchment *Daniel Bryant*	Understanding Smallmouth Bass Recruitment in Relation to Nest Fishing along Wisconsin's Door Peninsula *Eric Naas*	Assessing Historical Fish Movement Records in Relation to SARP (Southeast Aquatic Resources Partnership) Barrier Scores in the Ouachita Headwaters Watershed *Kyler Hecke*	Management of a Landlocked Striped Bass Population in the Upper Coosa River Basin in Northwest Georgia *John Damer*
2:40 PM	The riverscape less traveled-revisiting non-natal straying in adult Atlantic sturgeon *Shannon White*	Novel Methods for the Development of Mathematical Models for Record-Class Largemouth Bass *Terry Battisti*	Development of Propagation Protocols for the Tennessee Dace *Curt Brewer*		Restoring the Source - A Decade of Assessing and Removing Stream Barriers Through Collaborative Partnerships *Ben Thesing*	
3:00 PM	**Break 3:00 - 3:20**					

Saturday	Room 10	Room 11	Room 12	Room 16	Room 17	Room 18
Start Time	**General Session - Sportfish** *Mod: Jason Henegar*	**Best Student Presentation Competition- Undergraduate** *Mod: Pat Black*	**Best Student Presentation Competition - Graduate** *Mod: Darrell Bernd*	**SYMPOSIUM: Invasive Carp in Southeastern Waters** *Mod: Matthew Dollenbacher*	**SYMPOSIUM: Consequences of the Tenn-Tom Waterway on Biological Assemblages** *Mod: Patrick Kroboth*	**SYMPOSIUM: Crayfish Conservation, Natural History, and Systematics** *Mod: Chris Bonvillain*
1:00 PM	A Statewide Evaluation of Smallmouth Bass Exploitation in Tennessee Rivers and Streams *Brandon Simcox*	Environmental Correlates of Blue sucker occurrence in regulated rivers *Meghan Booknis*	An Investigation of Personality in the Creek Chub (Semotilus atromaculatus) *Jacob Barrett*	Molecular surveillance of larval silver carp (Hypophthalmichthys molitrix) in Tennessee rivers and reservoirs *Robert T. R. Paine*	Tennessee-Tombigbee Waterway: A Bidirectional Pathway for Aquatic Species Invasions *Jim Williams*	Resource use in transitional habitats by burrowing crayfish diverge from common biogeographic patterns in aquatic taxa *Caitlin Bloomer*
1:20 PM	Spatial and environmental factors contributing to ecosystem and regional variation in Smallmouth Bass growth: A hierarchical approach *Robert Mollenhauer*	Factors related to successful hatching and daily growth rate of Shoal Bass (Micropterus cataractae) and Largemouth Bass (M. salmoides) in the lower Flint River catchment *Garrison Forrester*	Spatial Drivers of Variance in the Diets of Redbreast Sunfish (Lepomis auritus) in the Savannah River basin *Patrick Lewis*	Movement patterns of Bighead Carp Hypophthalmichthys nobilis and Silver Carp Hypophthalmichthys molitrix in the Lower Red River *Aiden Maddux*	Canal Conundrum: a horizon scan of non-native aquatic species associated with the Tennessee-Tombigbee Waterway *Wesley Daniel*	Diet and Trophic Niches of Primary Burrowing Crayfishes Distocambarus youngineri and D. crockeri *Zanethia Barnett*
1:40 PM	Seasonal movement variability in riverine Shoal Bass and Largemouth Bass populations in the lower Flint River, GA *Jamie Rogers*		Distribution and Population Dynamics of Peppered Shiner, Miniellus perpallidus *Jessica Rath*	Come Hell or Highwater: Gage Height Mitigates Silver Carp Movement at Reelfoot Lake Tennessee *Tom Flanagan*	The Tenn-Tom Waterway: the worst location for conserving the best of southeastern U.S. aquatic biodiversity *Bernie Kuhajda*	On the surface or down below: the ecology of a primary burrowing crayfish determined through video surveillance *Zachary Loughman*
2:00 PM	Largemouth Bass Regulation Evaluation in the Escambia River Marsh *Matt Wegener*	Life history of the Harlequin Darter Etheostoma histrio in the lower Neches River basin of Texas *Daisy Blake*	Patterns in mussel and fish communities within an upper reach of karst spring-dominated riverine system during extreme drought *Zachary Hutchens*	Temporal and ecological effects of lock and dam operations and hydrology on residency patterns of invasive silver carp in the Kentucky Dam tailwater *William Budnick*	Genomic Homogenization in the Tenn-Tom Waterway *Michael Sandel*	Burrowing behaviors and invasive control methods of Red Swamp Crayfish *Nick Barnes*
2:20 PM	Muskies on the Edge: The French Broad River, NC *Derek Crane*	Microhabitat Use of Turquoise Darters (Etheostoma inscriptum) in South Carolina Piedmont Streams *Kathryn Lusk*	Growth and Abundance of Reintroduced Lake Sturgeon in the Coosa River, Georgia - Alabama *Matt Phillips*	Assessing silver carp passage at three locks and dams on the Tennessee and Cumberland Rivers *Kyle Mosel*	Detection of Walleye Populations in Mississippi Streams using eDNA *Kevin Jones*	Translocation and Monitoring of the Meadow River Mudbug (Cambarus pauleyi), a Primary Burrowing Species of Crayfish: Efforts, Results, and Implications Following Four Years of Relocation Efforts *David A. Foltz II*
2:40 PM	Estimating Muskellunge growth using long-term mark-recapture in a Tennessee stream *Will Collier*	Investigating the effects of an eye nematode infection on age, growth, and condition of sunfishes in the Yellow River Watershed *Mark Lougee*	Habitat Correlates of Southern Appalachian Brook Trout (Salvelinus fontinalis) Populations in South Carolina *Joseph Barnes*	Modeling Invasive Silver Carp Population Characteristics and Management Alternatives in the Tennessee and Cumberland rivers *Alexanderia Lacey*	Status of Black Carp Mylopharyngodon piceus in the Mississippi River Basin; pathways to Tennessee-Tombigbee Waterway *Patrick Kroboth*	Effects of chronic environmental hypoxia in the Atchafalaya River Basin on Procambarus clarkii epigenetics, fecundity, and oocyte development *John D. Carrier*
3:00 PM	**Break 3:00 - 3:20**					

Saturday	Room 3	Room 4	Room 5	Room 6	Room 8	Room 9
Start Time	**SYMPOSIUM: Atlantic and Gulf Sturgeon Status, Conservation, and Management** *Mod: Adam Fox*	**SYMPOSIUM: Trophy Bass Management and Research Throughout the Southeast** *Mod: Drew Dutterer*	**SYMPOSIUM: Conservation, Successes, and Current Status of Rare and Non-Game Fishes** *Mod: Bo Baxter*	**SYMPOSIUM: Beyond Borders - Challenges in Reservoir Management** *Mod: Natalie Coash*	**SYMPOSIUM: The Science Behind the Decisions: Aquatic Organism Passage Research** *Mod: Tate Wentz*	**General Session - Genetics** *Mod: Phillip Parsley*
3:20 PM	Seasonal migration cues differ for dual spawning Atlantic Sturgeon in the Great Pee Dee River *Brandon Peoples*	An Investigation of Genetic Markers Associated with Gender and Ultimate Size in Florida Bass *Josh Sakmar*	Moving forward with studies of migratory sucker subsidies: insights from salmon *Kit Wheeler*	Aging Reservoirs: Where Do We Go From Here? *Mark Pegg*	Collaborative Approach to Large-Scale Restoration on War Eagle Creek: Breaking Through Barriers & Not Giving a Dam *Becky Roark*	
3:40 PM	Migratory dynamics of adult Atlantic sturgeon in the Cape Fear River *Joseph Mathews*	Assessing Intial Growth Rate of Florida Largemouth Bass Fingerlings at 4 month Increments *Steve Bardin*	Bringing Back the Natives: Reintroduction of Five Large River Associate Species in the Upper French Broad River *Luke Etchison*	Fish Habitat Enhancements in Old Hickory Reservoir, Nashville, TN *Ted Alfermann*	TRBN: A Tennessee River Basin Network where aquatic and human life thrive *Daniel West*	Population Trends Assessment and Genetic Analysis of Saltmarsh Topminnows (Fundulus jenkinsi) in Florida *Calvin Beech*
4:00 PM	Seasonal Variation of Riverine Habitat Use for Adult Atlantic Sturgeon in South Carolina *David Hood*	Advancing Nonlethal Age Estimation Methods and Applications for Florida Bass *Summer Lindelin*	Development of a Regulatory Framework for Management of Native Nongame Fishes Targeted by Bowfishing *Jason D. Schooley*	Factors affecting persistence of fish attracting structures in reservoirs *Preston Bean*	American Shad Fish Passage on the Cape Fear River: Evaluating the Effects of Environmental Flows and a Nature-Like Fishway *Margaret Gaither*	Allopatric Speciation of the Fundulus subgenus Xenisma in the Central Highlands Ecoregion *Kayla M. Fast*
4:20 PM	New Insights Reveal a Temporally Distinct Two-Stock Genetic Structure for Suwannee River Gulf Sturgeon *Melissa Price*		Recovery of endangered Roanoke Logperch (Percina rex): key lessons on teamwork, persistence, and dealing with uncertainty *James Roberts*	Crappie Population Dynamics in 4 Southeastern Oklahoma Reservoirs *David Bogner*	Lower Alabama River Fish Passage - Reconnecting the Gulf of Mexico to the Appalachian Mountains *Jason Throneberry*	Mitochondrial and nuclear genetic markers suggest at least three introductions of Weather Loach (Misgurnus anguillicaudatus) introductions in Georgia *Brian Shamblin*
4:40 PM	Growth estimations of Gulf Sturgeon across their range using length-at-age data *Kasea Price*		Integrative approaches using genetic markers identify sources of population isolation and low genetic diversity and inform conservation actions for several benthic, freshwater fishes *Rebecca Blanton*	A Really Crappie Reunion: Revisiting Length-Limit Model Predictions for Tennessee Reservoir Crappie Populations Two Decades Later *Dan Isermann*	Changing habitat or changing connectivity: How grade control structures affect fish assemblages in North MS streams *Nicky Faucheux*	Optimizing Colonization and Proliferation of Blue Catfish (Ictalurus furcatus) Donor Stem Cells for the Creation of Xenogenic Catfish; Determining the Optimal Donor Stem Cell Quantity *Kate Pottle*
5:00 PM	**Adjourn 5:00**					

Saturday	Room 10	Room 11	Room 12	Room 16	Room 17	Room 18
Start Time	**General Session - Catfish** *Mod: John Hammonds*	**Best Student Presentation Competition - PhD (cont'd)** *Mod: Pat Black*	**Best Student Presentation Competition - Graduate** *Mod: Darrell Bernd*	**SYMPOSIUM: Invasive Carp in Southeastern Waters** *Mod: Josh Tompkins*	**General Session - Marine** *Mod: Ashley Padgett*	**SYMPOSIUM: Crayfish Conservation, Natural History, and Systematics** *Mod: Zachary Loughman*
3:20 PM	Invasive Catfish in North Carolina *T.D. VanMiddlesworth*	Investigating the role of seasonal drought and stream permanence in Faxonius marchandi colonization and extinction dynamics *Leah Bayer*	Juvenile and Subadult Gulf Sturgeon (Acipenser desotoi) Residency in the Pascagoula River Estuary *Sarah Stovall*	Size-based Evaluation of Population Structure of Bigheaded Carp Through Time in the Tennessee and Cumberland River Waterways *Rachael Irby*	Recreational exploitation rates from reward tagging of Red Snapper in the northern Gulf of Mexico *Matthew Catalano*	Effects of an absent riverine flood pulse on Red Swamp Crayfish Procambarus clarkii life history and fecundity characteristics in the upper Barataria Basin *Robert A. Bergeron III*
3:40 PM	Advancing Blue Catfish (Ictalurus furcatus) management in the James River, Virginia using acoustic telemetry *Margaret Whitmore*	Bayou Behavior: Carp Intracoastal, Estuarine, and Spawning Movements in Louisiana *Christian Walker*	Movement patterns of Black Drum and Sheepshead between subsystems in Mississippi Sound *Alyssa Pagel*	Innovation in Recreation-Grade Technology for Assessing and Monitoring Silver Carp *Josey Ridgway*	Estimating Fishing Mortality and Large-scale Movements of Greater Amberjack off the Southeastern US *Samantha Young*	The effects of dams and a nonnative species, Faxonius virilis, on the trophic interactions of stream crayfishes in the Upper Cahaba Drainage, Alabama *Riley Egan*
4:00 PM	Optimizing Sampling Protocols: Evaluating how electrofishing settings affect the capture of Flathead Catfish in the field *Jacob Martin*	Population genetic structure in a rare freshwater mussel, Pleurobema riddellii *Alex Zalmat*	The importance of spatial scale and host distribution in modelling suitable habitat for a recently federally listed mussel species *Seth Drake*	Experience matters: Commercial fishing can reduce relative biomass of invasive silver carp *Joshua Tompkins*	Reforming the NC Fisheries Reform Act of 1997: Past Lessons and Present Status *Apria Valenza*	The Big Blue-Green Crayfish that Could! Conservation Efforts for the Big Sandy Crayfish (Cambarus callainus) *Brittany Bajo-Walker*
4:20 PM	Retention of operculum Carlin dangler tags in Flathead Catfish and Blue Catfish *Douglas Zentner*			You Are Not Alone: Using Resolutions and Organizations as Advocacy Tools *Dennis Riecke*		The Caney Mountain Cave Crayfish (Orconectes stygocaneyi): establishing a habitat parameter baseline with additional biological notes *Emile Ellingsworth*
4:40 PM				Discussion/Housekeeping: Invasive Carp in Southeastern Waters *Caleb Aldridge*		The Evolution of Body Size in Crayfish *Zackary Graham*
5:00 PM	**Adjourn 5:00**					

NOTES

Sunday Sessions

SDAFS ANNUAL MEETING 2024

CHATTANOOGA, TN

AMERICAN FISHERIES SOCIETY
TENNESSEE CHAPTER

Sunday	Room 3	Room 4	Room 5	Room 6	Room 8	Room 9
Start Time	**SYMPOSIUM: Atlantic and Gulf Sturgeon Status, Conservation, and Management** *Mod: Bill Post*	**SYMPOSIUM: Trophy Bass Management and Research Throughout the Southeast** *Mod: Drew Dutterer*	**SYMPOSIUM: Conservation, Successes, and Current Status of Rare and Non-Game Fishes** *Mod: Kit Wheeler*	**SYMPOSIUM: Beyond Borders - Challenges in Reservoir Management** *Mod: Melissa Wuellner*	**General Session** *Mod: Tom Flanagan*	**General Session - Gear** *Mod: John Hammonds*
8:30 AM	Rise of the machines: leveraging side scan sonar and machine learning to enumerate sturgeon in a large river system *Amanda Higgs*	The impact of genetics and water level fluctuations on trophy bass production in O. H. Ivie Reservoir, Texas *Lynn Wright*		Nuisance and Invasive Fish Controls in a Tailwater Reservoir Fishery: The Challenge of Lake Ogallala *Melissa Wuellner*	Anonymous Location Data and its Applications in Fisheries Management *Ryan Gary*	Assessing the effectiveness of APEX backpack electrofisher settings on estimates of fish catch, abundance, and diversity in a suburban watershed *Peter C. Sakaris*
8:50 AM	Side Imaging: a viable alternative to monitoring of trends in Gulf Sturgeon population abundance *Adam Kaeser*	Use of Female-only Stocking to Create a Trophy Largemouth Bass Fishery in a Georgia Small Impoundment *Tim Bonvechio*	Current Status of Oklahoma Long-Term Stream Community Sampling *Samuel Johnston*	Characterizing Dietary Overlap Between Invasive Silver Carp and Native Gizzard Shad in Kentucky and Barkley Reservoirs *Andrew Gable*	Secondary Benefits of an Internal R Package *Powell Wheeler*	Comparing Standardized Crappie Data from Two Fyke Net Throat Designs *Alexis Whiles*
9:10 AM	Estimating adult Atlantic Sturgeon abundance in the Great Pee Dee River using side-scan sonar and N-mixture modelling *Troy Farmer*	The Four Pillars of Trophy Largemouth Bass Management *Troy Goldsby*	Utilizing Fisheries Management Data to Implement On-Farm Conservation Practices in the Upper Chattahoochee Watershed *Nathan Eason*	Using Human Dimension Data to Help Manage Florida's Lake Istokpoga *Sara Menendez*	Dealing with the Press: Being Reactive and Proactive *Dennis Riecke*	Evaluating Post-Capture Delayed Mortality of Alligator Gar in the Red River using Modified Jugline Methods *Chelsea Gilliland*
9:30 AM	An Assessment of Benthic Recovery Following Restoration of Ship Island *Dara H. Wilber*	Panel Discussion: A Look at Trophy Bass Management and Research Throughout the Southeast	How many organizations does it take to save a fish? Research and conservation in the Coosa Basin, Georgia *Ani Escobar*	Impacts of COVID-19 on Angler Pressure at Three Small Impoundments in Northwest Oklahoma *Dalton Norris*		
9:50 AM	Changes in Gulf Sturgeon use of designated critical habitat surrounding Ship Island, MS and adjacent island passes pre/post island restoration *Paul Grammer*		Believe it or not – A Bayesian network for estimating imperilment of data-deficient fishes *Corey Dunn*	Benefits of long-term monitoring on predominant freshwater systems in Florida *Rachel Liebman*		
10:10 AM	**Break 10:10 - 10:40**					

Sunday	Room 10	Room 11	Room 12	Room 16	Room 17	Room 18
Start Time	**General Session** *Mod: Phillip Parsley*	**SYMPOSIUM: Small Lakes Management** *Mod: Jason Henegar*	**General Session - Streams II** *Mod: Alex Bybel*	**SYMPOSIUM: Invasive Carp in Southeastern Waters** *Mod: Caleb Aldridge*		**SYMPOSIUM: Crayfish Conservation, Natural History, and Systematics** *Mod: Chris Bonvillain*
8:30 AM	Natal Origin and Broad-Scale Movement Patterns of Northern Snakehead in the Potomac River *Hae Kim*	Struggles and Successes in Small Impoundments *Troy Goldsby*	Investigating Long Term Fish Community Change in the Headwater Streams of Bayou Pierre *Matt Aiken*	An Overview of Mississippi River Sub-Basin Invasive Carp Partnerships in the Southeast *Caleb Aldridge*		Overview of Arkansas' Crayfish Conservation Program *Maxwell Hartman*
8:50 AM	Impacts of Non-Native Cichlids in the Everglades: A Comparative Study of Ecological Niches *Tala Bleau*	Managing for angler success at Fall Creek Falls Lake, a Bill Dance Signature Lake *Will Collier*	Hydrology and geology as structuring mechanisms of semi-arid fish communities *Lauren Chappell*			Systematic distributional survey of endemic and invasive crayfishes in the upper Saint Francis River drainage, Missouri *Anna Raney*
9:10 AM	AquaDePTH-Aquatic Disease and Pathogen Repository: a New Public Resource *Clay Raines*	Fisheries management in Mississippi state-operated fishing lakes: A review and look to the future *Hayden Funk*	Prioritizing watersheds in the Upper Little Tennessee River to guide restoration initiatives *Keith Gibbs*			Crayfish plague – should it really be a non-issue in North America? Outbreaks in Montana *Susan Adams*
9:30 AM	Use of multiple climate change scenarios to predict future distributions of alligator gar (Atractosteus spatula) in the United States *Jory Bartnicki*	A review of techniques and strategies practiced by small impoundment management consultants in the private sector *Preston Chrisman*	Evaluating Associations Between Riverine Habitat, Biotic Assemblages, and Spread of a Non-native Minnow Species in the Little Tennessee River System *Garrett McCarson*	Discussion: Invasive Carp in Southeastern Waters - Synthesis and Future Directions		Crayfish confusion: Are you a competitor or do you thrive in disturbed habitat? *Shannon Brewer*
9:50 AM	Thermal optima, critical swimming speed, and respiration rate of hatchery raised juvenile paddlefish *Ehlana Stell*	Using anonymous location data to evaluate Arkansas' Family and Community Fishing Program *Joseph E. Kaiser*	Abundance and richness drivers differ for nonnative stream fishes *Lily Thompson*			Response of red swamp crayfish (Procambarus clarkii) to increasing current velocities: attraction or repulsion? *Nicole Tripp*
10:10 AM	**Break 10:10 - 10:40**					

Sunday	Room 3	Room 4	Room 5	Room 6	Room 8	Room 9
Start Time	**SYMPOSIUM: Atlantic and Gulf Sturgeon Status, Conservation, and Management** *Mod: Marty Hamel*		**SYMPOSIUM: Conservation, Successes, and Current Status of Rare and Non-Game Fishes** *Mod: Bo Baxter/Kit Wheeler*	**SYMPOSIUM: Beyond Borders - Challenges in Reservoir Management** *Mod: Melissa Wuellner*		**General Session** *Mod: John Hammonds*
10:40 AM	Analysis of acceleration data from acoustically tagged Gulf Sturgeon (Acipenser desotoi) around Ship Island, Mississippi *Morgan Segrest*		Discussion: What's Next for Rare and Non-Game Fishes?	When it is okay to chase after Shiny objects: demonstrating a user-friendly web application for the standardization of data analysis and reporting using the Shiny package in R *Preston Chrisman*		Using Environmental Variables to Predict Water Temperature on a Longitudinal Scale *Levi Olhousen*
11:00 AM	An overview of Gulf Sturgeon conservation efforts in the new millenia- a manger's perspective *Adam Kaeser*			Gear bias of low-frequency electrofishing for sampling Blue Catfish populations in Oklahoma reservoirs *Austin Griffin*		Avian Predation on Rainbow Trout in a Tennessee Tailwater Fishery *Connor Ballard*
11:20 AM	An overview of Atlantic Sturgeon conservation efforts in the new millenia- a manger's perspective *Andy Herndon and Lynn Lankshear*			Stocked vs Natural – Assessing the Potential use of Otolith Microchemistry to distinguish Stockton Lake Walleye Stocks *Hae Kim*		Fish communities at islands populated by Interior Least Tern (Sternula antillarum athalassos) colonies along the Arkansas River in Arkansas *Nathan Mansor*
11:40 AM	Discussion/Wrap-up: Atlantic and Gulf Sturgeon Status, Conservation, and Management			Beyond the Borders: Challenges in Reservoir Management in the North-Central and Southern Divisions - Summary *Steve Sammons*		
12:00 PM	**Adjourn 12:00**					

Sunday	Room 10	Room 11	Room 12	Room 16	Room 17	Room 18
Start Time	**General Session - Stocking** *Mod: Matt Combs*	**SYMPOSIUM: Small Lakes Management** *Mod: Jason Henegar*	**General Session - Streams II** *Mod: Alex Bybel*			**SYMPOSIUM: Crayfish Conservation, Natural History, and Systematics** *Mod: Jacob Westhoff*
10:40 AM	Evaluation and application of pectoral spine microchemistry to identify stocked channel catfish and infer fish size at stocking *Morgan Winstead*	Performance evaluation of two largemouth bass population control methods for small impoundments *Matthew Catalano*	Elucidating the hierarchical relationships between drivers of nonnative richness in stream fish communities of United States *William Annis*			The smaller, the better? First evaluation of growth and mortality in crayfish internally tagged with p-Chips *Jacob Westhoff*
11:00 AM	Fish stocking destabilizes ecological communities *Akira Terui*	Growth and survival of larval to juvenile White Crappie (Pomoxis annularis) in three different pond densities and growing conditions *Matthew Nichols*	Comparing the Distribution of Macroinvertebrate and Ichthyoplanktonic Communities Above and Below a Sill in the Lower Bouie River, Mississippi *Cecilia Quesada*			Open Discussion: Crayfish Conservation, Natural History, and Systematics of the Southeastern United States
11:20 AM		Assessing the Use of WaterIQ Pulsar Units in the Control of HAB's *Steven Bardin*				
11:40 AM		Advances in Lake Oxygenation and What it Means for Fisheries Management *Troy Goldsby*				
12:00 PM	Adjourn 12:00					

NOTES

Poster Sessions

SDAFS ANNUAL MEETING 2024

CHATTANOOGA, TN

AMERICAN FISHERIES SOCIETY

TENNESSEE CHAPTER

POSTER PRESENTATIONS
*Presenter

1. **Assessing the Utility of Otolith Microchemistry on Invasive Carps in the Red River**
   Yahua Zhu* (Wuxi Fisheries College), Hae H. Kim (Missouri State University), Kristen Sardina (US Fish and Wildlife Service), Samantha Hannahbass (US Fish and Wildlife Service), Brian Fillmore (US Fish and Wildlife Service), Stephen Banaszak, Jian Yang (Chinese Academy of Fisheries Science), and Quinton E. Phelps (Missouri State University)

2. **Sampling Techniques and Habitat Types for Young of Year Black Carp (Mylopharyngodon piceus) in the Coastal Plain Province of Western Kentucky**
   Matthew Dollenbacher* (Kentucky Department of Fish and Wildlife (KDFWR)), Matthew R. Thomas (KDFWR), Joshua Tompkins (KDFWR)

3. **Mitogenomes derived via genome skimming reveal a complicated history for Cambarus longulus**
   Paul R Cabe* (Washington and Lee University), David Foltz (Environmental Solutions and Innovations), Bronwyn W. Williams (North Carolina Museum of Natural Sciences)

4. **Annual estimates of effective number of breeders in systems across the range of the Gulf Sturgeon**
   Kobe White* (University of Southern Mississippi), Jacob Zona (University of Southern Mississippi), Brian Kreiser (University of Southern Mississippi)

5. **Range Extension of Endangered Fountain Darter Etheostoma fonticola**
   Lauren Chappell* (Texas State University), Elibardo Leal (Texas State University), Joshua D. Tivin (Texas State University), Timothy H. Bonner (Texas State University)

6. **Mussel community and water quality within a southcentral river basin of North America with emphasis on two federally proposed species**
   Caitlin N. Schoeck1*, Kyle T. Sullivan2, Jubentino Guajardo3, Brad M. Littrell2, Bill Kirby3, Alan W. Groeger1, and Timothy H. Bonner1, 1 Department of Biology, Texas State University 601 University Drive, San Marcos, Texas 78666-4684, U.S.A, 2BIO-WEST, Inc 1405 United Drive, Suite 111 San Marcos, Texas 78666-2834, 3Sabine River Authority 450 TX-135 Spur, Burkeville, Texas 75932, U.S.A

7. **Evaluation of Cypress Tree Survival Rates at Kentucky Lake and Lake Barkley**
   Nick Simpson* (Kentucky Department of Fish and Wildlife Resources), Adam Martin (Kentucky Department of Fish and Wildlife Resources), Justin Graben (Murray State University), Scott Starr (Kentucky Department of Fish and Wildlife Resources)

8. **Assessing the accuracy of gonadosomatic index (GSI) staging for maturity and age at first maturity in summer flounder, Paralichthys dentatus**
   Julian Quinones* (Virginia Tech), Hailey Conrad (Virginia Tech), Holly Kindsvater (Virginia Tech)

9. **Hauling away the Blues- Evaluating the use of a commercial haul seine fishery as a management tool for tilapia in Upper St Johns River Lakes**
   Arthur Bernhardt* (Florida Fish and Wildlife Conservation Commission) Reid Hyle (Florida Fish and Wildlife Conservation Commission)

10. **Preliminary Life-History Characteristics for Bigeye Scad in Southeast Florida**
    Mariah France (Nova Southeastern University), Nicole Kirchhoff (Live Advantage Bait LLC), David Kerstetter (Nova Southeastern University)

11. **Developing a standardized quantitative framework for evaluating imperilment of southeastern crayfishes**
S.E. Cathey* (North Carolina Cooperative Fish and Wildlife Research Unit; North Carolina State University, Department of Applied Ecology, Raleigh, North Carolina), M.E. Colvin (U.S. Geological Survey, Columbia Environmental Research Center, Columbia, Missouri), and C.G. Dunn (U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit; North Carolina State University, Department of Applied Ecology, Raleigh, North Carolina)

12. **Monitoring river herring abundance in a Virginia tidal river using fishway electronic counts**
L. Alan Weaver (Virginia Department of Wildlife Resources), Matthias Gaffney* (Virginia Department of Wildlife Resources), and Tim Owen (Virginia Department of Wildlife Resources)

13. **Utilizing Fisheries Management Data to Implement On-Farm Conservation Practices in the Upper Chattahoochee Watershed**
*Eason, N.1, Hibbs, G.1, MacAllister, C. 1 *Patrick, S.1, C.1, Pennisi, B.1, Wunderly, M. 1, Bowen B.B.2, Kaiser, C.2, Roop, H.J.2, Severens, D.2, Ewing T.3, Darling, J. 4, Peoples, B. 5, Taylor, A.6, Shelton, J.L.7, Brown, C.8, McCay, J.8, Biagi, J.9, 1 UGA Extension – College of Agricultural & Environmental Sciences, 2 Georgia Department of Natural Resources, Wildlife Resources Division, Freshwater Biodiversity Program, 3 Southeast Aquatic Resources Partnership, 4 Unicoi Outfitters, 5 Clemson University College of Agriculture, Forestry, & Life Sciences, 6 University of North Georgia, Dahlonega, 7 UGA Warnell School of Forestry and Natural Resources, 8 USDA Natural Resources Conservation Service, 9 Gwinnett County Department of Water Resources

14. **Following fishes: engaging stakeholders in fisheries research**
Samantha Hagedorn*, Danielle Morley, Alejandro Acosta (Florida Fish and Wildlife Conservation Commission)

15. **Temporal assessment of fish communities in the headwaters of a South-Central Plains ecoregion watershed**
Tara L. Schnelting* (Arkansas Tech University), Kyler B. Hecke (Arkansas Tech University)

16. **Fostering data sharing and scoping needs assessment through simple digital tools: A case study with an acoustic telemetry lookup tool**
Evan C. Boone* (U.S. Fish and Wildlife Service) and Caleb A. Aldridge (U.S. Fish and Wildlife Service)

17. **A Comparison of Freshwater Mussel Species Detection and Abundance Across Different Survey Methods**
Hunter Torolski*(Oklahoma State University), James M. Long and Robert Lonsinger (U.S. Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit) and Lindsey Bruckerhoff (Ohio State University)

18. **I spy with my IBI: Application of fish bioassessment across an urban-rural gradient in a watershed spanning multiple ecoregions**
Olivia Reves* (University of Illinois-current, University of Texas at San Antonio-former)

19. **Temporal Fish Assemblage Patterns Associated with Fluctuating Flow in a Cumberland River Watershed in Tennessee**
Mark Rine* (Tennessee Tech University), Kit Wheeler (Tennessee Tech University)

20. **Stream Restoration on Cub Creek, tributary to Hatchie Scenic River, in Middleton, TN**
Kimberly Rios Rosado* (West TN River Basin Authority), Kayla Key (West TN River Basin Authority), Amy Alford (West TN River Basin Authority), Kris Gordon (West TN River Basin Authority), and David Blackwood (West TN River Basin Authority)

21. **Assessing aquatic organism passage (AOP) of culverts in degraded streams of West Tennessee**
Caitlin Scott*, Kayla Key, Kimberly Rios Rosado, Amy Alford

22. **Movement of bighead carp in response to a flow field produced by a half-cylinder**
Fred Martin* (US Army Corps of Engineers, Engineer Research and Development Center), Olivia Douell (US Army Corps of Engineers, Engineer Research and Development Center), James Biedenbach (US Army Corps of Engineers, Engineer Research and Development Center), Christa Woodley (US Army Corps of Engineers, Engineer Research and Development Center), David Smith (US Army Corps of Engineers, Engineer Research and Development Center)

23. **A Potential Unifying Model to Assess Fish Thermal Tolerance**
Jacob Daley* (Clemson University), Luke Bower (United States Geological Survey), Troy Farmer (Clemson University)

24. **Validating Shortnose Sturgeon (Acipenser brevirostrum) Age Estimates from Known Age Fish**
Hunter Rider* (University of Georgia), Adam Fox (University of Georgia), Martin Hamel (University of Georgia)

25. **Influences of environmental variation on estuarine nekton assemblages in the Guadalupe River Delta, Texas**
Kyle Sullivan*, Bradley Littrell, Edmund Oborny (BIO-WEST, Inc.)

26. **Predictors of angler catch and effort in Texas black bass fisheries**
David R. Smith (LSU), Mitch Nisbet (TPWD), Randy Myers (TPWD), J. Warren Schlechte (TPWD), Stephen R. Midway (LSU), Michael A. Dance (LSU)

27. **Evaluating the efficacy of regional models in predicting flow regimes in ungaged catchments of West Tennessee**
Amy B. Alford (West TN River Basin Authority), Kayla Key (West TN River Basin Authority), Kimberly Rios Rosado (West TN River Basin Authority), David Blackwood (West TN River Basin Authority)

28. **Distribution and habitat associations of Procambarus pearsei and P. braswelli and range overlap with invasive Red Swamp Crayfish (P. clarkii) in Southeastern North Carolina**
Robert Adams*(Appalachian State University), Sidney Busch (Appalachian State University), Elijah Thompson (Appalachian State University), Robert Creed (Appalachian State University), Michael Gangloff (Appalachian State University)

29. **Assessment of Fish Movement in Relation to Barriers in the Upper Illinois Bayou Watershed**
Risa McCollough* (Arkansas Tech University) and Kyler Hecke (Arkansas Tech University)

30. **Crayfish Conservation in Kentucky**
Michael C. Compton* (Office of Kentucky Nature Preserves), Zach Couch* (Kentucky Department of Fish and Wildlife Resources), David Hayes (Eastern Kentucky University)

31. **CPUE of Invasive Silver and Bighead Carp in Kentucky and Barkley Lakes**
Joshua Tompkins (Kentucky Department of Fish and Wildlife Resources), Matthew Dollenbacher (Kentucky Department of Fish and Wildlife Resources)

32. **Offshore movements and potential spawning behaviors of southern flounder inferred from archival satellite tags**
Eric Taylor* (University of North Carolina, Wilmington), Mason Collins (University of North Carolina, Wilmington), Anne Markwith (NCDEQ), Micheal Loeffler (NCDEQ), and Frederick S. Scharf (University of North Carolina, Wilmington)

33. **Minimum Length Evaluation of Stockton Lake Crappie**
Chase Forck (Missouri State University), Grant Schmitz (Missouri State University), Hae H. Kim (Missouri State University), T. Ben Parnell (Missouri Department of Conservation), and Quinton E. Phelps* (Missouri State University)

34. **Assessing Stream Health: What More Can Fish Assemblage Tell Us About Kansas Streams?**
Aaron Walker, Caitlin Schoeck, Alexander Bornstein, Elizabeth Smith (Kansas Department of Health and Environment)

35. **Utility of side-scan and down-scan sonar for monitoring Paddlefish**
Wyatt Wolfenkoehler* (Oklahoma State University, Stillwater) James M. Long (US Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit), Lindsey A. Bruckerhoff (US Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit), Robert C. Lonsinger (US Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit), Patrick Joyce (Oklahoma State University, Stillwater), Ryan Gary (Arkansas Game and Fish Commission), Richard A. Snow (Oklahoma Department of Wildlife Conservation), Jason D. Schooley (Oklahoma Department of Wildlife Conservation)

36. **Combining spatial gradients and sparse time series data to predict fish assemblage response to increasing aridity**
Thomas A. Dodson* (Department of Ecology and Conservation Biology, Texas A&M University, College Station, TX), Jacob Barret (Department of Ecology and Conservation Biology, Texas A&M University, College Station, TX), Noah Santee (Department of Ecology and Conservation Biology, Texas A&M University, College Station, TX), David Smith (Environmental Research & Development Center, U.S. Army Corps of Engineers, Vicksburg, MS), Joshuah S. Perkin (Department of Ecology and Conservation Biology, Texas A&M University, College Station, TX)

37. **New Vs. Old: Comparing eDNA metabarcoding with conventional electrofishing sampling to monitor fishes in headwaters of Western Tennessee**
Tony Kumetis*(Tennessee Tech University, Department of Biology), Kit Wheeler (Tennessee Tech University, Department of Biology), Robert T. Paine (Cooperative Research Fishery Unit, Tennessee Tech University), Kayla Key (West Tennessee River Basin Authority, Tennessee Department of Environment and Conservation), and Amanda Rosenberger (U.S. Geological Survey, Cooperative Fishery Research Unit, Tennessee Tech University)

38. **Analyzing Gizzard Shad Dorosoma cepedianum Populations in Two Kentucky Reservoirs Affected by the Infiltration of Silver Carp Hypophthalmichthys molitrix**
Justin Graben* Graduate student Timothy Spier PhD Associate Professor

39. **Uncharted waters: high-resolution stream networks reveal habitats for petitioned headwater crayfish**
Devin M. Raburn* (North Carolina Cooperative Fish and Wildlife Research Unit; North Carolina State University, Department of Applied Ecology, Raleigh, NC), Hafez Ahmad (Mississippi State Cooperative Fish and Wildlife Research Unit; Mississippi State University, Department of Wildlife, Fisheries, and Aquaculture, Mississippi State, MS), Patrick F. Allison Jr. (Department of Biology, University of Mississippi, University, MS), Susan B. Adams (USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research, Oxford, MS), Zanethia C. Barnett (USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research, Oxford, MS), Ryan C. Garrick (Department of Biology, University of Mississippi, University, MS), Kenneth A. Sterling (USDA Forest Service, Okanogan-Wenatchee National Forest, Naches Ranger District, Naches, WA), Sara Cathey (North Carolina Cooperative Fish and Wildlife Research Unit; North Carolina State University, Department of Applied Ecology, Raleigh, NC), Michael E. Colvin (U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO), Corey G. Dunn (U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit; North Carolina State University, Department of Applied Ecology, Raleigh, NC)

40. **PING-Mapper: Efficient and Reproducible Substrate Mapping with Recreation-grade Sonar Systems**
Cameron S. Bodine* (Northern Arizona University), Daniel Buscombe (Northern Arizona University)

41. **The Middle Collins River is not as barren as we thought: Assessment of a newly discovered population of the Barrens Topminnow (Fundulus julisia)**
Kirsten Humphries* (Tennessee Tech University), Kit Wheeler (Tennessee Tech University)

42. **Can eDNA be used to locate Shawnee Cavefish?**
Megan Brandt* (Murray State University), Dr. Timothy Spier (Murray State University)

43. **Land Use Impacts on Fish Communities in the Arkansas Valley Ecoregion: A Preliminary Analysis**
Jarrett Tallent* (University of Central Arkansas), Ryne Lehman (University of Central Arkansas), Ginny Adams (University of Central Arkansas), Reid Adams (University of Central Arkansas)

44. **Conditional Occupancy and Habitat Selection of the Rocky Shiner, Notropis suttkusi, in Arkansas**
Savannah Wise* (Arkansas Tech University), John Jackson (Arkansas Tech University)

45. **Temporal and spatial patterns of larval fish assemblages across a river-reservoir continuum**
Madison Niles* (Clemson University), Luke Bower (USGS South Carolina Cooperative Fish & Wildlife Research Unit, Clemson University)

46. **The development of triploidy induction methods for hybrid Striped bass production**
Samuel Garcia-Vazquez* (University of Arkansas at Pine Bluff), David Straus (United States Department of Agriculture), Dayan A. Perera (University of Arkansas at Pine Bluff)

47. **Assessment of barriers to connectivity in Alabama's Uphapee Creek watershed**
Susan Fuller (Troy University), Josiah Gullatte (Auburn University), Colin Nunn (Troy University), Daniel West (Geological Survey of Alabama), James Stoeckel (Auburn University), and Kaelyn Fogelman (Troy University)

48. **Genetic Analysis of Cambarus aff. dubius in Kentucky using RADseq Methodologies**
Kathryn Schulz* (Department of Organismal Biology, Ecology, and Zoo Sciences, West Liberty University), Eric Ng (Department of Organismal Biology, Ecology, and Zoo Sciences, West Liberty University), Nicole Garrison (Department of Organismal Biology, Ecology, and Zoo Sciences, West Liberty University), Zachary Loughman (Department of Organismal Biology, Ecology, and Zoo Sciences, West Liberty University)

49. **Geomorphic and Ecological Responses of a Small Dam Removal**
Emily Chalfin* (University of Georgia), Seth Wenger (University of Georgia, Odum School of Ecology), Rhett Jackson (University of Georgia, Warnell School of Forestry and Natural Resources)

50. **Impact of land management on Distocambarus crockeri (Piedmont prairie burrowing crayfish) burrow density in Sumter National Forest**
Eric Ng* (Department of Organismal Biology, Ecology, and Zoo Science, West Liberty University), Kathryn Schulz (Department of Organismal Biology, Ecology, and Zoo Science, West Liberty University) Zanethia Barnett (USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research, Oxford MS), Zachary Loughman (Department of Organismal Biology, Ecology, and Zoo Science, West Liberty University)

51. **First dedicated survey of the Upper Guyandotte River for Cambarus veteranus (Guyandotte River Crayfish)**
Montana Fonner* (West Liberty University), Zachary Loughman (West Liberty University)

52. **Scale-dependent tradeoffs between habitat and time in explaining Alligator Gar (Atractosteus spatula) movement**
Hayden Roberts* (Department of Ecology and Conservation Biology, Texas A&M University), Johnathan Ellard (Department of Ecology and Conservation Biology, Texas A&M University), Daniel Daugherty (Inland Fisheries Division, Texas Parks and Wildlife Department), Matthew Acre (U.S. Geological Survey, Columbia Environmental Research Center), and Joshuah Perkin (Department of Ecology and Conservation Biology, Texas A&M University)

53. **Hydrodynamics and Fish Assemblage Fluxes in a Forested Riverscape**
Blake Elzi* (Texas A&M University), Hannah Evans (Texas A&M University), Lucas Stevens (Texas A&M University), Joshuah Perkin (Texas A&M University)

54. **A Statistical Model to Assess Juvenile Atlantic Sturgeon Age Based on Length and Julian Day**
Alan Bond* (University of Georgia), Adam Fox (University of Georgia), Martin Hamel (University of Georgia)

55. **Does Rio Grande Cichlid (Herichthys cyanoguttatus) induce trophic niche shifts in native centrarchids?**
Jacob Wolff* (Texas A&M University), Joshuah Perkin (Texas A&M University), Chris Johnson (Living Waters Fly Fishing)

56. **Identifying Drivers of Arapaima Population Dynamics in a Floodplain Ecosystem**
Emma A. Hultin* (Virginia Tech), George Brooks (Virginia Tech), Holly K. Kindsvater (Virginia Tech), Leandro Castello (Virginia Tech)

57. **Silver Carp Hypophthalmichthys molitrix movements in the Lower Cumberland River and Lower Tennessee River**
Miranda Belanger* (Murray State University), Tim Spier (Murray State University)

58. **Assessment of Barriers to Connectivity in Alabama's Uchee Creek Watershed**
Colin Nunn (Troy University), Josiah Gullatte (Auburn University), Susan Fuller (Troy University), Daniel West (Geological Survey of Alabama), James Stoeckel (Auburn University), Katelyn Lawson (Auburn University), and Kaelyn Fogelman (Troy University)

59. **Effects of prolonged holding in recirculating aquaculture systems on spawning efficiency of wild White Crappie (Pomoxis annularis)**
Matthew E. Nichols* (Mississippi State University, Starkville), Charles C. Mischke (Mississippi State University), Sandra B. Correa (Mississippi State University), Peter J. Allen (Mississippi State University)

60. **U.S. INLAND CREEL PROGRAMS: A REGIONAL COMPARISON AND BEST PRACTICES**
Anna L. Kaz* (Louisiana State University), Nicholas A. Sievert (USGS National Climate Adaption Science Center), Abigail J. Lynch (USGS National Climate Adaption Science Center), Stephen R. Midway (Louisiana State University), David R. Smith (Louisiana State University), Holly S. Embke (USGS Midwest Climate Adaption Science Center), Matthew D. Robertson (Fisheries and Marine Institute of Memorial University of Newfoundland), Lyndsie Wszola (University of Missouri), Craig P. Paukert (University of Missouri)

61. **Effects of Extreme Flow Events on Community Composition and Habitat Complexity in Groundwater Dominated Systems**
Josh Tivin* (Texas State University), Timothy Bonner (Texas State University)

62. **Responses of Fishes to Multiple Barrier Removals on War Eagle Creek**
Claire Binfield* (University of Central Arkansas), Ginny Adams (University of Central Arkansas), Reid Adams (University of Central Arkansas)

63. **Examining spatial heterogeneity in the summer flounder sex ratio using fishery-independent data**
Hailey Conrad* (Virginia Tech), Holly Kindsvater (Virginia Tech)

64. **Determining Minimum Habitat Availability for Muskellunge in North Carolina**
Delaney Whitson* (Western Carolina University), Keith Gibbs (Western Carolina University)

65. **Investigating Batrachochytrium dendrobatidis presence in Mississippi crayfish and exploring bounds of critical temperature possibly affected by Batrachochytrium dendrobatidis load**
Lauren M. Flood* (Department of Biology, University of Mississippi, University, MS), Ashlyn K. Silliman (Department of Biology, University of Mississippi, University, MS), Arma'Rosa R. Mohead (Department of Biology, University of Mississippi, University, MS), Patrick Allison F. Jr. (Department of Biology, University of Mississippi, University, MS), Michel E.B. Ohmer (Department of Biology, University of Mississippi, University, MS)

66. **Non-invasive Survey of Walleye in the Tennessee-Tombigbee Waterway**
Austin Lisowski* (Mississippi State University), Michael Sandel (Mississippi State University)

67. **Assessment of stream fish assemblage responses to hydrologic variability and disturbances in the Ichawaynochaway Creek Watershed, GA**
Jake R. Duhé* (School of Renewable Natural Resources, Louisiana State University), Garrett W. Hopper (School of Renewable Natural Resources, Louisiana State University and Agricultural Center), Carla L. Atkinson (Department of Biological Sciences, University of Alabama)

68. **Trophic dynamics of an expanding population of invasive blue catfish in Albemarle Sound, North Carolina**
Nolen Vinay* (University of North Carolina Wilmington), Cami Miller*(East Carolina University) Frederick S. Scharf (University of North Carolina Wilmington), James W. Morley (East Carolina University)

69. **Use of secondary pectoral fin rays to age Atlantic sturgeon: examining section thickness to improve the clarity of annuli distinction**
Marc Chelala* (UNCW), Joseph Mathews (UNCW), Frederick Scharf (UNCW)

70. **Optimizing environmental DNA assays for Atlantic Sturgeon: a pilot study in the Ocmulgee River, Georgia**
Taylor Faherty* (1), Adam Fox (1), James Shelton (1), Wesley Gerrin (1), Sarah McNair (1), Kayla Evans (1), Miluska Olivera-Hyde (2), David Kazyak (2), Brian Shamblin (1); 1 Warnell School of Forestry and Natural Resources, University of Georgia; 2 U.S. Geological Survey, Eastern Ecological Science Center

71. **Detection and Modeling of Darters and Madtoms: eDNA Surveillance of Imperiled Southeastern US Fishes**
Hannah Swain-Menzel1, Robert T. R. Paine1, and Amanda E. Rosenberger2; 1 Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN; 2 U.S. Geological Survey, Cooperative Fishery Research Unit, Tennessee Tech University, Cookeville, TN

72. **Effects of anthropogenic stream barriers on Sandhills Chub (Semotilus lumbee) population genetics**
Riley Phelps* (Coastal Carolina University), Derek Crane (Coastal Carolina University), Tanya Darden (South Carolina Department of Natural Resources), Mark Scott (South Carolina Department of Natural Resources), Brena Jones (North Carolina Wildlife Resources Commission), Charles Bryan (Fort Liberty Endangered Species Branch), and John Hutchens (Coastal Carolina University), Zach Ramsey (Coastal Carolina University)

73. **Angler attitudes toward longnose gar in Virginia's recreational fisheries: Ecological outcomes and management implications**
Lily Casteen* (Virginia Tech- College of Natural Resources and Environment), Jeff Williams (Virginia Department of Wildlife Resources), Dr. Elizabeth Nyboer (Virginia Tech- College of Natural Resources and Environment)

74. **Looking for Lazarus: Environmental DNA (eDNA) surveillance of the federally threatened Slender Chub (Erimystax cahni) in the Clinch River and Powell Rivers**
Robert T. R. Paine1 and Mark W. Rogers2; 1 Cooperative Research Fishery Unit, Tennessee Tech University, 1100 N. Dixie Ave, Box 5114, Cookeville, TN 38505, United States; 2 U.S. Geological Survey, Cooperative Fishery Research Unit, Tennessee Tech University, 1100 N. Dixie Ave, Box 5114, Cookeville, TN 38505, United States

75. **Microhabitat Use of the Highland Darter (Etheostoma teddyroosevelt) in the Illinois Bayou Watershed of Arkansas**
Colton W. Morris* (Arkansas Tech University), Kyler Hecke (Arkansas Tech University)

76. **Quantifying Movement of Seven Imperiled Pelagic-Broadcast Spawning Fishes in Three Great Plains Rivers**
Lucas Stevens* (Texas A&M University), Dr. Zachary Steffensmeier (Ohio State University), Kevin B. Mayes (Texas Parks and Wildlife Department), Dr. Joshuah Perkin (Texas A&M University)

77. **Movement and Habitat Use of Lemon Sharks (Negaprion brevirostris) in Mississippi Coastal Waters**
Lindsay K. Bomgardner,*(1.2), Paul O. Grammer(1), Angie M. Hoover(1), Jeremy M. Higgs(1), Jill M. Hendon(1), Micheal J. Andres(2), 1 Center for Fisheries Research and Development, The University of Southern Mississippi, Ocean Springs, MS 39564, 2 Division of Coastal Sciences, The University of Southern Mississippi, Ocean Springs, MS 39564

78. **Evidence of an extant spring-spawning population of Atlantic sturgeon in a southeastern North Carolina river**
Joseph A. Mathews* (University of North Carolina, Wilmington), Joseph J. Facendola (North Carolina Division of Marine Fisheries), Aaron Bunch (Clemson University), Troy Farmer (Clemson University), David C. Kazyak (U.S. Geological Survey), and Frederick S. Scharf (University of North Carolina, Wilmington)

79. **Evaluation of passage efficiency and migration of striped bass in relation to a modified nature-like fish swimway and elevated flows in the Cape Fear River**
Gabrielle Shay* (University of North Carolina-Wilmington), Maggie Gaither (Clemson University), Troy Farmer (Clemson University), and Frederick Scharf (University of North Carolina-Wilmington)

80. **Stomach Content Analysis of the Non-Native Mayan Cichlid (Mayaheros urophthalmus) in Wolf Branch Creek Nature Preserve, Tampa, Florida**
Adam Cieslik* (The University of Tampa), Mark McRae (The University of Tampa)

81. **Spatial Assessment of Slender Madtom (Noturus exilis) Diets within the Illinois Bayou Watershed**
Kade B. Mitchell* (Arkansas Tech University), Kyler B. Hecke (Arkansas Tech University)

82. **Mate Choice as a Driver of Reproductive Isolation in Fundulus notatus and Fundulus olivaceous**
C. E. Davis (University of Southern Mississippi honors scholar), Emilee Holderness* (University of Southern Mississippi graduate research assistant), and Jacob Schaefer (University of Southern Mississippi director & professor and curator of fishes)

83. **Assessment of Aquatic Macroinvertebrate Assemblages in the Upper Illinois Bayou Watershed of Arkansas**
Coley Turner* (Arkansas Tech University), Risa McCollough (Arkansas Tech University), and Kyler Hecke (Arkansas Tech University)

84. **Assessing vulnerability to overfishing of the top imported marine ornamental species into the US using productivity susceptibility analysis**
Alice A. Wynn (University of Massachusetts-Boston), Gabrielle A. Baillargeon (Roger Williams University), Jemelyn Grace P. Baldisimo* (Old Dominion University), Michael F. Tlusty (University of Massachusetts-Boston), Andrew L. Rhyne (Roger Williams University)

85. **Estimation of Sportfish Populations in an Unmanaged Farm Pond in Arkansas**
Karson Hamilton* (Arkansas Tech University) and Kyler Hecke (Arkansas Tech University)

86. **Machine Learning, Longlining Fishing Tactics, and Seabird Bycatch Risk**
Iman Pakzad* (Department of Fish and Wildlife, Virginia Tech), Joan Browder (NOAA, Southeast Fisheries Center), Yan Jiao (Department of Fish and Wildlife, Virginia Tech)

87. **RAPID ASSESSMENT OF MUSSEL COMMUNITIES OF TWO TRIBUTARIES IN THE ARKANSAS SOUTH CENTRAL PLAINS ECOREGION**
Jimmy Hall* (Arkansas Tech University), Seth Drake (Arkansas Tech University), Kyler Hecke (Arkansas Tech University), Parker Brannon (Arkansas Tech University), Savannah Wise (Arkansas Tech University), and Tom Nupp (Arkansas Tech University)

88. **Native crayfish morphological variation in relation to dams and introduced species**
Rachel Simpson (Troy University), Riley Egan (Troy University), Zanethia Barnett (US Forest Service), Brian Helms (Troy University)

89. **Reproductive Life History of Pleurobema riddellii**
Alex Zalmat, Camelle Garner*, Clementine Adams, Timothy Bonner

90. **Mitogenome Surveillance of Invasive and Endangered Fishes in the Southeastern United States**
Tobin J. Davidson (Wildlife, Fisheries, and Aquaculture, Mississippi State University), Kayla M. Fast (Wildlife, Fisheries, and Aquaculture, Mississippi State University), Michael W. Sandel (Forest and Wildlife Research Center, Mississippi State University & Wildlife, Fisheries, and Aquaculture, Mississippi State University)

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TENNESSEE CHAPTER

Crayfish plague – should it really be a non-issue in North America? Outbreaks in Montana

Susan B Adams* (USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research), Stacy A Schmidt (Montana Fish, Wildlife and Parks, Aquatic Invasive Species Program), David A Schmetterling (Montana Fish, Wildlife and Parks, Fisheries Division), Javier Diéguez Uribeondo (Department of Mycology, Real Jardín Botánico CSIC, Madrid, Spain), Laura Martin-Torrijos (Department of Mycology, Real Jardín Botánico CSIC)

During the first-ever statewide crayfish survey of Montana, we found several crayfish populations with high incidences of severe lesions. In addition to the heavily impacted populations, we found lesions--albeit often minor ones--in at least 60 sites. Further sleuthing, including genetic testing, revealed this to be the first-known symptomatic expression of crayfish plague in North America (NA). Crayfish plague is a disease primarily of crayfishes that is caused by the oomycete Aphanomyces astaci. The pathogen is native to NA, and crayfishes in NA often carry the pathogen without displaying disease; however, when North American crayfishes are introduced to other continents, the disease wreaks havoc, often extirpating native crayfishes. The nearly universal assumption has been that crayfish plague is not a problem in NA, where it co-evolved with our crayfishes. Our observations raised many questions and concerns about drivers and impacts of the outbreaks and contributed to a state regulation change. We will present the case study, basic information about crayfish plague, and some of the questions/research our results have led to. We will also discuss implications of the findings for how we think about the pathogen in NA and why we might need to pay more attention to it.

Fish Habitat Enhancements in Old Hickory Reservoir, Nashville, TN

Ted Alfermann* (Tennessee Wildlife Resources Agency), Phillip Parsley (Tennessee Wildlife Resources Agency)

Interest in reservoir fish habitat improvement methods and evaluation has increased in recent years. Organizations like Bass Pro Shops and Friends of Reservoirs have made grant funding available to help financially support these projects and to bring awareness to their importance. The Tennessee Wildlife Resources Agency was recently awarded such a grant to help fund a wide scale fish habitat improvement project in Old Hickory Reservoir, located close to Nashville, TN. The project joined together funding from the Tennessee Wildlife Resources Agency and Bass Pro Shops to create 31 new fish habitat sites over a 7 mile stretch of the reservoir. Specifically, 10 sites received 20 "spiders" and 20 "jacks" each and will receive a special Bill Dance Fishing Trail buoy, 10 sites received three experimental structures each called "Tennessee Towers", and 11 sites received 100-150 tons of large (2-4' diameter) rock. Because of depth restrictions, most structures will be evaluated using down imaging sonar, hook and line sampling, and angler reports. Project costs, methods, lessons learned, and early evaluation information will be discussed.

An Integrative Approach to Species Delimitation of Hobbseus Crayfishes (Decapoda: Cambaridae)

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Recent advancements in morphological data collection and molecular phylogenetics have resulted in numerous updates to crayfish taxonomy. However, there are still problematic taxa among these decapods. The genus Hobbseus is one such group, as the morphological characters traditionally used for species identification can provide ambiguous diagnoses. Given that some Hobbseus species have been petitioned for listing under the Endangered Species Act, this uncertainty is particularly concerning, as it inhibits implementation of effective conservation strategies. We reassess the taxonomy of Hobbseus using an integrative approach to species delimitation that combines morphological and molecular data. We will include four complimentary datasets: 1) traditional morphometrics; 2) geometric morphometrics; 3) single-locus mitochondrial DNA sequences; and 4) multi-locus hybrid enrichment single copy nuclear DNA sequences. Here, we provide preliminary results from the mitochondrial cytochrome c oxidase subunit I (COI) barcoding region.

Deposited sediment influences occurrence of functional traits of stream fishes

Angermeier[1], Paul L.*, Mallory Hirschler[2], Amy Villamagna[3], and Eric Laflamme[3]

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[3]Plymouth State University

Excessive fine sediment (silt and sand) can homogenize benthic habitat and reduce biological production and diversity. Traits reflecting specific modes of feeding and reproducing shape species' sensitivity to fine sediment. However, field-based empirical relations between trait occurrence and fine-sediment deposition are largely undocumented for stream fishes. To explore fish sensitivity to fine sediment, we documented assemblage-wide responses by selected traits along a sedimentation gradient in the upper Piedmont of the Roanoke River basin in North Carolina and Virginia. We assessed fine-sediment sensitivity of 81 species based on eight traits stratified by four attributes: food preference, feeding location, spawning substrate, and spawning behavior. We ranked each trait and scored each species with respect to expected sediment sensitivity. Using electrofishing surveys, we calculated proportional abundances of traits observed at 30 sites and grouped species by their aggregate sensitivity scores. We used a combination of regression and ordination approaches to assess relations between embeddedness and silt cover and trait occurrences. All focal traits responded to embeddedness or silt cover, or both. Feeding traits responded more strongly to embeddedness, while reproductive traits responded more strongly to silt cover. The observed negative responses of the probability of presence for traits highly sensitive to embeddedness and silt cover were linear, with no apparent thresholds. Additionally, proportional abundances of species with multiple high-sensitivity traits were inversely related to embeddedness and silt cover. Our findings regarding population-level responses to sedimentation were consistent with our findings for trait-specific responses. Our analysis of species sensitivity to fine sediment corroborated the patterns we saw in our trait-specific analyses, indicating that population responses to sedimentation can be predicted from combinations of species traits. The "dose-response" relations we documented may be applicable to managing sediment impacts on fishes, especially in the contexts of biotic assessments and conservation of sediment-sensitive species.

Elucidating the hierarchical relationships between drivers of nonnative richness in stream fish communities of United States

William K. Annis* (Clemson University), Luke M. Bower (Clemson University), Stephen R. Midway (Louisiana State University), Julian D. Olden (University of Washington), Lily M. Thompson (Clemson University), Brandon K. Peoples (Clemson University)

The introduction of nonnative species to habitats is a leading cause of global biodiversity decline. As a result, a goal in ecology is to determine what invasion drivers are associated with high nonnative species richness to predict and reduce the spread of nonnative species. Many studies treat invasion drivers as independent of each other and neglect to account for indirect effects that drivers may have on nonnative richness through other drivers. Ignoring these hierarchical relationships between drivers can confound interpretation of the true processes leading to high nonnative richness, which could lead to management practices that may not be as effective or efficient. To add further complication, the relationships between invasion drivers and nonnative richness may vary regionally. Stream fishes make an ideal study system for invasion ecology as stream fishes occupy a wide range of habitats, have high native biodiversity, and are subjected to many nonnative introductions and habitat modifications. In this study will we utilize structural equation modelling and a stream fish community dataset for the conterminous United States to untangle the direct and indirect effects of invasion drivers on nonnative richness in multiple level 3 ecoregions. Specifically, the drivers we will examine are habitat characteristics, human impacts, propagule pressure, and native biodiversity. We predict to find both direct and indirect effects of these drivers on nonnative richness, which will differ with region, stressing the importance of considering indirect effects of invasion drivers and regional context when managing nonnative species richness.

Invasive Carp in Alabama: Current distribution, monitoring, and management actions in state waters

Dave Armstrong*, Adrian Stanfill, and Garrett Ray (Alabama Department of Conservation & Natural Resources)

There are four species of invasive carp that have been introduced to the Southeastern United States. They include Silver Carp Hypophthalmichthys molitrix, Bighead Carp Hypophthalmichthys nobilis, Grass Carp Ctenopharyngodon Idella, and Black Carp Mylopharyngodon piceus. Since the late 1970's and mid-1980's, Silver, Bighead, and Grass Carp are known to exist in Alabama waterways with no documentation of Black Carp to date. Grass Carp and Bighead Carp are ubiquitous in Alabama waterways, though only adults appear sporadically. These two species likely present competition with native species for food and habitat. Silver Carp are Alabama's most concerning species and currently occupy an invasion front within the shared waters of Pickwick Reservoir including, Tennessee and Mississippi along the Tennessee River. This species emigrates from the Ohio and Mississippi River basins via Kentucky Lake. Current numbers of Silver Carp in Alabama are relatively low, though recent reports by commercial anglers and collaborative agency monitoring are concerning. Alabama Division of Wildlife and Freshwater Fisheries staff have performed standardized boat electrofishing and gill net surveys for invasive carp in three reservoirs (Pickwick, Wilson, and Wheeler) along the Tennessee River since summer, 2020. Additional management actions have included, news releases and interviews, access signage installations, monitoring of telemetry receivers, partnership planning for dam deterrents, and engagement with stakeholders via sighting reports. These efforts are routinely coordinated with state and federal partnerships and are invaluable in developing plans for invasive carp management. Current management strategies and specific actions will be discussed herein.

The Big Blue-Green Crayfish that Could! Conservation Efforts for the Big Sandy Crayfish (Cambarus callainus)

Brittany Bajo-Walker* (Virginia Department of Wildlife Resources), Andrew Phipps (US Fish and Wildlife Service- White Sulphur Springs National Fish Hatchery), John Scott Moore (US Fish and Wildlife Service-White Sulphur Springs National Fish Hatchery), Brian Watson (Virginia Department of Wildlife Resources), Zachary Loughman (West Liberty University)

The Commonwealth of Virginia currently recognizes at least 26 native and 6 non-native crayfish species, only one of which is listed, the Big Sandy crayfish (Cambarus callainus, BSC). Endemic to the Big Sandy River basin in the central Appalachians and once known as Cambarus veteranus, a significant portion of BSC's range occurs within Virginia. Unfortunately, many of these rivers and tributaries have experienced pollution pressure and irregular 100-year flooding events that have impacted the physical stability and water quality. Given BSC's rarity and significance within Virginia, the Virginia Department of Wildlife Resources (DWR) has prioritized conservation of BSC and worked with several partners to help advance conservation efforts. Questions regarding topics such as their unique niche habitat, reach level distribution, life history, and genetics have inspired additional research efforts over the last 20 years. Status surveys over the past 15 years have indicated there are a number of pocketed, but healthy populations within watersheds like the Rusell Fork, yet numerous reaches also appeared to be devoid of BSC, like streams in the Levisa Fork watershed. In 2022 and 2023, surveys were conducted in portions of the Levisa Fork watershed, resulting in the discovery of BSC at several sites- the 1st positive collections in two decades. Many of the populations contained various size classes and reproductive females. Healthy populations of BSC in the Russell Fork watershed created a unique opportunity to attempt propagation in a hatchery setting. These efforts have had some success over the last year and have allowed us to observe the species in an intimate setting, giving further insight into behaviors, breeding patterns and more. While concern for the species still exists, significant progress over the last 2 years has given managers hope for Big Sandy crayfish.

Avian Predation on Rainbow Trout in a Tennessee Tailwater Fishery

Connor Ballard* (Tennessee Wildlife Resources Agency)

Recent increases in colonial-nesting waterbird populations, specifically Double Crested Cormorants Phalacrocorax auritus and Great Blue Herons Ardea herodias, have led to angler conflicts and potential negative effects on fisheries. Avian piscivores often congregate near heavily stocked trout fisheries, taking advantage of naïve hatchery trout. No study, to our knowledge, has evaluated avian predation of Rainbow Trout in the southeastern United States using individually marked Rainbow Trout. Over a 4-year period we PIT tagged 3,219 Rainbow Trout Oncorhynchus mykiss of hatchery and wild origin across 20 km of the Norris tailwater in east Tennessee. We then searched for PIT tags in the only colonial nesting site observed in the study area and detected 124 of the deployed PIT tags. Avian predation rates were significantly higher for hatchery Rainbow Trout than wild Rainbow Trout; minimum avian predation rates over the duration of the study were 3.23%, 9.96%, and 3.85% for wild, hatchery, and combined Rainbow Trout groups respectively. True predation rates are presumably higher and could represent a large source of Rainbow Trout mortality in the Norris tailwater and other fisheries were avian piscivores are abundant. We also found that Rainbow Trout size did not appear to limit avian predation, so stocking larger Rainbow Trout may not reduce avian predation risk. Understanding how avian predation impacts sport fisheries can inform mitigation for this potentially underestimated source of mortality.

Assessing Initial Growth Rate of Florida Largemouth Bass Fingerlings at 4 month Increments

Steven Bardin* (Texas Pro Lake Management)

Historically planning a reservoir renovation or new reservoir build includes using a formulaic surface acreage-based forage stocking, followed by a wait period, and predatory fish stocking. We assessed the growth of fingerling Florida Largemouth Bass supplied from Red Hills Fish Hatchery using a standardized forage stocking with a 1 year wait period before bass stocking. Growth of fingerling bass was assessed by collecting total length and weight of individuals captured by electrofishing. Sampling was conducted every four months to provide initial growth assessments and maximum growth to 16 months in age. These initial growth assessments shows the ability of Texas managers to exceed 2 inches of growth per month and 18.75 inches and 4 lbs of growth within 16 months post stocking of fingerling Florida bass.

Assessing the Use of WaterIQ Pulsar Units in the Control of HAB's

Steven Bardin* (Texas Pro Lake Management)

Harmful Algal Blooms (HAB's) and control continue to become more important in small impoundment management. HAB's can reduce growth and abundance of fishes and limit recreational use of a waterbody by many user groups. This results in economic loss for communities, agencies, or landowners. Recent innovations by WaterIQ Technologies with ultrasonic sound and critical structural resonating frequency appear to have promising implications on mitigating harmful algal blooms of multiple Cyanobacteria species and Golden Algae (Prymnesium parvum). We explore the laboratory and field-based case studies currently underway and how sound frequencies are being used to collapse gas vacuoles of Cyanobacteria and remove flagella from Golden Algae. Theoretically this renders the algae unable to move within the water column, causing it to sink and eventually die off. As the technology continues to advance ultrasonic algae control may become effective in short term bloom mitigation or long-term population control especially in conjunction with aeration and phosphorus reduction.

Habitat Correlates of Southern Appalachian Brook Trout (Salvelinus fontinalis) Populations in South Carolina

Joseph Barnes* (Western Carolina University), Keith Gibbs (Western Carolina University), Thomas Martin (Western Carolina University)

The Brook Trout (Salvelinus fontinalis) is the only native salmonid species found in the Appalachian Mountains. Populations of Brook Trout inhabit <80% of their historic range due to habitat loss, invasive species, and climate change. The purpose of this study was to determine if populations of genetically distinct Southern Appalachian Brook Trout (SABT) in the South Saluda River watershed are abundant enough to be used as a source population for translocations or propagation to restore populations to the North Saluda River watershed. We also sought to determine correlations of habitat characteristics between streams with SABT present compared to streams where SABT are absent. We conducted single-pass electrofishing surveys to calculate catch per unit effort (CPUE) for stream reaches above and below potential waterfall barriers. We also analyzed instream habitat characteristics in 100m reaches at 31 sites in 5 streams. We quantified habitat types, substrate size and percentages, availability of cover and large woody debris, and percent canopy cover. South Saluda River and Laurel Creek have SABT populations whereas populations in North Saluda River and Bryce Creek were historically extirpated. Additionally, the SABT population in Slicking Creek was extirpated after an intense wildfire in 2016. Laurel Creek had the highest CPUE (2.06 fish/min.) and South Saluda River had a lower CPUE (0.63 fish/min.). We did not detect significant differences in habitat characteristics among sites with or without SABT. However, canopy cover was significantly reduced in recently extirpated sites in Slicking Creek compared to sites with extant populations. Accordingly, Laurel Creek would be most suitable as a source population with appropriate management to maintain genetic integrity. We also recommend not attempting to reestablish a population in Slicking Creek until the canopy has recovered. Analyzing SABT habitat characteristics further bridges the information gap between northern and southern strains of brook trout.

Burrowing behaviors and invasive control methods of Red Swamp Crayfish

Nick Barnes* (Auburn University), Jim Stoeckel (Auburn University), James Rodgers (Auburn University)

Red Swamp Crayfish (RSC; Procambarus clarkii) are one of the most invasive crayfish species globally. Because RSC are capable of creating and living in terrestrial burrows, control methods applied to surface waters may not be effective for the portion of the population inhabiting burrows. It is therefore important to determine the factors that encourage/discourage burrowing behavior and to develop and refine control techniques focused on terrestrial burrows. We developed and refined artificial burrowing chambers, based on ant farms but with the ability to easily adjust underground water levels, to examine environmental conditions that induce burrowing. Crayfish were exposed to three treatments: groundwater initially 1 cm below the surface and subsiding at a rate of 4 cm/day; groundwater subsiding at a rate of 8 cm/day, and groundwater held constant at 24 cm below the surface. Preliminary results indicate RSC require groundwater close to the surface followed by a slow rate of decline to induce burrowing. The majority of crayfish initiated burrows and tracked groundwater subsiding from the surface at a rate of 41 cm/day, whereas no crayfish burrowed down to the groundwater when it was initially 24 cm below the surface. We are also evaluating the use of hot water as an alternative to chemical treatment or physical blockers to treat RSC in burrows. Initial laboratory studies showed 100% mortality at 50°C within 5 minutes. Ongoing experiments are evaluating the feasibility of using a commercially available self-contained, mobile, heated pressure-washer to control burrowing RSC in drained, earthen pond-bottoms. A better understanding of the cues inducing burrowing, and feasibility of novel burrowing control strategies will allow us to more efficiently and effectively apply field control techniques to manage invasive RSC populations.

Diet and Trophic Niches of Primary Burrowing Crayfishes Distocambarus youngineri and D. crockeri

Zanethia C. Barnett* (USDA Forest Service), Hogan Wells (West Liberty University), Zachary Loughman (West Liberty University)

Understanding the trophic ecology of a species gives insight into food webs, functional roles of a species, and the flow of energy throughout the system. Crayfishes can have significant impacts on their environment and have been reported to be both ecosystem engineers and potential keystone species due to their ability to modify microbenthic and macrophyte community compositions. Using stable isotope analysis, we examined resource use by the Newberry (Distocambarus youngineri) and Piedmont Prairie (D. crockeri) Burrowing Crayfish. These crayfishes are endemic to South Carolina, only occurring in the Piedmont Region of the state. We determine resources used by both species and assessed the effects of land use (roadside habitat v. managed fields) on crayfish diet to aid in successful species conservation. Results indicate that these crayfishes have an omnivorous feeding strategy depending on invertebrates, vegetation, and detritus as food sources. There were small variations in trophic position and dietary contributions between sites and habitat types. Our work highlights the ecological function of burrowing crayfishes and how these functions may change due to land use changes.

An Investigation of Personality in the Creek Chub (Semotilus atromaculatus)

Jacob Barrett* (Austin Peay State University), Mollie F. Cashner (Austin Peay State University)

Intraspecific variation in personality traits is increasingly recognized as an important driver of ecological processes, particularly within the context of species invasions. However, relatively few studies have investigated personality in native fauna with more localized dispersal patterns, and information regarding the existence of personality in stream fishes native to the southeastern United States is particularly lacking. In this study, we investigated and characterized personality in a native and widespread minnow species, the Creek Chub (Semotilus atromaculatus). The Creek Chub presents a unique opportunity to investigate the importance of personality-dependent processes for stream communities due to its piscivorous diet, use of its nests by nest-associating minnows, and its role as a colonizer of intermittent streams. We identified personality traits by estimating the repeatability of sociability, boldness, exploration, and activity in two separate behavioral assays, and interpreted correlations between traits as evidence of behavioral syndromes. We did not detect repeatability for measures of sociability, possibly due to potential predatory interactions within this species. However, boldness, exploration, and activity were significantly repeatable and positively correlated, pointing to the existence of a bold-exploratory-active syndrome in this species. Larger individuals were less active, and, despite a relatively small sample size, we detected significant differences between source populations for measures of boldness. This is the first study to identify the existence of a behavioral syndrome in Creek Chub and points to the importance of considering the role of personality in ecological processes involving native fauna.

Use of multiple climate change scenarios to predict future distributions of alligator gar (Atractosteus spatula) in the United States

Jory Bartnicki* (Oklahoma Department of Wildlife), Richard Snow (Oklahoma Department of Wildlife), Andrew Taylor (University of North Georgia), Christopher J. Butler (Texas A&M University)

Climate change is expected to cause extinction in vulnerable species and reduce available habitat for others. Freshwater fishes are particularly vulnerable considering they are confined to habitats that are disjunct or prone to fragmentation on the landscape. The alligator gar is a species that relies on specific habitat conditions, including water temperature ranges from 20-30oC and flooded vegetation, for successful spawning and recruitment and is likely to be impacted by changes in climate. We created a species distribution model to provide insight about the projected range for alligator gar in the United States under four different climate change outcomes (SSP126, SSP245, SSP370, SSP585). Our models suggest that the most suitable habitat will change from where alligator gar currently dwell and shift northward and slightly east by 2080. Under the most severe climate scenario, the centroid for alligator gar range is projected to shift to the north-northeast, nearly 900 km from the current location in central Louisiana, to south-central Illinois. Freshwater fish have limited dispersal capabilities, and alligator gar will likely be unable to populate newly suitable habitats without translocations by fishery managers. Suitable habitat is projected to decline across alligator gar's current range, and it is plausible that local extinctions will occur. However, the initial impacts of decreasing suitability may be overlooked, considering that alligator gar are a long-lived species and larger, more mature individuals will likely be found across their current range even as suitable habitat decreases.

Novel Methods for the Development of Mathematical Models for Record-Class Largemouth Bass

Terry J. Battisti* (The Big bass Podcast)

Weight estimation formulas, or more correctly, models, are used throughout the fisheries science discipline to predict and track the health of a fishery. They are also used by the sportfishing community to predict the weight of a fish that may either be released or if a scale is not readily available. For example, Relative Weight (Wr) is used to determine if a fish is either skinny or fat compared to a statistically determined Standard Weight (Ws) based on weight and length. Other models, like the International Game Fish Association's largemouth bass model developed by Don Peters, include length and girth, can be used to predict the weight of largemouth bass in lieu of a scale. The inherent problem with these models is as the aspect ratio (L:G) of these fish varies, the weight estimate deviates from actual weight. This is due to density differences from fish to fish, and the fit parameter used in the finished model, which considers the aspect ratio. Because of these deviations, three new models were developed for record-class largemouth bass weighing over 14 pounds. The first model followed standard geometric modeling techniques where the second and third models used more of an empirical technique to arrive at a more accurate weight prediction. All three of these models will be discussed and compared with standard weight estimation models for largemouth bass.

Investigating the role of seasonal drought and stream permanence in Faxonius marchandi colonization and extinction dynamics

Leah Bayer* (Arkansas Coop Fish & Wildlife Research Unit, University of Arkansas), Daniel Magoulick (U.S. Geological Survey, Arkansas Coop Fish & Wildlife Research Unit, University of Arkansas)

Despite their well-documented importance, freshwater crayfish face global declines. Extreme weather events like droughts can amplify threats posed by other biotic and abiotic stressors on crayfish populations. Drought events can be expected to increase in frequency and severity in the future, but knowledge is very limited on how these events will affect crayfish persistence. Understanding current population dynamics gives critical insight into how a species may respond to future environmental changes. We sought to understand how seasonal droughts and stream permanence influence the colonization and extinction dynamics of the imperiled Mammoth Spring Crayfish (Faxonius marchandi) in the Spring River Drainage of Arkansas and Missouri, USA. We used quantitative kickseine and hyporheic sampling methods to obtain presence of F. marchandi at 25 intermittent and permanent stream sites in the summer (peak flow period) and fall (peak dry period) of 2022 and 2023. We fit our data to a multi-season dynamic occupancy model to explore crayfish colonization and extinction dynamics under different flow regimes in periods of peak flow and seasonal drought. This study demonstrates how an imperiled crayfish species may respond to environmental shifts in the coming years and gives potential implications about its persistence.

Factors affecting persistence of fish attracting structures in reservoirs

Preston Bean* (Texas Parks and Wildlife Department), Daniel Daugherty (Texas Parks and Wildlife Department), Timothy Bister (Texas Parks and Wildlife Department), Todd Driscoll (Texas Parks and Wildlife Department), Caleb Huber (Texas Parks and Wildlife Department), Michael Homer (Texas Parks and Wildlife Department)

As reservoirs age and coarse woody habitat degrades, fisheries managers often utilize fish attracting structures (FAS) made from either natural (e.g., brush piles) or synthetic (e.g., Georgia cubes) materials to concentrate fish for anglers. The effectiveness and longevity of FAS varies greatly and has been anecdotally described as dependent on materials used in their construction and characteristics of their deployment locations. However, factors affecting FAS longevity have not been thoroughly assessed. We surveyed FAS locations published online for anglers in sixteen Texas reservoirs using side-scan sonar to assess presence or absence of FAS at their original deployment locations and to locate FAS that were not present at their original locations. Presence/absence and distance from original location were modeled as responses to their construction (e.g., material, design type) and deployment location (e.g., depth, slope, distance to river channel) characteristics. Results from this study will inform construction and placement of FAS to better match anticipated site longevity with fisheries management goals.

Creating Trophy Fisheries

David Beasley* (SOLitude Lake Management)

Implementing the most appropriate management strategies when creating a trophy fishery is paramount to maximizing the probability that stakeholder goals are met. For waterbodies with sufficient trophy fishery attributes, management approaches will vary significantly, and should, as they conform to the goals, waterbody characteristics, available resources, etc. Starting with proper data and stakeholder alignment, a variety of management strategies should be considered. Probabilities of success, as well as the cost and effort required to implement the strategies, should be outlined and foresight applied to ensure that the strategy selected has the highest odds of success based on the resources available. During this presentation, many of these strategies will be shared.

Intensive trophy Florida Bass management in Suwannee Lake, FL

Steve Beck*, Drew Dutterer, Allen D. Martin, Summer Lindelien, Scott Coerver (all Florida Fish & Wildlife Conservation Commission)

Suwannee Lake is a 25.5 ha Fish Management Area located near the town of Live Oak in north central Florida. This lake was completely drained and renovated in 2014. After the lake was refilled and stocked with fingerling Florida Bass (Micropterus salmoides), numerous bass approaching 4.5 kg were observed within four years. The bass population subsequently became overcrowded and the abundance of trophy-size bass declined. The demonstrated rapid production of trophy-size bass led Suwannee Lake to be included in Florida Trophy Bass Project (FTBP) initiatives. Several trophy bass management strategies have been implemented since 2021, including regulation changes, bass population reduction events, and stocking several bass forage species. In addition, pellet feeders have been installed and fish attractors are being maintained to support bass forage species. A lake drawdown schedule has also been developed to fluctuate water levels for habitat management and to help concentrate bass and forage species to further increase bass growth rates. This intensive, multi-faceted approach to trophy bass management applies several interactive methods in an attempt to increase chances of success over any single method. With this project expected to continue for several more years, several metrics indicate that FTBP efforts from 2021-2023 are already increasing trophy bass production potential in Suwannee Lake.

Population Trends Assessment and Genetic Analysis of Saltmarsh Topminnows (Fundulus jenkinsi) in Florida

Cavin Beech*(Florida Fish and Wildlife Conservation Commission), Chelsea Myles-McBurney (Florida Fish and Wildlife Conservation Commission), Brandon Barthel (Florida Fish and Wildlife Conservation Commission), Jason O'Connor (Florida Fish and Wildlife Conservation Commission)

Saltmarsh Topminnows are protected as a State-designate Threatened species in the state of Florida due to their restricted range, severe population fragmentation, and general decline in extent and quality of habitat. The Saltmarsh Topminnow (Fundulus jenkinsi) is a smaller species of the Topminnow family that inhabit brackish tidal marshes along the Gulf of Mexico from Texas to Florida. Within Florida, their only known range includes the Perdido and Pensacola Bay systems. Prior to this study, there was no publication on population structure or effective population size for Saltmarsh Topminnows within Florida. During this study, a multi-season site-occupancy model was developed to determine population trends of Saltmarsh Topminnows within the Pensacola Bay complex and to establish a genetic monitoring protocol. Thirty-nine sites were sampled within the Pensacola Bay complex between 2016-2020 using a standardized trapping array. Between 11 February 2016 and 8 July 2020, a total of 1,203 Saltmarsh Topminnows were captured. Trap type was the best predictor of detection probability, and the null model was the best model for colonization and extirpation probability. Results from this study estimated the proportion of occupied sites within the study area to be 29% in the summer of 2016 to a maximum of 50% in the spring of 2020. Additionally, 266 Saltmarsh Topminnows were successfully genotyped from seven different locations from the Pensacola Bay complex. Results from this study also identified genetically differentiated subpopulations of Saltmarsh Topminnows within the Perdido River, Bayou Grande, Escambia Marsh, Escambia Bay, and the Yellow River Marsh. These results suggest that future efforts should be taken to evaluate the factors that influence Saltmarsh Topminnow dispersal.

Effects of an absent riverine flood pulse on Red Swamp Crayfish Procambarus clarkii life history and fecundity characteristics in the upper Barataria Basin

Robert A. Bergeron III* (Nicholls State University), John D. Carrier (Nicholls State University), and Christopher P. Bonvillain (Nicholls State University)

The Atchafalaya River Basin (ARB) and the Barataria Basin (BB) are large river-floodplain systems in southeast Louisiana that are separated by only 25 km and historically shared similar hydrologic regimes including a natural riverine flood pulse from the Mississippi River. However, anthropogenic modifications to both basins have altered historic river-floodplain connectivity. Although the historic ARB floodplain has been reduced, the ARB still receives an annual flood pulse from the Mississippi River that typically inundates floodplain habitats in the spring and dewaters in late summer to early fall. Conversely, anthropogenic modifications in the BB have eliminated an annual flood pulse from the Mississippi River and precipitation events are the only drivers of floodplain inundation. The purpose of this research is to examine life history and fecundity characteristics of Red Swamp Crayfish Procambarus clarkii between the ARB and BB, two hydrologically different large river-floodplain ecosystems. Procambarus clarkii were sampled every two weeks in the upper BB and eastern ARB during the 2023 crayfish season. Catch per unit effort and water quality were recorded at all sites on every sample date and all captured crayfish were identified to species, sexed, measured, and male reproductive form determined. Additionally, P. clarkii ovarian maturation stage, oocyte number and size, and maturation index were compared between the ARB and BB. Female P. clarkii from the BB produced significantly fewer oocytes (375 ± 20; $F_{1,96} = 4.0$, $P = 0.047$) compared to individuals from the ARB (460 ± 34). Mean P. clarkii carapace length was also significantly smaller ($F_{1,3553} = 683.8$, $P < 0.001$) in the BB (39.9 ± 0.2 mm) compared to the ARB (44.5 ± 0.1 mm). The results from this research will provide a foundation for future ecological assessments and anthropogenic modifications to river-floodplain hydrology as Mississippi River reintroduction projects become viable ecosystem restoration options."

Life history of the Harlequin Darter Etheostoma histrio in the lower Neches River basin of Texas

Daisy Blake* (Texas State University), Lauren Chappell (Clemson University), Dr. Timothy Bonner (Texas State University)

The purpose of this study was to describe life history attributes of the Harlequin Darter Etheostoma histrio, a rare species within the westernmost extent of their range. Study objectives were to quantify reproductive season and diets of Harlequin Darter from a surprisingly dense population found within an irrigation canal system located within the lower Neches River (Tx) drainage. Reproductive season, as inferred from gonadosomatic indices, is December through May with spawning likely occurring January through April. Patterns in oocyte diameters suggest multiple clutch production during the reproductive season. Diets consisted primarily of chironomids (mean percent by count = 73%), followed by trichopterans (23%), and ephemeropterans (3%). Diets are similar to those reported for Harlequin Darters elsewhere; however, reproductive season is longer with an earlier initiation than those from more northern latitudes of their range, which is similar to other closely related Etheostoma on the western and southern extent of their range.

Integrative approaches using genetic markers identify sources of population isolation and low genetic diversity and inform conservation actions for several benthic, freshwater fishes

Rebecca E. Blanton* (Center of Excellence for Field Biology, Austin Peay State University)

Aquatic organisms of the southeastern US are imperiled by numerous anthropogenic activities. The status of species of conservation concern is often described initially by occurrence and abundance surveys. Although clearly valuable to our understanding of species status, reliance on occurrence and abundance data alone provides an incomplete picture of the potential resiliency of a taxon to ongoing or future stochastic events or anthropogenic disturbances. We examined the conservation status and causes of species imperilment for several benthic-adapted, freshwater fishes (darters and madtoms) that have shown recent declines. We used the integration of several genetic markers and methods of data analysis, including estimation of phylogeographic relationships, population genetic assessments, and riverscape modeling, to describe genetic diversity, patterns of population differentiation, and to evaluate the relative impacts of past vicariance and contemporary, human-mediated habitat disturbance on population connectivity. For some, such as the Piebald Madtom, we found that geofluvial features of the Mississippi River mainstem had contributed to long-standing phylogeographic structure among populations, but subsequent human-mediated habitat degradation contributed to low genetic diversity and population loss. For others, such as the Kentucky Arrow Darter, population isolation and differentiation was linked to anthropogenic habitat use that led to loss of forest cover and high stream conductivity, but the primary cause of forest cover loss varied across river systems. Identifying historic and contemporary causes of population declines and differentiation using integrative methods allows for targeted conservation actions that address primary concerns, while understanding patterns of genetic diversity informs recovery and rescue actions such as propagation and translocation.

Impacts of Non-Native Cichlids in the Everglades: A Comparative Study of Ecological Niches

Tala Bleau* (The University of Georgia, The University of Tampa), Bridgette F. Froeschke (The University of Tampa)

Cichlids have been invading Florida since the 1940s and the extent of their impacts on the feeding ecology of native species has not been fully described. The percent stomach content of non-native Mayan Cichlids, Oscars, and Tilapia from the Everglades was determined. Percent stomach content was also determined for natives in the Everglades, including Rockbass, Warmouth, Bluegill, Spotted Sunfish, and Redear Sunfish. An Analysis of Similarities (ANOSIM) showed a significant difference between invasive and native feeding niches. A Multidimensional Scaling (MDS) analysis confirmed this difference between invasive and native feeding niches with little overlap between the two groups. An ANOSIM between all species also showed a significant difference between individual feeding niches. Comparison of individual species through MDS analysis indicated similar feeding niches between Oscars and Warmouth, Bluegill and Spotted Sunfish, and no overlap between Mayan Cichlids and Bluegill. A large portion of the Mayan Cichlid feeding niche had no overlap with any other fish. More specifically, the diet of Mayan Cichlids was comprised of 37.08% gastropods, 22.08% fish, 13.79% insect, 9.46% detritus, 7.19% shrimp, 4.25% algae, 3.62% nematodes, 1.93% seagrass, and 0.59% crab. The Oscar's diet consisted of 32.77% fish, 25.46% shell, 19.39% crayfish, 17.84% insect, 2.45% algae, 1.37% nematodes, and 0.72% detritus. Tilapia were found to have 100% algae in their stomachs. This research is crucial because it can be used to observe what impact non-native cichlids have on native species in the Everglades and what resources have the potential to be depleted as cichlids continue to spread and occupy habitats of natives.

Resource use in transitional habitats by burrowing crayfish diverge from common biogeographic patterns in aquatic taxa

Caitlin C. Bloomer* (Illinois Natural History Survey) and Christopher A. Taylor (Illinois Natural History Survey)

Ecological theory predicts that species exhibiting broader niches should also exhibit wider geographic ranges. This pattern has held true across several aquatic and terrestrial taxa and in multiple aspects of the niche. This study demonstrates that burrowing crayfish, a semi-terrestrial aquatic taxon, exhibited an inverse relationship to this pattern, and we propose mechanisms via which this may occur. We used stable isotope analysis to establish trophic breadth metrics for six species in the central US. Trophic niche breadth was significantly predicted by intraspecific site density, suggesting competitive interactions are a strong driving force behind trophic specialization. The evolution of a semi-terrestrial lifestyle in burrowing crayfish presents the opportunity to study how taxa adapt to novel environments. Documenting population-level ecological dynamics is key to understanding drivers of biogeographical patterns and processes of terrestrial colonization by aquatic species.

Automated Mapping of Gulf Sturgeon Spawning Substrates in the Pearl and Pascagoula River Basins

Cameron S. Bodine* (Northern Arizona University), Daniel Buscombe (Northern Arizona University)

Gulf Sturgeon (Acipenser oxyrinchus desotoi) are a threatened anadromous fish species which are reliant on rocky substrates in freshwater river systems for spawning. Several spawning grounds have been documented across the Suwannee, Apalachicola, Choctawhatchee, Yellow, and Escambia river basins which comprise the eastern extent of the species range. In contrast, only one spawning ground has been located on the Pascagoula river basin while no spawning grounds have been identified on the Pearl river basin. Effective restoration of the Pearl and Pascagoula Gulf Sturgeon populations requires information on the extent and location of potential spawning grounds to evaluate the quality and prioritize restoration of these habitats. Recreation-grade side scan sonar (SSS) instruments, or fishfinders, have proven an effective tool for rapidly surveying river habitats. However, existing methods for processing sonar mosaics and generating substrate maps requires a high degree of human-intervention and expertise, which limits the accessibility, efficiency, and reproducibility of these approaches. To address this issue, we developed a new open-source and freely available Python-based software called PING-Mapper to map suitable spawning substrates in these systems. PING-Mapper is an end-to-end framework for surveying and mapping aquatic systems at large spatial extents reproducibly, with minimal intervention from the user. Over 1,000 km of river habitats have been imaged with Humminbird® side imaging systems and PING-Mapper workflows have automatically predicted and mapped substrates with deep neural network models trained on data from the Pearl and the Pascagoula. The new maps provide a means of identifying reaches with potential Gulf Sturgeon spawning grounds across this large spatial extent, which will contribute to the recovery of the species.

Crappie Population Dynamics in 4 Southeastern Oklahoma Reservoirs

David Bogner* (Oklahoma Department of Wildlife Conservation)

Collectively, White Crappie (Pomoxis annularis) and Black Crappie (Pomoxis nigromaculatus) are some of the most pursued sportfish in Oklahoma and North America. Recent technological advances have raised concerns about the effect of angler harvest on crappie populations. Utilizing recent trap net surveys on four popular crappie fisheries in southeast Oklahoma, we evaluated White Crappie relative abundance, growth rates, and mortality rates. We then investigated common angler related concerns regarding harvest habits and harvest regulations across the four lakes. Current size selective harvest by anglers, fast growth rates, and high mortality limit the effectiveness of size restrictions on many lakes, and lower creel limits are not likely to reduce harvest unless the limit is severely reduced. Proactive strategies that communicate biologists are actively monitoring a fishery by informing anglers about the current and future predicted status of a fishery are instead a more productive long-term option than regulatory changes.

Use of Female-only Stocking to Create a Trophy Largemouth Bass Fishery in a Georgia Small Impoundment

Timothy Bonvechio*(Georgia Department of Natural Resources)

Avid anglers are interested in catching trophy Largemouth/Florida bass (Micropterus salmoides) but creating and maintaining these fisheries is challenging. Georgia DNR has used a low-density stocking of female-only bass in combination with stocking supplemental forage and a catch-and-release regulation to create trophy fisheries. Here we present the chronicle of Ocmulgee PFA (43-ha) and 2 case studies for this female-only recipe. First, under a new lake scenario (2005 to 2012) and then under the reclaimed lake from 2017 to present. Under the first, a total of 15.9 bass/acre were stocked and angler catch rates were high in 2012 due to lower water, taking an average of only 7.35 angler-h to catch a 3.6 kg fish. Of the 180 bass collected in the spring of 2012; 34.4% exceeded 3.6 kg and 8.8% exceeded 4.5 kg. Mean relative weight across all size groups was 119 in 2012. Growth was fast, as bass reached 457- and 508-mm TL in 2.59 and 3.69 years, respectively. Under the second and current study (20017 to present), a total of 22.8 bass/acre were stocked and the creel (2022) revealed the average fish caught was 2.3 kg. Mean relative weight across all size groups from 2020 to 2023 was 108 and growth was also fast. Of the 153 bass collected in the spring of 2020, 6.5% exceeded 4.5 kg. That number has declined since. Trophy bass management typically requires appropriate genetics, excellent habitat, high productivity, low mortality, low predators, high prey biomass, and reduced intraspecific competition for available resources. Thus, a program designed to stock females appears to be a viable option to keep densities low and produce a high number of trophy bass. This strategy accommodates anglers that have a high voluntary release ethic, producing a bass population with low recruitment and fast growth without requiring high harvest.

Environmental Correlates of Blue sucker occurrence in regulated rivers

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Blue sucker (Cycleptus elongatus) populations occur in the Mississippi River and Gulf of Mexico drainages of North America and are negatively affected by habitat fragmentation and flow regime alteration caused by dams. During fish assemblage surveys in August of 2022, we collected five juvenile blue suckers (312–428 mm total length) in the Angelina River upstream of Sam Rayburn Reservoir in East Texas (46,335 ha surface area) where the occurrence of the species was previously unconfirmed. Given this unexpected finding, we (1) analyzed mesohabitat associations to compare habitats we sampled with reports in the literature and (2) reviewed blue sucker occurrences in state, national, and global databases across historical (1950–1980) and contemporary (1981–2022) time periods to assess occurrence across gradients of habitat fragmentation and streamflow regulation. The blue sucker population in the Angelina River upstream of Sam Rayburn Reservoir was previously unconfirmed but is within the native range. Mesohabitats occupied by blue suckers were consistent with literature reports, including fast velocity, shallow depth, and coarse substrates. The low degree of regulation (19% of natural runoff stored by upstream reservoirs) and a high degree of habitat connectivity (287 rkm of unfragmented mainstem habitat) for the Angelina River upstream of Sam Rayburn Reservoir matched range-wide patterns of persistence within relatively intact (unfragmented and unregulated) or remnant (fragmented but unregulated) riverscapes. Our review reveals that blue sucker populations might persist (1) in remnant river fragments where local habitat conditions are appropriate and (2) where effects of habitat fragmentation and flow regulation are not coupled.

Stream fish assemblage and functional trait responses to dam removal

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Dam removal is seen as an effective way of restoring riverine systems, yet few studies have explored the changes in stream fish functional and assemblage structure after dam removal. The objective of this study was to quantify the changes in functional diversity base of life history traits and assemblage structure of stream fishes in response to dam removal in Twelvemile Creek, South Carolina. Fish community and habitat data were collected above and below dams as well as four reference sites 5-years prior and 5-years following dam removals. We explored the shift in fish assemblage structure using multivariate analyses as well as the changes RaoQ and community weighted means of life history traits using a novel approach. We found significant shifts in assemblage structure and decrease in equilibrium life history strategists after dam removal in the impounded sites, likely resulting in shift from stable lentic environment to unstable lotic environment. No significant change in assemblage structure or function diversity was observed for the control or below dams sites. This study demonstrates that integrating taxonomic and functional trait approaches provides more insights and predictability than one approach alone.

A massive collaboration to characterize coastwide Sturgeon migrations, merging genotyping and telemetry

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Following decades of intensive conservation efforts, many U.S. Atlantic Sturgeon populations remain critically imperiled. While they are still experiencing the negative impacts of historic overharvest and habitat loss, Atlantic Sturgeon are also exposed to ongoing threats including offshore power development, marine construction, vessel strikes, and fisheries bycatch. Because Atlantic Sturgeon have great longevity and a propensity for long distance migrations, threats are often realized over vast temporal and spatial scales which confound monitoring and mitigation efforts. Moreover, interpopulation variation in spawning phenology likely results in substantial variation in the timing and magnitude of migration, which inhibits the transferability of individual studies across the species' range. Although many independent regional studies of Atlantic Sturgeon migration have been conducted, integration across broader scales is necessary to gain a more comprehensive understanding of migration and habitat use. Working collaboratively with 14 institutions, we have compiled telemetry (n = 32 million detections) and genetic data for 2,650 telemetered Atlantic Sturgeon. Genetic assignment tests combined with acoustic telemetry provide insight into when and where specific population segments occur, and in turn where they are differentially exposed to threats thereby improving the ability to mitigate potential damage, especially to imperiled populations. Results from this study identify important critical habitat areas, migration timing, and opportunities to protect Atlantic Sturgeon during vulnerable life stages.

Development of Propagation Protocols for the Tennessee Dace

Curt Brewer* (Conservation Fisheries, Inc.)

Tennessee Dace (Chrosomus tennesseensis) are a small and colorful minnow that usually inhabit shaded, spring fed, first order streams. These fish are nest associates and in the wild spawn over Creek Chub (Semotilus atromaculatus) and Central Stoneroller (Campostoma anomalum) nesting mounds. This species is threatened primarily by deforestation, habitat fragmentation, and sedimentation and Tennessee lists them as in need of management. The goal of this work is to establish effective propagation protocols for the Tennessee Dace to reinforce existing populations as well as reintroduce fish to previously inhabited streams and inaccessible reaches. Initial propagation strategies utilized reflected strategies used to spawn other Chrosomus spp. While these methods worked well to produce Tennessee Dace, new protocols have since been developed and refined that allow for more effective production at a larger scale. These protocols include managing spawning triggers, optimizing egg collection, and ensuring steady growth and survival of larvae. Two seasons of captive propagation have taken place utilizing various methods of spawning and rearing fish, with these protocols proving to be most effective. The success of these protocols combined with habitat improvement has created a much more resilient and growing population of Tennessee Dace in the wild.

Crayfish confusion: Are you a competitor or do you thrive in disturbed habitat?

Shannon Brewer* (U.S. Geological Survey, Alabama Cooperative Fish and Wildlife Research Unit), Jordan Ramey (Alabama Cooperative Fish and Wildlife Research Unit, Auburn University), and Robert Mollenhauer (Texas Parks and Wildlife Department)

Dominant and aggressive native and non-native species outcompete other species, although the mechanisms are not well understood. Even species native to political boundaries may invade adjacent drainages or novel habitats but go unnoticed for a long time. These species are often highly adaptable and can thrive in a variety of conditions, which also allows them to quickly establish themselves in new environments. Although dominant and aggressive native species can play important ecological roles, they can also have negative effects on both other species in their native range or novel species when introduced outside their range. We used field-collected covariates and geospatial data in a multi-species occupancy model framework to determine the factors related to the occurrence of crayfishes native to the Ozark Highlands. The focal species included F. neglectus and F. virilis, which commonly are thought to displace other species. As expected, there were some shared relationships among species and some important differences. All species shared a negative relationship with landscape disturbance at the catchment scale and a positive relationship with cobble substrate at the reach scale. F. nana, F. macrus, and F. meeki brevis shared relationships with most habitat factors, except F. macrus was less likely to occur in reaches with deep pools. Both F. neglectus and F. virilis were more likely to occupy reaches with a large proportion of pool habitats reflective of disturbance at the reach scale. Interestingly, F. neglectus and F. virilis had opposite relationships with other reach and landscape factors. Our results suggest mechanisms associated with catchment-level disturbance negatively affect even strong competitors that appear to share few habitat relationships. Moreover, disturbances that increase the proportion of pool habitat at the reach scale appear to benefit strong competitors. Future efforts using lab-controlled trials would be beneficial to assessing the conditions where common invaders are either simply opportunistic or truly outcompete native species.

Habitat use by buffalofishes Ictiobus bubalus, I. cyprinellus, and I. niger in the lower Red River catchment

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Buffalofishes are long-lived catostomids that are widely distributed in North America. Conservation and management plans for non-game fishes can benefit from examination of multi-scale habitat use due to their understudied nature and distributions that extend beyond political boundaries. Recent literature has typically focused on either Smallmouth Buffalo or Bigmouth Buffalo; here, we examine habitat use by three sympatric species of buffalofishes in the Red River catchment over three years (April-Sept). We assessed their multi-scale (reaches were nested within river segments and catchments) habitat use using a multi-species occupancy model framework to determine their relationships with both field derived and geospatial covariates. Each site was surveyed 2-3 times each year to account for incomplete detection. We sampled approximately 60 sites during April to September of each year (2021-2023) using electrofishing and gillnets. Preliminary modeling results indicated that detection of all three buffalo species increased with water temperature. Neither Smallmouth nor Bigmouth Buffalo presence was related to sinuosity; however, Black Buffalo tended to occur in less complex areas of the river (low sinuosity). Smallmouth Buffalo and Black Buffalo presence was not related to elevation, whereas Bigmouth Buffalo was associated with lower elevation river segments. All three species were negatively associated with river segments that were wider and shallower, with the strongest relationship with Bigmouth Buffalo. These preliminary results provide some insight into shared ecological relationships among Buffalofishes, but also identifies some differences among the species that are helpful to understanding the conservation status of these fishes. Continued efforts will focus on adding interactions and non-linear possibilities to these models.

Temporal and ecological effects of lock and dam operations and hydrology on residency patterns of invasive silver carp in the Kentucky Dam tailwater

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Throughout the Mississippi River Basin, invasive carps frequently congregate in tailwaters of dams, which can pose substantial barriers to upstream dispersal. Locks and dams with especially high head (i.e., rarely subject to open-river conditions) serve as bottlenecks to upstream carp movement, entirely restricting passage to use of navigation locks. Research across the Basin has focused on researching strategies that managers can adopt to exploit pinch-point locks and dams for restricting carp dispersal. Designing removal efforts, especially within tailwater zones where carps aggregate, could also be advantageous. However, dam tailwaters are dynamic environments subject to shipping traffic and day-to-day hydrologic changes in discharge locations and volume, river height, and physicochemistry. Whether, and how, hydrologic and ecological factors drive invasive carp presence and residency patterns in lock and dam tailwaters is poorly understood. In this presentation, we use data obtained from silver carp (Hypophthalmicthys molitrix) implanted with acoustic transmitters between 2021–2022 to examine how daily lock and dam operations (frequency of lockage, number of barges, and dam discharge), tailwater elevation, and temperature correlate with fish counts and residency patterns of the Kentucky Dam tailwater (Tennessee River). Our findings can shed light on the ecology of invasive carps in the Kentucky Dam tailwater and serve as a basis for understanding differences in tailwater residency patterns of invasive carp at other locks and dams throughout the Tennessee and Cumberland River systems. These results can also inform broader carp management strategies (e.g., removal) within lock and dam tailwaters.

VARIATION IN FINE-SCALE WATER TABLE DEPTH DRIVES ABUNDANCE OF A UNIQUE SEMI-TERRESTRIAL SPECIES

Molly Carlson* (University of Illinois Natural Resources and Environmental Sciences, Illinois Natural History Survey), Dusty Swedberg (Illinois Natural History Survey), Elizabeth Miernicki (Illinois Natural History Survey), Christopher Taylor (Illinois Natural History Survey)

With anthropogenic changes altering the environment and the subsequent decline of natural habitats, it can be challenging to predict essential habitats for elusive and difficult to study taxa. Primary burrowing crayfish are one such group due to the complexity in sampling their semi-terrestrial, subterranean habitat. Sampling burrows usually requires a labor-intensive, time-consuming excavation or trapping process. However, limited information on burrowing crayfish suggests that fine-scale habitat variation may drive burrowing crayfish habitat choice. This project aimed to evaluate the fine-scale habitat characteristics that influence burrowing crayfish presence and abundance at a large, restored-remnant grassland preserve in north-central Illinois. We documented burrow abundance and quadrat-specific habitat variables such as root biomass, canopy cover, apparent seasonal high-water table (ASHWT) depth and dominant vegetation at sites with and without burrowing crayfish populations. Data was recorded at every quadrat and analyzed using Generalized Linear Mixed Models (GLMM). A total of 21 models were created to determine what habitat variables affected burrow presence and abundance. We found that the ASHWT depth was a significant driver of burrow presence and abundance. While root biomass and vegetation cover were not significant drivers, they did show up in the final models, explaining the data. These findings demonstrate empirical support for previous observations from other burrowing crayfish research and demonstrate the influence of fine-scale habitat when modeling elusive taxa requirements.

Effects of chronic environmental hypoxia in the Atchafalaya River Basin on Procambarus clarkii epigenetics, fecundity, and oocyte development

John D. Carrier* (Nicholls State University), Robert A. Bergeron III (Nicholls State University), and Christopher P. Bonvillain (Nicholls State University)

The Atchafalaya River Basin (ARB), is the largest bottomland hardwood river-floodplain in North American and produces 90% of the wild crayfish harvest in Louisiana. However, anthropogenic modifications to the natural hydrology in the ARB have altered historic river-floodplain connectivity and reduced water circulation and flow patterns that cause extensive areas of chronic environmental hypoxia for several months throughout the annual flood pulse. Although Red Swamp Crayfish Procambarus clarkii can tolerate relatively low dissolved oxygen concentrations, chronic hypoxia can negatively impact crayfish population characteristics. The purpose of this project is to compare P. clarkii fecundity, oocyte development, and epigenetics between chronically hypoxic and normoxic areas of the ARB. Crayfish were sampled every two weeks at 14 sample sites in the eastern ARB during the 2023 crayfish season. Water quality and catch per unit effort (CPUE) were recorded at all sites on every sample date and sex and carapace length were recorded for all captured crayfish. A maximum of 50 female P. clarkii were collected from every sample site on all sample dates and oocyte maturation and number were examined in the lab. Although not significant, female P. clarkii in hypoxic areas produced fewer mean oocytes (320 ± 68) compared to individuals from normoxic areas (466 ± 43). Additionally, female P. clarkii maturation stage was higher at normoxic locations on every sample date and mean maturation stage was also higher at normoxic sites. A comparison of transcriptomic analysis of differentially expressed genes via methylation between hypoxic and normoxic locations is currently underway. The information from this research can be applied to future ARB management decisions and is critical to stakeholders and resource managers as efforts to improve water quality and reduce the severity and duration of ARB hypoxia move forward.

Microplastics as a vector for endocrine-disrupting chemicals and its effects on the reproductive social behavior of fathead minnows

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Microplastics (MPs) have become an environmental concern in recent years, with most research focused on the physiological effects of exposure. Little consideration has been given to behavioral impacts from exposure, thus having fitness consequences for effected individuals. Additionally, MPs may serve as a vector for harmful contaminants known to impair behavioral responses, including endocrine-disrupting chemicals (EDCs). This project aimed to determine if MPs, alone or in association with a common environmental EDC) 17-alpha ethinyl estradiol; EE2) alter reproductive behavior in fish. Male and female fathead minnows (Pimephales promelas) were exposed to MPs without a concentration of EE2 (MPVirgin) or at a low (10 ng/L; MPEE2 10) or high concentration (50 ng/L; MPEE2 50) of EE2 adhered to the MPs. Fish were exposed for 30 days via a dietary feeding protocol. Behavioral trials were conducted on day 31 to determine changes in reproductive interactions. Male secondary sexual traits known to effect female decisions were observed with no observable changes. Male courtship was additionally unaffected by exposure. However, non-exposed females in all treatment groups discriminated against exposed males, with statistical significance for the MPEE2 50 group. Additionally, non-exposed females were equally likely to approach non-exposed or exposed males. The results from this study suggest that MPs may alter social behavior in fishes and the behavioral impacts of exposure may be more strongly pronounced in females than males. Individual-level changes in reproductive behavior may alter population and community structures.

Seasonal movement and habitat use of Striped Bass in the Edisto River

Joshua Cary* (South Carolina Department of Natural Resources)

The Edisto River, the longest free-flowing blackwater river in the Southeast, supports a diverse range of aquatic species, including a distinct population of Striped Bass. While the watershed has not experienced the high-density urban development seen in many other southeastern rivers, the river is faced with challenges from industrial agriculture and increasing water withdrawals. These impacts, coupled with droughts or climate change, have the potential to significantly limit the availability of suitable habitats. The project's objective is to evaluate Striped Bass's utilization of the river and identify any habitats that are crucial to the population's survival. Since the project's inception in 2019, we have implanted acoustic tags in 28 fish and tracked them using a stationary receiver array covering approximately 140 miles of the river. Tagged fish utilized the lowest tidal reaches of the river in the winter months before migrating upstream in the spring to the cooler well-canopied upper reaches where they stayed until the late fall before returning downstream. Additional manual tracking was conducted to pinpoint summer habitat selection in the upper reaches, where fish were typically found in deep outside bends.

Performance evaluation of two largemouth bass population control methods for small impoundments

Matthew Catalano* (Auburn University), Tyler Coleman (University of Florida), Taylor Beaman (Auburn University)

Largemouth Bass (LMB) population density reduction is a commonly recommended management technique to improve average size and condition of LMB in small impoundments. We evaluated two different methods for reducing LMB densities in these systems: shoreline rotenone application to reduce survival of age-0 LMB, and mechanical removal of recruited LMB via electrofishing. We experimentally evaluated the effects of two years of shoreline rotenone application on the density of Bluegill and the density, growth, and survival of age-0 and age-1 LMB at 15 Alabama small impoundments. After rotenone treatment, Largemouth Bass densities declined and mean age-1 length increased, whereas Bluegill populations were not significantly reduced. These findings suggest that shoreline rotenone application may be a valuable method for reducing LMB recruitment and increasing LMB growth in these systems but further work on the duration and consistency of treatment are needed to understand the long-term viability of this method. Mechanical removal was evaluated experimentally by varying the proportion of LMB under 356 mm removed (0 to 83%) annually for two years across 11 small impoundments at Auburn University, Alabama. We found that achieving an annual mechanical removal rate of 50% required 4-9 complete shoreline electrofishing circuits. Largemouth bass PSD-Q, PSD-P, mean relative weight of 254-356 mm largemouth bass, and CPUE of >356 mm largemouth bass were weakly positively related to the proportion of LMB biomass removed but no significant relationships were identified for growth and recruitment. Similar to shoreline rotenone, electrofishing removal appears to have a positive albeit weak influence on LMB population metrics, but longer-term sustained evaluations are necessary to understand the efficacy of this approach.

Recreational exploitation rates from reward tagging of Red Snapper in the northern Gulf of Mexico

Matthew Catalano*

Alternative methods for estimating exploitation of Red Snapper in the northern Gulf of Mexico are valuable as independent sources of information to assist with management decision-making. We used a reward tagging study to estimate regional exploitation and size-based vulnerability to recreational angling for red snapper released at reef sites less than 40 m deep across the northern Gulf of Mexico. Red Snapper were tagged using standardized methods by regional science-based tagging crews and tag returns were obtained from anglers via a reward program that paid $250 per reported capture of a tagged fish. Field crews tagged 1,208 Red Snapper greater than 406 mm total length in spring 2019. There were 187 fish tagged at 33 sites in Florida, 335 tagged at 64 sites in Alabama, 386 tagged at 31 sites in the Eastern Texas Region, and 300 tagged at 35 sites in the Western Texas Region. Posterior median estimates of fully-vulnerable private sector exploitation rates across sites ranged from 0.18 in the West Texas region to 0.44 in the Florida Panhandle region. Fully vulnerable charter exploitation rates ranged from 0.06 in West Texas to 0.22 in East Texas. Fully-vulnerable exploitation rates across tagging sites were negatively related to the distance from the nearest port. Length-based vulnerability to recreational capture was dome-shaped in each of the regions. These estimates could be used to augment existing stock assessment information for this important species.

Hydrology and geology as structuring mechanisms of semi-arid fish communities

Lauren Chappell* (Texas State University) & Tim Bonner (Texas State University)

Surface and subsurface geological formations influence the spatial heterogeneity in fish communities observed in riverine networks. In this study, we quantified patterns in fish community heterogeneity within the upper Nueces River basin (Nueces, Frio and Sabinal rivers) and correlated the patterns with surface geology. Results indicated strong concordance among surface geology, water permanency, and fish communities. Greater numbers of spring associated fishes were associated with reaches within Cretaceous geology than downstream reaches within Pleistocene fluviatile terrace deposits. Within Cretaceous geology, greater numbers of spring associated fishes were associated with gaining sections than losing sections of surface flows. Understanding of natural factors influencing fish communities facilitates the identification of natural and anthropogenic factors affecting fish community structure.

Combining biotracer and stomach contents analysis to improve understanding of trophic dynamics in the northern Gulf of Mexico

Calvin Chee*, Robert T. Leaf, Kevin Dillon (University of Southern Mississippi, Division of Coastal Sciences, Gulf Coast Research Laboratory)

The northern Gulf of Mexico (nGOM) is a taxonomically rich ecosystem. Previous work based on a meta-analysis of stomach content data has shown the trophic connectivity of predators and prey to be substantial. However, the trophic dynamics of many economically and ecologically important species are still not well understood. Gulf Menhaden (Brevoortia patronus), a high biomass forage fish with the region's largest commercial value, is considered an important forage species, but the extent to which predators depend on the stock to provision their diets has not been quantified. In this study, we use information from meta-analysis of both stomach content and stable isotope analysis to investigate how nGOM nearshore predators rely on Gulf Menhaden and other forage species. Stomach content and stable isotope analyses are generally evaluated independently, with stomach contents used to directly identify trophic interactions, while stable isotopes of carbon (δ13C) and nitrogen (δ15N) provide insight into a consumer's long-term feeding habits. We used a multispecies trophic model, EcoDiet, developed by Hernvann et al. (2021), that integrates both stomach content and stable isotope analysis into a single framework to estimate diet proportions and trophic link probabilities. Data in the model include n = 41 predators, n = 173 prey, and n = 497 unique predator and prey interactions. The results indicate that nGOM nearshore predators are generalists using the diverse prey base, and in concordance with previous findings, there is no single menhaden-dependent predator. Our findings better quantify the trophic interactions of the highly diverse nGOM region and have important implications regarding future ecosystem modeling and management considerations for the Gulf Menhaden stock."

A review of techniques and strategies practiced by small impoundment management consultants in the private sector

Preston Chrisman* (South Carolina Department of Natural Resources)

Angling preferences have changed in recent decades, and, particularly with the increase in catch-and-release practices, traditional small impoundment management techniques have become more difficult to execute. This holds especially true in public fishing impoundments, where lake managers are challenged to provide opportunities for diverse angling groups. Public impoundment managers typically manage numerous waterbodies of various sizes and must divide their available time among all of them. These demands have made it difficult for lake managers in the public sector to perform experimental adjustments to traditional management techniques. However, lake managers in the private sector have proven to be able to experiment with and develop new management techniques to provide diverse angling opportunities for their clients. They are utilizing different management strategies that are on the cutting edge of small impoundment management and are often able to be more adaptable than public lake managers as their lakes and fisheries mature. To improve the management of public impoundments, a "literature review" was initiated that focused on modern management techniques from the private lake management industry. Information was obtained from pond management podcasts, YouTube videos, blogs, websites, forums, and social media pages. In this review, I discuss the information that was obtained and consolidated over several years, with particular emphasis placed on adjusted stocking rates, alternative forage stocking options, and trophy bass management.

When it is okay to chase after Shiny objects: demonstrating a user-friendly web application for the standardization of data analysis and reporting using the Shiny package in R

Preston Chrisman* (South Carolina Department of Natural Resources)

Resource agencies experience issues with standardizing data analysis and reporting. Potential causes include aversion to deviating from previous methods by experienced staff and by filling positions with newly hired employees that received inconsistent education and training at prior institutions or employers. Inconsistencies in data entry methods, analytical software preferences, favored metrics, plot designs, and reporting formats occur frequently among different groups within state agencies. Thus, there is a need to develop tools to enable standardization within resource agencies. The R programming language is becoming the dominant method for fisheries managers to organize and analyze data, as well as to create tables and plots for reporting purposes. However, not all agency staff have adopted the R programming language as their primary analytical method. I developed a universal R script that can analyze datasets from various collection methods and export the results with tables and plots that are required for annual reports. Furthermore, to allow this complex R script to be utilized by all staff across the agency, regardless of their experience level with R, it was converted into a user-friendly Shiny application. This application utilizes a user interface that resembles a typical web page and allows users of all R expertise levels to upload datasets, analyze their dataset, and download results with tables and plots. The Shiny application will allow agency staff of all fluency levels to utilize the power of the R programming language, while at the same time standardizing data analysis methods across the agency by calculating key metrics and creating required plots with a repeatable, predictable process. This presentation will provide an overview of the Shiny application to illustrate its capabilities and to encourage other resource agencies to consider developing similar applications to aid in standardizing analytical and reporting processes.

Where the River Chubs spawn: A study of Nocomis micropogon nesting habitats

Joelle Ciriacy* (Tennessee Technological University), Christopher "Kit" Wheeler (Tennessee Technological University)

River Chub (Nocomis micropogon) provide pre-fertilization parental care by gathering gravel into large spawning mounds, or nests. Numerous minnow species (family Leuciscidae) spawn over these nests in addition to N. micropogon, a phenomenon called nest association. While the spawning habitat associations of other Nocomis spp. are reasonably well described, N. micropogon specializes in larger water bodies and its spawning habitat associations have not been described across a wide range of sites. In this study, we described the microhabitat and site-level habitat associations of N. micropogon nests. In the spring and summer of 2023, we searched for nests in 21 sites ranging widely in size and collected a suite of microhabitat and site-level habitat variables. We used Principal Component Analyses to identify microhabitat characteristics associated with N. micropogon nests. We then examined site-level habitat characteristics correlated with the presence of nests using t-tests and Wilcoxon rank tests. We found that N. micropogon exhibits some preference toward certain microhabitat features; in particular, nests were constructed in areas with slower water velocity than present in the surrounding habitat. Nest presence at the site-level was also associated with higher proportions of pool habitats, lower proportions of riffle habitats, greater wetted widths, and greater maximum depths. We conclude that maintaining a stream's natural flow regime could be key to the spawning success of N. micropogon and its nest associates. Some hypothesize that N. micropogon nests may facilitate the reproduction of these nest associates and that managing for the habitat preferences of spawning fishes is essential to their conservation.

Simulating Tradeoffs Between Fishing Quality and Economic Performance of a Reservoir Black Bass Fishery with High Tournament Effort

Natalie Coash* (Auburn University, SFAAS), Matthew Catalano (Auburn University, SFAAS)

Black bass (Micropterus spp.) populations in the southeastern US are subject to high catch-and-release angling effort partly attributable to the popularity of fishing tournaments. Systems with high catch-and-release rates, and low post-release survival, can have catch-and-release mortality rates that exceed harvest mortality, possibly resulting in negative effects on fishing quality. Tournaments may have a stronger negative impact on fishing quality due to higher post-release mortality in comparison to non-tournament catch and release angling. However, tournaments also provide economic benefits through increased expenditures in local communities. The objectives of this study are to evaluate the trade-offs between economic benefits and fishing quality across a gradient of increasing black bass tournament fishing effort at Neely Henry Lake, a 4,500-hectare reservoir within the Coosa River Basin in northeast Alabama. We utilize a dynamic age structured simulation model that includes a sub model for fishing-related economic expenditures. The model allows for differential effort, post-release mortality, and effort-related expenditures between tournament and non-tournament anglers. The model is informed by a current intensive reward/telemetry tagging study being conducted on Neely Henry as well a tournament and non-tournament bass angler survey. The angler survey utilizes a mixed methods approach including access point and roving creel survey methods with contingent behavior questions to further understand the angler effort and behavior of both groups of anglers in several hypothetical management scenarios. The survey is used to inform the reallocation of angler effort and expenditures under various simulation scenarios when evaluating valuable tradeoffs. In summary, we came up with a framework to evaluate tradeoffs between fishing quality and the economic performance of tournament angling. Agencies can utilize this information to construct management regulations that maximize the benefits of the tournament fishing industry as well as support a high-quality fishery with desirable catch rates and size structure.

Estimating Muskellunge growth using long-term mark-recapture in a Tennessee stream

Will Collier* and Brandon Simcox (Tennessee Wildlife Resources Agency)

Tennessee's native Muskellunge (Esox masquinongy) were once found throughout the upper Cumberland and Tennessee River systems. By the 1950s, poor water quality and reservoir impoundment had restricted muskellunge on the Cumberland Plateau to just a handful of streams. To mitigate the decline of muskellunge, the Tennessee Wildlife Resources Agency (TWRA) initiated a stocking program in 1976 utilizing the southern subspecies (E. m. ohioensis). TWRA ceased stocking the Collins River, a Cumberland River tributary, in 2013 due to evidence of natural reproduction and raised the minimum length limit the following year from 914 mm to 1270 mm to promote a self-sustaining population. The Collins River, the unofficial "Home of the Southern Musky", now boasts a popular riverine Muskellunge fishery that attracts anglers from across the United States and Canada. Since 2011, TWRA has implanted passive integrated transponders (PIT tags) in 326 Muskellunge and recorded 120 recapture events. A Fabens growth model was used to assess female (N = 42) and male (N = 55) Muskellunge growth characteristics. Estimates of asymptotic length (L_∞) and growth coefficient (K) differed between sexes: Female (L_∞=1108, K = 0.25) and Male (L_∞=1034, K = 0.20). While this is an ongoing project and more powerful mortality estimates are forthcoming, an assessment of current fishing regulations should be considered as the minimum length limit is much greater than the asymptotic length of both sexes.

Managing for angler success at Fall Creek Falls Lake, a Bill Dance Signature Lake

Will Collier (Tennessee Wildlife Resources Agency)

The Bill Dance Signature Lakes initiative kicked off in 2020 as a partnership between Tennessee Wildlife Resources Agency (TWRA), TN Dept. of Environment and Conservation (TDEC) State Parks, and TN Dept. of Tourism Development committed 15 million dollars for improvements on 18 lakes. Planned improvements have ranged from intensive management of 8 small lakes to improve game fish populations, habitat, and facilities to the improvement of access areas and access facilities on 10 large reservoirs to create fishing experiences worthy of bearing the fishing legend's stamp of approval. The eight small impoundment fisheries, advertised as "small venue" lakes, entice anglers of all ages to go fishing and enjoy quality fishing with above average catch rates. Fall Creek Falls Lake, a 295-acre impoundment of Fall Creek, was chosen due to its location within Tennessee's most visited state park, superb bank access, and history of producing state record Bluegill and Channel Catfish. The lake was created in 1969 and provides fishing opportunities via multiple bank access points, miles of paved trails, a new lodge, 20 lakeside cabins, boat ramp, two fishing piers, and boat and kayak rentals. With the increases in funding and interest in maximizing potential in these small lakes, TWRA has taken an intensive fisheries management approach to developing these fisheries by utilizing bathymetric mapping, artificial habitat installation, supplemental feeding, and stocking of forage and advance-sized sportfish. Biannual electrofishing surveys have revealed a notable increase in Largemouth Bass size structure and mean relative weight of Bluegill since 2020, and a 2023 creel survey has shown that angler effort and direct expenditures on this small impoundment rival much larger lakes. By all accounts, the significant investment and ensuing management activities have improved an aging fishery and enhanced angling opportunity in an economically depressed locale.

Muskies on the Edge: The French Broad River, NC

Derek Crane* (Department of Biology, Coastal Carolina University), Amanda Bushon and Scott Loftis (North Carolina Wildlife Resources Commission)

Muskellunge are native to river systems of southern Appalachia, but unfortunately, they have been extirpated from many waters or populations are reliant on stocking. The upper French Broad River in NC represents the southeastern extent of the Muskellunge's native distribution, but the population was likely extirpated by the mid-20th century. Stocking of Muskellunge in the French Broad River began in the 1970s and currently annual stocking maintains a popular fishery in about 50 km of the upper river. Given the popularity of the fishery, estimation of contemporary population characteristics are needed to guide management actions and provide information to anglers about the resource. Additionally, data from this study will serve as a baseline for comparison in future studies that evaluate the effects of extensive, ongoing habitat restoration efforts. To estimate abundance, growth, and longevity we initiated a 5-year study based on late winter – early spring electrofishing of a 51.2 km reach between Brevard and Asheville, NC. Annual abundance was estimated with the Lincoln-Peterson closed population model, based on repeated sampling of the entire study reach over a 3-week period. Von Bertalanffy growth parameters and longevity were estimated based on age assignments from anal fin rays, known age, or partial known age. Abundance of fish ≥762 mm was 78 (95% CI = 47–161) in 2022 and 51 (95% CI = 38–77) in 2023. Estimates of L_∞ are comparable to other river populations in the southern portion of the Muskellunge's distribution (L_∞ male = 1069 mm TL, L_∞ female = 1175 mm TL), but fish in the French Broad River appear to live longer (max age = 19). Sampling will continue through 2024 and allow for refinement of estimates that will inform future management actions.

O Sturgeon, Where Art Thou? Movement and Habitat use of Juvenile Gulf Sturgeon in a non-natal river

Caden Perry* (Florida Fish and Wildlife Conservation Commission)

Gulf Sturgeon (Acipenser oxyrinchus desotoi) are theorized to have differing habitat use patterns at different life-stages. To better understand these differences juvenile and subadult individuals were acoustically tagged in the Yellow and Escambia rivers during the sampling periods. They were monitored by a Pensacola Bay watershed acoustic array (N=74) year-round to determine differences in habitat use between the cohorts. Fine(<1km) and large(>5km) scale movements were observed among all individuals in the rivers and bays with the juveniles (age 1-4) as well as non-natal river usage. This presentation will be an overview of the four-year collaborative project focused on Escambia and Yellow River.

Management of a Landlocked Striped Bass Population in the Upper Coosa River Basin in Northwest Georgia

John Damer* (Georgia Department of Natural Resources)

There are only a handful of landlocked Striped Bass Morone saxatilis populations in North America that are self-sustained through natural reproduction. We present a case study on one such population that inhabits Lake Weiss and the upper Coosa River Basin (UCRB) in Alabama and Georgia. This population is of high importance to local anglers as it supports a popular sport fishery, but it also has statewide significance as a primary broodstock source for Georgia Department of Natural Resources (GADNR) production and stocking programs. A decade ago, both anglers and GADNR staff observed possible Striped Bass population declines in the UCRB. However, at the time there was no targeted monitoring that could confirm these qualitative observations or suggest causes for such declines. A Striped Bass monitoring program was initiated by GADNR in 2014, which continues to the present. Sampling is conducted in the spring each year via boat electrofishing coincident with the spawning run in the major rivers of the UCRB. Sampling data showed an immediate and significant decline in Striped Bass abundance over the first 5 years of the study and revealed poor spawning success in most of those years, suggesting partial recruitment failure likely contributed to the overall population decline. Supplemental annual fingerling stocking was initiated in 2018, resulting in more stable recruitment and increasing CPUE from 2019-2023. We are hopeful that the population will continue to rebound, but other factors (thermal stress, increased fishing pressure, new parasites) may continue to negatively impact the number and size of Striped Bass in the UCRB.

If You Renovate It, They Will Come - The Story of Louisiana's Trophy Bass Fishery

Ryan Daniel* (Louisiana Department of Wildlife and Fisheries)

Creating opportunities to catch trophy size Largemouth Bass (Micropterus nigricans) has been an important goal of the Louisiana Department of Wildlife and Fisheries (LDWF) since the early 1980s. Bussey Brake Reservoir, located in Morehouse Parish Louisiana, was donated to LDWF In 2013, and to capitalize on this opportunity, biologists developed renovation and management plans focused on creating a unique trophy-bass fishery. An extended drawdown period resulted in the establishment of beneficial vegetation throughout the lake bottom, essentially creating a 'new-lake' environment.

These ideal habitat conditions, combined with stocking of adult Florida Largemouth Bass (M. salmoides) and appropriate complimentary species, resulted in immediate positive results upon opening the reservoir in July 2020. Sample data reflects significant growth rates over the past 5 years, with some individuals averaging growth of 2 pounds/year. A creel survey conducted from January to June 2023 estimated bass fishing pressure to be 105 hours/acre, bass catch rates to be 1.63 fish/angler trip, and bass harvest rates to be 0.145 fish/angler trip. Visitation rates increased from 5,500 visits in 2022 to over 7,000 in 2023, due mainly to numerous catches of trophy-size bass and national television exposure.

The Largemouth Bass fishery at Bussey Brake is currently managed with a 16-inch maximum length limit, allowing for possession of one fish exceeding this length, and a total creel limit of 5 fish. The lake is currently providing an exceptional opportunity to catch trophy fish and has the potential to produce a new state-record Largemouth Bass for Louisiana. Continued high fishing pressure and the current regulations should maintain moderate catch and sustainable harvest rates in the immediate future. As productivity and fishing pressure change with the natural aging process of the lake, habitat work and changes in regulations will likely be required to maximize catch rates and trophy potential.

Canal Conundrum: a horizon scan of non-native aquatic species associated with the Tennessee-Tombigbee Waterway

Wesley M Daniel* (U.S. Geological Survey, Wetland and Aquatic Research Center), EM Dean (Cherokee Nation System Solutions)

The Tennessee-Tombigbee Waterway (Tenn-Tom) is an anthropogenic navigation route in the southeastern United States that spans approximately 234 miles, connecting the Tennessee River to the Gulf of Mexico via the Tombigbee River. This channel system was created to foster economic development, facilitate commerce, and promote regional connectivity. The Tenn-Tom featuring a series of locks and dams that enable the efficient transport of goods and materials and potentially non-native and exotic aquatic species. The connection of the historically discrete watersheds of the Tennessee River in the Mississippi River Basin with the Tombigbee River in the Mobile River Basin has allowed for the movement of aquatic species into novel non-native areas. Several studies have already documented the movement of exotic invasive carp (Hypophthalmichthys molitrix) and native species like silversides (Menidia audens and Labidesthes sicculus), catfish (Ictalurus furcatus and I. punctatus), and Ouachita Map Turtle (Graptemys ouachitensis) through the Tenn-Tom. This presentation will highlight a project to assessing 804 native and exotic aquatic species that are found in both the Mobile and Upper Mississippi Basins for species that could move through the Tenn-Tom into non-native waters. The Tenn-Tom horizon scan is assessing the potential of fish, aquatic plants, reptiles, amphibians, and invertebrate species to spread, establish, and cause impacts in the corresponding non-native waters. The resulting watch lists of species can be used by managers for awareness of high-risk species that have the potential to invade new waters north and south of the Tenn-Tom.

Quantitative Analysis of Pearl Darter, Percina aurora, habitat in the Pascagoula River Watershed

Malia Davidson* (The University of Southern Mississippi), Jake Schaefer (The University of Southern Mississippi)

Freshwater rivers are extremely complex ecosystems that can be driven by hydrologic, geomorphic, chemical, and biological processes. Altering the habitat of rivers can alter the suitability of the Freshwater rivers. There is a rich history of studies correlating hydrological stability and fish assemblage structure, suggesting a link. In general, benthic species are more prone to extirpation due to habitat alteration and their close association to substrate. A common habitat for benthic fishes is sand bars that are created during sediment being moved by the water flow. In addition to changes in sediment stability, flooding events can also have a large effect on freshwater river habitat. 2-dimensional flow models are a powerful tool that can examine flow patterns in river channels at varying flood stages. More recently, they can even be used to assess the suitability of aquatic habitat for aquatic organisms, such as fishes.

The Pearl Darter, Percina aurora, was formally described in 1994 by Suttkus et al. and has been listed as threatened under the US Endangered Species Act due to its contracting range. Pearl Darter habitat was theorized to vary between reproductive and non-reproductive habitat. Though, little is known about the factors that qualify habitat suitable for Pearl Darters. The purpose of this study was to determine quantitative factors of both theorized habitats that could indicate suitable Pearl Darter habitat. A 2-Dimensional flow model was created for the Bouie River in the Pascagoula River Watershed where known Pearl Darter populations exist. This provided new information on the hydrological conditions when Pearl Darters were detected.

Long term historical fish assemblage analysis in the Red River, Louisiana shows assemblage change attributable to lock and dam construction; a multi-metric approach elucidates underlying causes

Thomas A. Dodson* (Department of Ecology and Conservation Biology, Texas A&M University, College Station, TX), Kyle R. Piller (Department of Biological Sciences, Southeastern Louisiana University, Hammond, LA)

The Southeastern United States is rich in freshwater fish diversity. However, habitat alteration has a profound impact on fish assemblages across this region. The Red River, Louisiana has historically been diverse in fishes. In the 1980's and 1990's a series of five lock and dams were constructed on the Red River to facilitate watercraft traffic. To assess assemblage changes attributable to lock and dam construction, I analyzed historical survey data from the Red River between 1966 and 2002. I compared changes in assemblages pre- and post-construction of the first lock and dams using species composition and richness, life history strategist composition, and functional richness. The results show similar species richness across time, but the data also show a shift in assemblage composition after dam construction with three distinct periods corresponding to pre-construction, during construction, and post-construction of lock and dams. Life history analyses are similar, with the time periods following the first lock and dam construction showing a rapid decline in Periodic species and a increase in Equilibrium species. Functional richness also decreases following lock and dam construction. These results indicate a multi-metric approach may be the most informative when examining assemblage change."

Florida: Trophy Bass Fishing Capital of the World?

Jason Dotson* (Florida Fish and Wildlife Conservation Commission), Allen Martin (Florida Fish and Wildlife Conservation Commission), Drew Dutterer (Florida Fish and Wildlife Conservation Commission)

Florida is the birthplace of trophy bass fishing, and reigned as the undisputed trophy bass fishing capital of the world before floridanus was transplanted across the globe. From 1911 – 1969, only four of the largest bass entered in the annual Field & Stream Fishing Contest came from outside of Florida. This time-period coincided with minimal fisheries management, but Florida's trophy bass production was fueled by the right genetics, a water rich landscape with pristine habitat, and natural hydrological cycles. Pioneer anglers built a reputation for Florida's supreme bass fishing, which spurred an explosion of fish camps and guide services. Substantial increases in fishing effort with unsustainable harvest coupled with deteriorating water quality and habitat led to declining trophy catches. Over the next several decades, Florida began managing bass fisheries more intensively with harvest restrictions, stock enhancement, and habitat restoration efforts. While Florida bass fisheries were recovering, California, Texas, and other states began introducing Florida Bass and managing trophy fisheries with incredible success. California produced 20 of the heaviest 25 bass ever caught between 1973 – 2006. Texas launched the ShareLunker program in 1986 and the first submission was a new state record famously named "Ethel", which helped propel Texas into the national spotlight of trophy bass fishing destinations. By the 1990s Florida was no longer the trophy bass capital. In 2010, Florida developed a comprehensive Black Bass Management Plan with a vision to re-establish Florida as the "Bass Fishing Capital of the World" through innovative fish, habitat, and people management. TrophyCatch, a citizen-science trophy bass documentation program, became the flagship program to promote Florida trophy bass fishing while generating data to better inform research and management. The success of these investments ultimately led to the development of the Florida Trophy Bass Project, which will be presented in a companion talk.

The importance of spatial scale and host distribution in modelling suitable habitat for a recently federally listed mussel species

Seth Drake*(Arkansas Tech University), Tom Nupp (Arkansas Tech University), Kendall Moles (Arkansas Game and Fish Commission), Kyler Hecke (Arkansas Tech University)

Over 300 species of Unionid mussels occur in North America, more than any other region in the world. Historically numerically dominant, Unionid mussels are now one of the most threatened faunal groups with an estimated 65% considered imperiled. The Ouachita Fanshell (Cyprogenia sp cf. aberti) is a species of mussel native to the Ouachita Mountains that was recently listed as threatened. This species is experiencing declines in historical ranges potentially as a result of habitat alterations from impoundments and agricultural land use. Furthermore, a recent study found genetic differences amongst populations in the Saline and Ouachita River watersheds. As such, our study used maximum entropy modelling (Maxent) to further define reaches of suitable habitat for this species. We compiled occurrence records from the Global Biodiversity Information Facility (GBIF) and the Arkansas Game and Fish Commission mussel database. Environmental variables encompassing atmospheric data, hydrology, soil/geology, landcover, and topography were compiled from databases such as WorldClim and StreamCat and were reduced through principal component analysis. We investigated how the scale of consideration (whole watershed versus split watershed) and incorporation of biological data (e.g. fish hosts) impacted estimates of habitat suitability. We found some differences in amount and position of predicted suitable habitat between environmental only and environmental plus fish host models (1260 vs 1147 km). Furthermore, the spatial scale of consideration changed the contribution of environmental variables and position of predicted suitable habitats. Our analysis provides insight into factors affecting the distribution of Ouachita Fanshell and can provide insight to methodological considerations for modelling habitat suitability for aquatic species.

Micropterus Rising: A Short History of the Bass Boom

Ken Duke* (Fish Insider, The Big Bass Podcast, Bass After Dark)

There is little doubt that the Micropterus genus is the most impactful in all sportfishing, but especially in American sportfishing, and most particularly in the Southeast, where we count ourselves as lucky to live and work in the "Bass Belt."

It hasn't always been that way. Until the late 19th century, the black bass was almost universally considered inferior to the trout. Serious, thoughtful anglers pursued trout, and they did it with a fly rod. Sportsmen of the time maintained that trout lived in beautiful places, trout anglers were better people, and trout literature was superior. Conversely, bass lived in alligator- and snake-infested swamps, bass anglers were second class citizens, and bass writing strived to appear illiterate.

That attitude began to change with the publication of James Henshall's Book of the Black Bass (1881). Henshall predicted the rise of the bass as a result of "progress." Later, men like Jason Lucas (Sports Afield) and Ray Scott (Bass Anglers Sportsman Society) picked up the mantle so that by the early 1970s the black bass was clearly established as America's fish.

The presentation will highlight key developments that led to the rise of the black bass in America, the Americas, and overseas. It will attempt to explain and connect the events — natural and man-made, intentional and inadvertent — that have made the black bass the most sought-after gamefish in the world and the primary driver of the American sportfishing industry.

Believe it or not – A Bayesian network for estimating imperilment of data-deficient fishes

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North America's rich and highly imperiled freshwater fauna can challenge the capacity of management agencies charged with preventing species extinction. Most North American fishes, crayfishes, and mussels are knowledge- and data-deficient, which can limit analytical options for modeling imperilment risks under formal conservation assessments. Our goal is to develop a standardized and rapid approach that estimates imperilment risks of data-deficient freshwater fishes using a Bayesian belief network. Our belief-network model is built around the conservation principles of resiliency, redundancy, and representation (the 3 R's framework) and can be informed by disparate data sources including distributional occurrences, literature, species traits, dispersal indices, and expert opinion. We ground-truth our model by examining whether our model can reproduce findings of recent Species Status Assessments under the U.S. Endangered Species Act of three fish species with differing life histories and reported imperilment: Carolina Madtom (Noturus furiosus, deemed currently having "very limited" resiliency), Candy Darter (Etheostoma osburni, deemed currently having "moderate" resiliency), and Ozark Chub (Erimystax harryi, deemed currently having "moderately high" resiliency). There was substantial agreement between resiliency predicted by the belief network and the assessment-reported resiliency of populations within individual management units despite the original Species Status Assessments using different analytical methods and metrics (Carolina Madtom, Cohen's kappa [k] = 0.63, $p = 0.02$; Candy Darter, k = 0.75, $p < 0.01$; Ozark Chub, k = 0.53, $p < 0.01$). These results indicate our belief-network approach could help overcome capacity and standardization challenges when assessing imperilment risks of data-deficient species within an efficient and repeatable framework.

Experimental Use of Rainbow Trout as Trophy Bass Forage in Florida

Drew Dutterer* (Florida Fish and Wildlife Conservation Commission), Allen Martin (Florida Fish and Wildlife Conservation Commission), Jason Dotson (Florida Fish and Wildlife Conservation Commission), Summer Lindelien (Florida Fish and Wildlife Conservation Commission), Steve Beck (Florida Fish and Wildlife Conservation Commission)

Stocking catchable-size Rainbow Trout (Oncorhyncus mykiss) in support of put-and-take fisheries is common across North America. In some cases, these fish unintentionally become abundant forage sources for large piscivorous fishes, boosting some individuals to exceptional trophy sizes. This phenomenon was likely responsible for catapulting trophy Florida Bass (Micropterus salmoides and M. salmoides x Largemouth Bass M. nigricans hybrids) fisheries in California into world renown during the 1980s and 1990s. During that time, anglers there caught and documented 19 of the world's largest known 25 bass from reservoirs regularly stocked with Rainbow Trout. We explored the utility of stocking Rainbow Trout as supplemental forage for Florida Bass in Florida, where trophy bass management is a high priority. Over the past three winters, we experimentally stocked Rainbow Trout in three North Florida waterbodies while incrementally increasing stocking rates. Each year, we monitored a subsample of stocked trout with telemetry tags to estimate depredation rate, and results indicated that most trout were rapidly eaten. We also monitored survival as a function of water temperature by stocking trout into predator exclusion pens at each lake. Mortality of trout in the holding pens typically began after several consecutive days of water temperatures exceeding 70°F (mid-March). No trout remained alive after sustained water temperatures exceeding 75°F (early May). These results confirm that there is little risk of long-term survival of Rainbow Trout in Florida lakes due to warm summertime water temperatures, but our results also suggest that stocking them as supplemental forage for trophy bass is feasible over a 4–5-month period annually during winter and warrants further examination. Our current plan is to maintain experimental trout stocking at selected waterbodies for multiple consecutive years while monitoring Florida Bass populations via several fisheries-dependent and fisheries-independent mechanisms.

The effects of dams and a nonnative species, Faxonius virilis, on the trophic interactions of stream crayfishes in the Upper Cahaba Drainage, Alabama

Riley Egan* (Troy University), Zanethia Barnett (US Forest Service), Brian Helms (Troy University)

The effects of introduced crayfish and dams can alter stream communities, however, their combined effects are poorly understood. Faxonius virilis has been introduced into the Cahaba River drainage (Alabama) where it is often a dominant species. With over 117 dams throughout the Cahaba River drainage, the effect of F. virilis and dam alterations could be significant on native crayfish populations. By taking a food web approach, we investigated the impacts of F. virilis and dams on native crayfishes in the Upper Cahaba drainage. Six Impounded streams were sampled on 2 reaches each ("sites" immediately downstream of dam and ~1km downstream of dam). We repeated this sampling strategy in 4 unimpounded streams (10 streams, 20 sites total). We then compared diet and trophic position of native and introduced crayfishes using gut content analysis and stable isotope analysis across 4 "site types" (upstream/impounded; downstream/impounded; upstream/unimpounded; downstream/unimpounded) with varying abundances of F. virilis. Sampling revealed 6 species across all sites, however individual sites typically were dominated by one species with 1-2 subordinate species. There was no strong association between dams and F. virilis presence/absence. Crayfish trophic position ranged from 1.25 to 2.6 with an average of 1.84. Linear models showed no significant differences in crayfish trophic position across site types, and presence/absence and relative abundance of F. virilis had no effect on the trophic position of native crayfishes. Similarly, percent composition of food categories in the guts of native crayfish was not influenced by the presence of dams or F. virilis. However species guts were significantly fuller in unimpounded sites than impounded sites, but the presence of F. virilis had no influence on native gut fullness. These data suggest significant overlap in native and introduced crayfish diet, trophic ecology, and environmental tolerance.

The Caney Mountain Cave Crayfish (Orconectes stygocaneyi): establishing a habitat parameter baseline with additional biological notes

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The Caney Mountain Cave Crayfish, Orconectes stygocaneyi, is among the rarest crayfishes in North America, listed as “Endangered” by the state of Missouri, and is the only species in the genus Orconectes west of the Mississippi River. Its entire known range is less than 20 ha, specifically in one pool of water in the small, linear Mud Cave, on the 3,200 ha Caney Mountain Conservation Area in Ozark County, Missouri. Mud Cave’s lone pool of water is likely recharged by surface runoff with little to no subterranean hydrologic connectivity to other karst features. Although previous studies have collected preliminary natural history information, little is known about habitat parameters in Mud Cave such as water quality and interior pool volume, or how these parameters vary intra-annually. Our goal is to gain a greater understanding of these characteristics via monthly sampling across a 12-month period and establish a baseline for future monitoring. In addition to studying habitat parameters, we are opportunistically capturing crayfish and collecting additional life history data to supplement previous studies and have deployed game cameras at the cave entrance to examine potential crayfish predators. A comprehensive understanding of this species and its habitat will identify risks to its persistence and inform future conservation efforts.

How many organizations does it take to save a fish? Research and conservation in the Coosa Basin, Georgia

Anakela Escobar* (Georgia Department of Natural Resources), Joseph Kirsch (US Fish and Wildlife Service), Katie Owens (the Nature Conservancy), Stephen Bontekoe (Limestone Valley RC&D), Phillip Bumpers (University of Georgia)

The upper Coosa River Basin in Northwest Georgia is a hotspot for freshwater biodiversity, home to 150 species of fish, mollusk, and crayfish. Long-term monitoring in major Coosa tributaries has revealed a declining trend for many fish species, including those with state and federal protections. Anecdotal and historic records for mollusks indicate similar trends. There has been conservation interest in the area for decades, and in recent years several organizations have created full-time positions to focus exclusively on conservation in the upper Coosa. These and other organizations have informally formed the Partnership for the Upper Coosa (PUC). The PUC provides a forum for government, academic, and non-governmental organizations to regularly communicate and collaborate on research and conservation initiatives. One focal area of the partnership is Holly Creek, a tributary of the Conasauga River and habitat for many species of conservation interest. In 2018, monitoring for fish, mussel, and aquatic insect communities began in the hopes of evaluating the efficacy of conservation activities being implemented in the watershed. These activities include bank stabilizations, riparian enhancement, livestock exclusions, and aquatic organism barrier removal. Holly Creek is not the only area of conservation interest, and PUC actions encompass much of the Coosa Basin in Georgia and include other research, outreach, and management initiative.

Bringing Back the Natives: Reintroduction of Five Large River Associate Species in the Upper French Broad River

Luke Etchison* (NC Wildlife Resources Commission), Dylan Owensby (NC Wildlife Resources Commission), Chantelle Rondel (NC Wildlife Resources Commission)

The French Broad River is one of the oldest rivers in the world. From its headwaters in North Carolina to where it joins the Holston River to create the Tennessee River in East Tennessee, the French Broad River is home to an exceptionally high amount of aquatic biodiversity. The recent publication, An Annotated Atlas of Freshwater Fishes of North Carolina (Tracy et al. 2020), documented ~76 indigenous fish species from historical and recent collection data from the North Carolina sections of the French Broad River Basin. However, anthropogenic alteration over the last few centuries in the French Broad River and its tributaries have led to extirpations and population declines for many of its known and unknown historical species. Since Congress passed the Clean Water Act in 1972, the water quality of the French Broad River has drastically improved, but barriers to expansion (e.g. dams) limit the potential recovery of many historical fish species without stocking or translocation. Starting in June 2022, Black Buffalo (Ictiobus niger) Smallmouth Buffalo (Ictiobus bubalus), Smallmouth Redhorse (Moxostoma breviceps), Freshwater Drum (Aplodinotus grunniens), and Gizzard Shad (Dorosoma cepedianum), were reintroduced into the upper French Broad River. A combination of long-term monitoring sites and PIT antenna arrays will help track this reintroduction into the future.

Estimating adult Atlantic Sturgeon abundance in the Great Pee Dee River using side-scan sonar and N-mixture modelling

Troy M. Farmer* (Clemson University), Colby D. Denison (New Hampshire Fish and Game Department), Amy M. Cottrell (Great Lakes Indian Fish and Wildlife Commission), Dewayne A. Fox (Delaware State University), David M. Hood (South Carolina Department of Natural Resources), William C. Post (South Carolina Department of Natural Resources), Ellen Waldrop (South Carolina Department of Natural Resources), and Brandon K. Peoples (Clemson University)

Populations of Atlantic Sturgeon Acipenser oxyrinchus have been greatly reduced from historical levels due to exploitation and habitat alteration. Reliable abundance estimates are needed to assess current population status and to inform recovery strategies. Using side-scan sonar to estimate Atlantic sturgeon abundance has several advantages over traditional mark-recapture methods including the ability to sample large areas efficiently and to minimize or eliminate handling stress. In this study, we conducted side-scan sonar surveys along a 70 km section of the Great Pee Dee River, South Carolina, and used N-mixture models to predict daily abundance of adult Atlantic sturgeon and the effect of environmental covariates. Atlantic Sturgeon in the Great Pee Dee River exhibit dual annual spawning and a total of 65 daily sampling occasions were conducted between March and November 2021 in an effort to survey both spring and fall spawning runs. Across all daily sample occasions, detections ranged from 1-93 and abundance estimates ranged from 7-425. Discharge positively affected abundance of both spring and fall run fish, and temperature positively affected abundance of spring run fish. Discharge negatively affected detection probability for fall run fish. Our results suggest side-scan sonar is a viable and non-invasive alternative for estimating Atlantic sturgeon abundance, and provide insight into the environmental covariates affecting abundance and detection in this system. These methods can be applied elsewhere to assess population status and evaluate the success of management decisions.

Allopatric Speciation of the Fundulus subgenus Xenisma in the Central Highlands Ecoregion

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The Central Highland ecoregion of the eastern United States represents a hotspot of freshwater biodiversity, with replicated patterns of vicariant speciation east and west of the Mississippi River Delta. A previous phylogeographic investigation of the studfishes (Fundulus subgenus Xenisma) revealed evidence for vicariant speciation in the Central Highlands, but data were limited to a small number of gene sequences generated with sanger technology. We used double digest restriction-site associated DNA sequencing (ddRADseq) to improve resolution of phylogeographic patterns and better characterize population genetic variation. Our sample design included 90 individuals from the Fundulus catenatus species group (F. catenatus, F. sp. cf. catenatus, F. bifax, and F. stellifer) and four individuals from two outgroup taxa within the subgenus (F. julisiae, F. rathbuni). Phylogenetic analyses support four monophyletic groups within the Fundulus catenatus species group, including monophyly for the two Mobile Basin species (F. bifax, and F. stellifer) and two clades representing the Northern Studfishes (F. catenatus and F. sp. cf. catenatus). Individual ancestry coefficients provide evidence for geographically contiguous subdivisions of F. catenatus (n=3) and F. sp. cf. catenatus (n=4). Results of this study reveal evidence for long term isolation of F. catenatus, which is geographically restricted to the Tennessee River watershed. A sister species is native to southern tributaries to the Ohio River and western tributaries to the Mississippi River. A population introduced to Indiana in recent decades is shown here to descend from a clade native to drainages of the Ozark Highlands. Overall, results of this study corroborate previous evidence for a complex biogeographic history of taxa endemic to rivers of the Central Highland ecoregion. The improved resolution of genomic variation among studfish populations will guide future studies of morphological variation, and will improve conservation plans for rare and endemic taxa in a freshwater biodiversity hotspot.

Changing habitat or changing connectivity: How grade control structures affect fish assemblages in North MS streams

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In addition to having high diversity of stream fishes, streams in the hills of the Yazoo Basin in North Mississippi have a long history of land use modification and subsequent erosion control issues. To address widespread instream erosion, over 160 low-drop grade control structures (GCS) were installed in the late 1980s and early 1990s as part of the federally funded Demonstration Erosion Control project. We assessed the effects of these GCS on fish assemblages, channel morphology, and instream habitat approximately 30 years post-installation. Analyses revealed that the GCS were successful in checking channel incision moving headward in the streams: sites upstream of the GCS were less incised and had greater accumulations of fine substrates compared to downstream sites and sites on streams lacking erosion control structures. The GCS could potentially affect fish assemblages through two different mechanisms: 1- habitat modification or 2- selective filtering of the assemblages by acting as barriers to upstream migration. Analysis of beta diversity revealed that diversity was driven by species replacement rather than nestedness, which indicates that differences in the assemblages were due to differences in habitat rather than barriers to fish passage. Analysis of catch per effort data confirmed differences in assemblage structure that echoed the instream habitat differences revealed in the stream morphology analysis.

Come Hell or Highwater: Gage Height Mitigates Silver Carp Movement at Reelfoot Lake Tennessee

Tom Flanagan*, Matthew Combs, Jerod Grooms, and Cole Harty (Tennessee Wildlife Resources Agency)

Reelfoot Lake is 6,000-hectares and is the only natural lake located in Tennessee. Water levels are controlled by a spillway structure located on the south end of the lower basin, which is controlled by U.S. Fish and Wildlife Service. During high water events, water levels equalize between Reelfoot Lake and Running Reelfoot Bayou, allowing Silver Carp to enter and exit Reelfoot Lake. The frequency and timing of Silver Carp immigration and emigration are unknown. Vemco VR2W-069k acoustic receivers (n=6) were deployed in Reelfoot Lake and drainage 2022. Four receivers were placed in Reelfoot Lake, one receiver was placed below the spillway, and one receiver was placed approximately 16 km downstream of the spillway in Running Reelfoot Bayou. Silver Carp (n=50) were implanted with Vemco 16-4x acoustic telemetry tags and organized into three separate categories: lake fish, translocated fish, and spillway fish. Lake fish were captured within Reelfoot Lake and released in Reelfoot Lake (n=13), translocated fish were captured within Reelfoot Lake and translocated below the spillway (n=25), and spillway fish were captured below the spillway and released below the spillway (n=12). Silver Carp (n=35) were detected on at least one acoustic receiver indicating minimal delayed mortality from surgery. Spillway crossings occurred between April 11th, 2022, and May 5th, 2022 during a high water event where water levels equalized between Reelfoot Lake and Running Reelfoot Bayou below the spillway. During this high-water event, gage height exceeded median daily levels below the spillway and Silver Carp (n=12) were able to cross the spillway, effectively entering or exiting Reelfoot Lake unimpeded. Silver Carp tagged in Reelfoot Lake were detected on multiple receivers outside of Reelfoot including receivers in the Mississippi and Ohio Rivers. Further tagging and monitoring of receivers in Reelfoot Lake is vital to understanding how Silver Carp immigrate and emigrate various waterbodies.

Translocation and Monitoring of the Meadow River Mudbug (Cambarus pauleyi), a Primary Burrowing Species of Crayfish: Efforts, Results, and Implications Following Four Years of Relocation Efforts

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The Meadow River Mudbug (Cambarus pauleyi) is a primary burrowing crayfish endemic to West Virginia's Meadow River drainage in southeast West Virginia. Following its description in 2015, a large project was set to cross through its known range. Despite not yet being listed, the West Virginia Division of Natural Resources (WVDNR) issued a request for habitat surveys along the project's footprint through the crayfish's range and two large colonies were identified. WVDNR requested relocation of the colonies, and in 2018, 2020, 2021, and 2023 salvage and relocation efforts for the crayfish were conducted using baited lines, net jabbing, nocturnal searches, and burrow excavation. In 2018, 186 C. pauleyi including 75 juveniles, 48 females, 14 Form II males, and 49 Form I males were collected. In 2020, an additional 115 including 59 juveniles, 35 females, 14 Form II males, and 7 Form I males of C. pauleyi were collected. In 2021, an additional 93 including 52 juveniles, 30 females, 8 Form II males, and 3 Form I males of C. pauleyi were collected, and in 2023, an additional 96 including 32 juveniles, 30 females, 29 Form II males, and 5 Form I males of C. pauleyi were collected. Herein we discuss the efforts utilized during the survey as well as our results. We also discuss the implications the success of the project has, not only for other species of imperiled burrowing crayfish, but for imperiled species of fauna that utilize the burrows of these crayfish as their primary habitat.

Factors related to successful hatching and daily growth rate of Shoal Bass (Micropterus cataractae) and Largemouth Bass (M. salmoides) in the lower Flint River catchment

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Changes in environmental factors have important implications for the successful hatching and early growth of stream fishes. Shoal Bass (Micropterus cataractae) and Largemouth Bass (M. salmoides) are native to the Apalachicola-Chattahoochee-Flint (ACF) River Basin. Little is known about reproductive requirements and age-0 growth characteristics of these two species in riverine environments. Our study objective was to determine hatch timing and growth of both species as related to discharge patterns and water temperature. We collected 293 age-0 Shoal Bass and 523 age-0 Largemouth Bass from nineteen sites in the lower Flint River catchment in 2022 and 2023. Shoal Bass ranged from 19 to 117-mm total length (TL) (average: 77-mm TL). Largemouth Bass ranged from 23 to 111mm TL (average: 54-mm TL). Hatch date was determined for each fish through back-calculation using daily bands on otoliths. Shoal Bass hatched over a 40-day period in 2022 with a median hatch date of May 14th, whereas the range of 2022 hatch dates in Largemouth Bass was 78 days with a median hatch date of May 7th. Both species generally hatched during periods of low, stable discharges, with no successful hatches during high-water events. Additionally, no successful hatches were recorded below Albany Dam after hydropeaking began in the summer. Hatches occurred at water temperatures from approximately 16 to 29 °C. Overall, Shoal Bass growth was faster than Largemouth Bass by approximately 0.3mm/day. Fish collected from the mainstem Flint River also grew faster than those collected from tributaries for both species. Knowledge of spawning dynamics in these two species over multiple years will provide information useful to agencies concerned about recruitment success in these populations.

Fisheries management in Mississippi state-operated fishing lakes: A review and look to the future

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The Mississippi Department of Wildlife, Fisheries and Parks currently manages 19 State Lakes and 18 State Park Lakes (hereafter, State Lakes) distributed throughout Mississippi to create fishing opportunities in areas that would otherwise not have many. State Lakes vary in size from 6 to 357 hectares but are generally small (median = 40 hectares), lack habitat complexity, and have simplified fish assemblages often dominated by centrarchids. Common fisheries management problems within these small impoundments include habitat degradation, bass crowding, eutrophication, and reduced visitation. The goal of this study was to conduct a comprehensive analysis of past monitoring and management activities in State Lakes to enhance understanding of lake dynamics, further develop existing management initiatives, and identify alternative avenues for effective management. To achieve this objective, we have undertaken a comprehensive examination and synthesis of the historical background pertaining to State Lakes as well as their management approaches. Additionally, we have conducted an analysis of pertinent data encompassing many aspects such as the physical and chemical attributes of the lakes, the features of their respective watersheds, the composition of fish communities, and their fisheries. Based on our analysis, it is evident that these State Lakes possess distinct and diverse attributes that may be effectively adapted to cultivate a wide range of fisheries that are well-suited to the numerous regions within Mississippi.

Characterizing Dietary Overlap Between Invasive Silver Carp and Native Gizzard Shad in Kentucky and Barkley Reservoirs

Andrew Gable* (Tennessee Tech University), Dr. Mark Rogers (U.S. Geological Survey), Dr. Justin Murdock (Tennessee Tech University)

Managers have faced negative ecological impacts of Silver Carp (Hypophthalmichthys molitrix) invasion in the Upper Mississippi River System for nearly 50 years. More recently, Silver Carp have migrated throughout the Mississippi and Ohio rivers, into both the Tennessee and Cumberland rivers via lock and dam passage allowing for their introduction into reservoir ecosystems across the south. The invasion of Silver Carp has altered native aquatic communities and food web dynamics. Kentucky and Barkley reservoirs offer exceptional sport fishing and recreation opportunities in Kentucky and Tennessee. Silver Carp have been reported in high densities in these eutrophic reservoirs. The recent influx of planktivorous Silver Carp into Kentucky and Barkley reservoirs poses a threat to lower trophic level communities, thus impacting the way native filter-feeding planktivores such as Gizzard Shad (Dorosoma cepedianum) graze. Using experimental gillnets and an electrified dozer trawl, we were able to collect gill raker filtrates from Silver Carp and Gizzard Shad. We then analyzed the particle size and particle type selectivity of both species and compared those metrics to the seasonal availability of plankton communities in Kentucky and Barkley reservoirs. Though it has been established that Silver Carp and native filter-feeding fishes compete for food resources, it is important to examine the degree of dietary overlap in which this competition occurs. Results from this research can aid biologists in sound management practices and eradication efforts allocated towards invasive carp, as well as the continued management of native filter-feeding fishes.

Notorious Bighead Carp in a Disconnected Oklahoma System

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Bighead carp first made their appearance in the United States in the early 1970s, with first reports in the Grand Lake O' the Cherokees system in the early 1990s. Being disconnected to any known infested waters, the Grand Lake system bighead carp population point source is unknown. Grand Lake O' the Cherokees consists of three dammed convergent rivers, the Neosho, Spring and Elk rivers, attracting several recreational user groups year-round. Much like other systems with invasive carp, an abundant population could be catastrophic to the Grand Lake system. Historically, carp have been collected via paddlefish anglers, with minimal collections via traditional gear (e.g . gillnets). Preliminary results indicate a very old population, consisting of large individuals. Reproduction has not been documented in this system, yet the potential for future reproduction is possible. Various data collections have been ongoing to give insight to movement and population patterns. However, with a possible low abundant population present in a large system, a suite of creative collection approaches is still necessary. The goals for this project are to create an age structure, better understand the reproduction potential, use otolith microchemistry to understand natal origins, and evaluate potential sampling techniques for bighead carp in the Grand Lake system.

American Shad Fish Passage on the Cape Fear River: Evaluating the Effects of Environmental Flows and a Nature-Like Fishway

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Dams are one of the most common forms of river alterations. Dams alter stream flow, fragment habitat, and create barriers to migration for native freshwater and diadromous fishes. Mitigation efforts to improve fish passage and connectivity include routing fish past dams through navigational lock chambers, over nature-like fishways or over smaller, low-head dams via environmental flows (e-flows). However, evaluations of e-flows paired with other mitigation efforts are limited regarding diadromous fish passage. Therefore, we studied the effects of e-flows on anadromous fish passage over three lock and dam structures (LDs) on the Cape Fear River, North Carolina. From March to May 2021-2023. In each year, we tagged and tracked between 50 and 99 adult American Shad (Alosa sapidissima) using an Innovasea® VR2W receiver array and V9 acoustic transmitters. We studied upstream fish passage effectiveness and timing in response to a major modification to an existing nature-like fishway, locking procedures, and e-flows at LD1 (river kilometer [rkm] 97) and through e-flows at LD2 (rkm149) and LD3 (rkm 186). Raw passage efficiency for American Shad at LD1 increased slightly following modification to the nature-like fishway (46.7% during 2021 [before] to 55.1% during 2022 [after]) and were highest in 2023 (71.8%) after modification and when e-flows coincided with the peak of the American shad migration during April and May. American shad passage was low at LD2 and LD3 during 2021 (LD2: 33.3%, LD3: 0%) and 2022 (LD2: 35.5%, LD3: 15.4%) when e-flows were conducted during early March, but increased dramatically during 2023 (LD2: 63.0%, LD3: 51.1%) when e-flows were conducting during April and May. Results highlight the importance of elevated spring flows to successful American Shad passage on the Cape Fear and suggest properly timed e-flows may improve fish passage.

Bridging the gap with RAD-seq: population structure across the range of the narrowly endemic Big Sandy Crayfish (Cambarus callainus)

Nicole Garrison* (West Liberty University), Zachary Loughman (West Liberty University)

Cambarus callainus is a range-restricted crayfish species endemic to the Big Sandy River drainage. This threatened species was taxonomically distinguished from the closely related and endangered Cambarus veteranus in 2014 on the basis of mitochondrial haplotypes, geography, and morphology. Both species are currently undergoing high-resolution genetic analysis to better understand their existing genetic diversity and population connectivity in preparation for captive propagation efforts. Gill tissue samples from C. callainus were collected non-lethally from sites in the Levisa, Tug, and Russell Fork watersheds in the summer of 2021 and sent to Floragenex (Beaverton, OR) for RADseq library preparation and Illumina sequencing in 2022. About 30,000 of unique SNPs have been identified within the dataset under the most lenient filtering strategy and have been used to identify unique genetic signatures within the sampled populations. Co-ancestry and clustering analyses indicate all samples belong to a single admixed population, though there is strong evidence for a barrier to gene flow downstream of Haysi, VA which has resulted in unique genetic structuring in the Russell Fork portion of the range.

Anonymous Location Data and its Applications in Fisheries Management

Ryan A. Gary* (Arkansas Game and Fish Commission), Christy Graham (Arkansas Game and Fish Commission), Joe Kaiser (Arkansas Game and Fish Commission), Vic DiCenzo (Arkansas Game and Fish Commission)

The use of anonymous location data (ALD) has become more prevalent with the increase in cell phone availability and accuracy. Historically first applied to forensic investigations and the private and commercial business sectors, ALD is now being used by fish and wildlife management agencies. In order to evaluate the accuracy and application of ALD as a substitute for creel survey methods, fishing effort and residency data from a 2021-22 creel survey of Bull Shoals Tailwater were compared to ALD data secured for the same area. The relationship between daily creel and ALD effort estimates was positively correlated. Seasonal effort estimates were similar in spring and summer between creel and ALD estimates, but were found to be significantly different between summer and winter seasons. Residency also differed between the two methods. During the creel, 84% of Arkansas counties were represented, whereas ALD accounted for 100% of counties. Additionally, interview data indicated 45% of angling parties were residents, while ALD estimated 70% of visitors were residents. Nationwide, creel and ALD data overlapped for 43 states, but there was disparity in 7 states. Based on this data, the use of ALD has the potential to save management agencies resources in evaluating a fishery's use and demographics. However, this data also shows where reasonable conclusions may be drawn based on ALD and where conclusions may be ambiguous.

Exploitation and harvest characteristics of the Striped Bass fishery in Arkansas

Eric J. Gates*(Arkansas Game and Fish Commission), Jon Stein (Arkansas Game and Fish Commission)

Annual stockings of Striped Bass (M. saxatilis) support a popular recreational fishery in Arkansas. In recent years, biologists have become aware of increasing public concern over perceived declines in catch rates and overall fishery quality. A statewide tag-reward study was initiated in February 2022 to evaluate annual exploitation and harvest characteristics of the Striped Bass fishery. A total of 667 legal-sized Striped Bass were doubled tagged in three large flood control reservoirs and each tagged fish offered a $100 return incentive. A total of 154 tagged Striped Bass have been reported (23% overall return rate) and adjusted annual exploitation ranged between 4—14% among reservoirs. Information derived from this study will be used to guide future management of the Striped Bass fishery in Arkansas.

Where Sleeping Clams Lie: Multivariate Analyses Examining Freshwater Mussel (Bivalvia: Unionidae) Bed Habitat Use

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Freshwater mussel beds are considered among the best naturally occurring fish attractants. The physical structure that mussel beds provide stabilizes sediment and contributes three-dimensional complexity and heterogeneity to habitats often dominated by soft sediments. Mussels couple the benthic and pelagic worlds through filter feeding and thus play a large role in nutrient cycling, nutrient excretion, and biodeposition. These processes enhance primary production, promoting in-stream secondary production, and in so support the rest of the food web. Overall, mussel beds provide habitat and food for macroinvertebrates which creates the ideal forage and spawning habitat for the surrounding fish community. In turn, freshwater mussels have a unique life cycle as obligate larval parasites on the gills and/or fins of a host fish. The Freshwater Mussel Conservation Program within the Florida Fish and Wildlife Conservation Commission has conducted mussel surveys in Florida's major river basins since 2013. Program biologists collected data on mussel assemblage, substrate composition, water quality, and stream characteristics during each survey. Using a subset of these data, habitat use of freshwater mussel assemblages in five of Florida's major river basins was examined using multivariate analyses. Due to the interdependence of fish and mussel populations, correlating how freshwater mussels utilize different habitats will help us characterize localities that are important for sympatric fish assemblages.

Prioritizing watersheds in the Upper Little Tennessee River to guide restoration initiatives

Keith Gibbs* (Western Carolina University), Diane Styers (Western Carolina University), Tom Martin (Western Carolina University)

We developed a watershed prioritization index for the mountains of western North Carolina, specifically the Upper Little Tennessee River Basin, to direct future conservation efforts in the region. We extracted land cover and use percentages and landscape features at multiple spatial scales to categorize attributes and rank subwatersheds from least to most susceptible to degradation. Instream and riparian habitat were evaluated, and sedimentation was quantified in a subset of subwatersheds to verify and validate geospatially derived prioritization rankings. Historical fish and macroinvertebrate assemblage data were compiled and georeferenced to identify gaps in knowledge and target supplemental sampling efforts. Fish and macroinvertebrate assemblages were sampled following standardized protocols for comparison to historical records. The basin is mostly forested (~86%); however, development (~10%) and agriculture (~2%) are concentrated along the riparian corridor of major streams and rivers (e.g., Little Tennessee (LTR) and Tuckasegee (TKR) rivers). The concentration of altered land use is due to gentler terrain and more productive soils in the floodplain and has resulted in substantial habitat degradation, especially in the upper portions of the upper LTR. Both the LTR and TKR have run-of-river dams bisecting them into upper and lower reaches. The lower LTR has a protected riparian corridor and biodiversity remains high. Hydropower reservoirs in the upper TKR watershed have altered hydrology and water quality, yet habitat quality remains high throughout the system. The upper reaches of both systems have depressed biotic integrity due to morphologic and hydrologic alteration. However, opportunities exist to restore ecological functionality and integrity within the basin with targeted rehabilitation, especially in riparian zones. Our findings will be shared with partners to assist prioritization of future monitoring and restoration efforts.

Evaluating Post-Capture Delayed Mortality of Alligator Gar in the Red River using Modified Jugline Methods

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The Arkansas Game and Fish Commission (AGFC) Alligator Gar Species Management Team sampled Alligator Gar from the Red and Sulphur Rivers in Arkansas in order to evaluate the effect that traditional AGFC sampling methods have on survival. A post-capture delayed mortality study was completed in August and September of 2022. Traditional jugline sets using treble hooks followed methods used over three previous years of sampling. An exploratory method using juglines set with circle hooks was also conducted due to its rise in popularity among recreational guides and likelihood of mouth-hooking rather than gut-hooking using treble hooks. Catch per unit effort was 0.29 Alligator Gar per 100 jug-hours. In total, 29 Alligator Gar were collected: 22 caught with treble hooks, and 7 caught using circle hooks. Two fish expired prior to translocation, therefore 27 individuals were transferred to an off-site observation pond. Post-capture survival, regardless of hook type or location was 96.3%. Treble hooks accounted for 7% of the overall mortality compared to 3% for circle hooks. This study provides support that traditional modified jugline methods do not cause erroneously high rates of post-capture delayed mortality and further evidence that the large estimated population size may be more robust than previously suspected.

An industry perspective on the challenges -- and opportunities -- from the growth of tournament bass fishing

Gene Gilliland* (Bass Anglers Sportsman Society)

Tournament bass fishing has experienced unprecedented growth over the last 10-15 years, further cementing the importance of this type of angling in reservoir fisheries. High school and collegiate bass tournaments have particularly experienced rapid growth, often recruiting novice anglers and organizers that may be less adept at minimizing fish mortality. New technologies like forward-facing sonar may be threatening previously unpressured fish by increasing angler success and possibly resulting in increased mortality at the population level. More and larger tournaments occurring on individual reservoirs are likely increasing conflicts with other user groups. As anglers increase their use and proficiency of social media, many times they convey misinformation that hurts agency credibility. However, social media likewise affords agencies increased opportunities to engage and educate anglers. The boating and fishing industry depend on angler participation as do agencies. However, the basic difference between these groups in motivation and funding sources, namely profit motive vs. Sportfish Restoration excise taxes that help fund management, can lead to conflicting goals between users and managers. However. they both depend on a healthy resource. Most companies understand that. It's important to the success of their business. But questions regarding how much growth, and where, is too much remain unresolved. Is there a balance? Can managers provide the science and regulatory framework to sustain fisheries, but also help the industry thrive and continue to recruit new anglers into the sport? These are some of the questions managers and biologists must address in the coming years if the quality of our bass fisheries is to continue into the 21st Century.

The Four Pillars of Trophy Largemouth Bass Management

Troy Goldsby* (Aqua Services, A Jones Lake Management Company)

The world of Largemouth Bass management has evolved significantly over the past 20 years. The ability, in the private sector, to move quickly when the science dictates has allowed us to develop strategies that are outside of the norm. In doing so we have identified 4 pillars of trophy largemouth bass growth. Adopting these strategies, no matter the region, will create a fishery that is unlike most. Adopting the strategies is easy and based firmly in science. But, changing minds proves to be very difficult. But, that is our goal.

Struggles and Successes in Small Impoundments

Troy Goldsby* (Aqua Services, A Jones Lake Management Company)

Managing small impoundments allows us the ability to perfect our science. And, hopefully, use the successes we see in these small impoundments to change management strategies on a large scale. Understanding water quality, aeration, vegetation management, nutrient mitigation, and the purpose of the reservoir are imperative in proper small impoundment management. We will look at all of these issues and discuss how we scale them to larger impoundments.

Advances in Lake Oxygenation and What it Means for Fisheries Management

Troy Goldsby* (Aqua Services, A Jones Lake Management Company)

Traditional aeration systems, which rely on water mixing and bubbles to add oxygen to water, often fail to meet and sustain desired dissolved oxygen levels (DO), reduce ammonia, and prevent fish kills. Mixing from aeration systems increases bulk water temperatures, leading to thermal stress on fish and reduced feeding rates. Mixing can also increase lake turbidity via sediment re-suspension and, during warmer months, will often exacerbate water quality by bringing nutrient-rich water upwards to the surface. Major advances have been made over the past three years to address the limitations of traditional aeration systems described above. Oxygen Saturation Technology ™ (OST) is the first commercial oxygenation system that delivers oxygen to target waters with zero bubbles, no mixing, and no sediment re-suspension while maintaining the natural aquatic ecosystem (preserving thermal stratification). OST ™ allows for pre-programable DO levels to be maintained continuously 24-7 365 days a year. These higher DO levels eliminate ammonia issues and provide a 3-fold increase in lake-carrying capacities over traditional aeration. This talk will present current fisheries projects where OST has been implemented and results.

The Evolution of Body Size in Crayfish

Zackary A. Graham* (West Liberty University), Alastair M. M. Richardson (University of Tasmania)

Crayfish vary in body size, with a few species reaching only a few centimeters in length, to the large and charismatic Astacopsis gouldi, which rivals clawed lobsters in size. Because body size is correlated to all aspects of biology, such as physiology (i.e., temperature tolerance) and ecology (i.e., predation, life-history), exploring how body size evolves gives insight into disparate fields. In the current study, we collect body size data on over 300 species of freshwater crayfishes from all extant families. Then, we use phylogenetic comparative methods to explain how this body size evolves across the crayfish phylogeny. Interestingly, we identify repeated evolution of miniaturization and gigantism across the crayfish tree. Lastly, we relate body size to classifications of burrowing behavior, and discuss how these two traits co-evolve across the crayfish phylogeny.

Changes in Gulf Sturgeon use of designated critical habitat surrounding Ship Island, MS and adjacent island passes pre/post island restoration

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Gulf Sturgeon (GS: Acipenser desotoi) are a federally threatened, anadromous fish that opportunistically forages in estuarine and marine systems from October–April. The waters surrounding the Mississippi barrier islands were designated critical GS habitat in 2003 given these habitats are used by GS natal to the western population unit (WPU; Pearl and Pascagoula rivers) and individuals from many eastern population unit rivers (EPU; Escambia, Yellow/Blackwater, and Choctawhatchee rivers). Restoration of Ship Island (SI: i.e., filling of Camille Cut, an island pass separating east and west Ship Island) was proposed in 2009 as a major focus of the Mississippi Coastal Improvement Program. The overall project included a pre-restoration study to assess occupancy patterns of GS within and around SI occurring from 2011–2015 using an acoustic telemetry array of 21–39 deployed receivers. Following the completion of island restoration in 2020, an expanded post-restoration array was deployed from 2021–2023 consisting of 68 receivers. During the pre-restoration period, GS from both the WPU and EPU were found to occupy an island pass, Dog Keys Pass, four times more than Camille Cut or the ends of the islands. The post-restoration findings indicate increased occupancy of the restored island habitat north of the former Camille Cut and decreased use of Dog Keys Pass. Pre-restoration network analyses indicate disjunct clustering of habitat use for WPU and EPU individuals across the study area; however, post-restoration networks indicate cyclical movement patterns of WPU GS and a reduced movement network in EPU GS, concentrated in Dog Keys Pass. When these results are taken together, we find that although overall GS occupancy of habitats were similar pre- and post-restoration, GS movements and overall use differed by population. This study highlights the plasticity of GS habitat use after a large-scale habitat restoration project.

Environmental factors driving fine-scale, non-migratory movement of Gulf Sturgeon (Acipenser desotoi) size classes within the Pascagoula River holding reach

Elizabeth M. Greenheck* (George Mason University), Mark S. Peterson (The University of Southern Mississippi), Michael J. Andres (The University of Southern Mississippi)

Anadromous Gulf Sturgeon (GS) occupy deeper river bends holes and areas of low flow velocity and cooler water temperatures during their period of summer freshwater residency, presumably to conserve energy and to seek thermal refuge as GS > age 1–2 cease feeding and move minimally in freshwater habitats. These riverine environments, known as holding areas, have been identified for adult GS in the Pascagoula River but little description of subadult and juvenile distribution within holding areas exists. Additionally, it is unknown whether GS of different size classes are distributed evenly among holding areas, and how within holding area (i.e., non-migratory) movement is influenced by biotic and abiotic factors. Therefore, the objective of this study was to fill the aforementioned gaps in knowledge. Tagged GS were detected from 2016–2022 on an array of acoustic receivers within the Pascagoula River holding reach, which was separated into roughly even river segments for data analyses purposes. An analysis of variance showed significant difference in holding area distribution between subadult and adult GS, and in river segments with known holding areas. However, the data suggests that holding reaches defined for this study (areas targeted for fishing efforts) may not fully capture GS holding in the Pascagoula River as GS also exhibited holding behavior in non-delineated holding areas. Generalized additive models indicated that movement among holding areas was non-random and was influenced by river discharge, celestial variables, temperature, and density of GS within the holding reach. These data are necessary to determine how use of holding reaches change overtime and provide an initial step in determining how climate change may impact GS during summer resting. For the Pascagoula River, these data may inform whether this system is holding area limited despite being the largest contiguous river of its size in the lower United States.

Gear bias of low-frequency electrofishing for sampling Blue Catfish populations in Oklahoma reservoirs

Austin Griffin* (Oklahoma Department of Wildlife Conservation), Douglas Zentner (Oklahoma Department of Wildlife Conservation), Graham Montague (Ohio Department of Natural Resources), Dan Shoup (Oklahoma State University, Stillwater), Richard Snow (Oklahoma Department of Wildlife Conservation)

Blue Catfish, Ictalurus Furcatus, are a popular sportfish amongst anglers in the United States, particularly due to their trophy size potential and quality table fare. In Oklahoma, anglers can harvest 1 Blue Catfish over 760 mm with the goal being increased abundance of larger fish. Anecdotal evidence from Oklahoma Department of Wildlife Conservation (ODWC) standardized sampling suggests that low-frequency electrofishing (LFE; 15 pulses per second) inaccurately samples the true population and may underrepresent larger size classes of fish (>760 mm), making the assessment of upper size classes of Blue Catfish populations difficult to interpret. Therefore, we designed a study to quantify the capture probability of Blue Catfish sampled with LFE by conducting a mark-recapture study in 3 Oklahoma reservoirs (Lake Arcadia, 2021; Wiley Post Reservoir, 2021; and Lake Ellsworth, 2022). We captured fish using LFE, gill nets, and juglines and tagged and released fish > 200-mm TL with modified Carlin dangler tags. Each lake was further sampled with LFE, gill nets, and juglines to collect recapture data. Size structure data suggests that LFE collects small individuals relative to gillnets and jug lines with low overlap in the density of observations when comparing LFE with the other two gear types. Preliminary Cormack Jolly Seber mark-recapture models suggest that capture probability decreases as fish size increases for LFE, while capture probability increases as fish size increases for gillnets and juglines.

The Reticulate Crayfish complex: an example of shifting perspective on crayfish morphology and taxonomy

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Historically, crayfish taxonomy relied on morphology to describe species. However, crayfishes exhibit a high degree of morphological plasticity, and traits previously thought to be stable across environmental conditions within a species may be products of convergent evolution. Therefore, traditional morphological approaches to describing and classifying crayfishes are limited and may lead to taxonomic assignments that inaccurately reflect evolutionary lineages. For example, several crayfishes are currently believed to be species complexes harboring undescribed diversity. Funding to address species complexes are limited because these complexes are treated as a single taxon from a legislative standpoint. Therefore, additional approaches are needed to delineate biodiversity within species complexes in an efficient manner. We present here an integrative, cost-effective framework combining morphological and molecular data generated from museum specimens. We applied our approach to the widespread Faxonius erichsonianus (Reticulate Crayfish) species complex found within several major watersheds of the southeastern U.S. We studied ten F. erichsonianus populations within the Tennessee River drainage and collected multiple environmental variables from each population. We gathered ~30 traditional morphological characters and sequenced two mitochondrial genes (COI and 16S) from specimens. We used regression with our morphological dataset to examine influences from the environmental variables. Characters found to be influenced by environmental conditions were considered plastic and were removed from the morphology dataset. Then, the reduced morphology dataset and the molecular dataset were each used for phylogenetic analyses. We generated two phylogenetic trees using maximum parsimony (morphological data) and maximum likelihood (molecular data) approaches. Our phylogenetic analyses identified five genetic clades that correspond loosely with major tributary systems of the Tennessee River. We observed limited agreement between our genetic phylogeny and our reduced morphology datasets; however, we observed congruence in the lack of ability to distinguish our outgroup taxa from our complex, suggesting introgression may have occurred. Our preliminary results in this framework suggest that traditionally measured crayfish morphological variation is a weak indicator of hidden diversity within F. erichsonianus.

Assessing the Multi-Scale Impact of Culverts on Stream Fish Communities

Langston Haden* (University of Southern Mississippi), Jake Schaefer (University of Southern Mississippi), Scott Clark (University of Southern Mississippi)

Connectivity of populations is a common goal of conservationists in order to retain genetic diversity, ample habitat, and healthy ecosystem function. Within rivers, culverts are the most common type of barrier to connectivity and movement. It is vital that we understand how these structures influence riverine fish communities in headwater streams of the Southeastern U.S. where a biodiversity hotspot overlaps with increasing habitat loss, fragmentation, and high levels of imperilment. The overarching goal of this study is to identify the impact of culverts on stream fish communities at both local and watershed scales. We selected 30 sites based on standardized barrier assessments at all accessible road-stream crossings across four tributaries to the Red River. At each of these sites, fish were surveyed at two reaches above and below the culvert. Local scale hypotheses were tested by comparing communities between culvert separated reaches and adjacent reaches whereas watershed scale hypotheses were tested using a comparative modeling framework to determine what spatial and environmental variables contribute most to structuring the communities. Our results align with previous work on headwater fishes, but provide novel information on the multi-scale impacts of road culverts. Additionally, these results emphasize the utility of considering multiple spatial scales when assessing the impacts of environmental alterations on fish communities.

Overview of Arkansas' Crayfish Conservation Program

Maxwell Hartman* (Arkansas Game and Fish)

The Arkansas Game and Fish Commission (AGFC) Crayfish Conservation Program is conducting a variety of crayfish conservation and research projects. Arkansas is home to 60 species of crayfish ranging from narrow-range endemics only known to occur along a single highway to wide-ranging species containing undescribed cryptic species. Most of these species have many unanswered questions, including life-history aspects, genetic diversity, and habitat associations, that need to be answered before effective conservation and species management decisions can be made. Research is currently being conducted across the state to address some of these critical needs. The Jefferson County Crayfish (Creaserinus gilpini) is an Arkansas endemic that was recently translocated to the world's first Burrowing Crayfish Sanctuary. The Spring River Crayfish (Faxonius roberti) is Arkansas's highest priority species and is being displaced in the South Fork Spring River by the invasive Gap Ringed Crayfish (Faxonius neglectus chaenodactylus). The Western Painted Crayfish (Faxonius palmeri longimanus) is the most widely distributed stream crayfish in the state, but the species is likely several undescribed species. Future genetics projects will hopefully clarify their taxonomy. These are all examples of ongoing projects that will expand the breadth of knowledge of crayfishes in Arkansas and lead to many more opportunities and conservation actions.

Assessing Historical Fish Movement Records in Relation to SARP (Southeast Aquatic Resources Partnership) Barrier Scores in the Ouachita Headwaters Watershed

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There has been increased concern about the effects stream barriers can have on aquatic organism passage. Human-made barriers such as various types of road crossings can prohibit movement of aquatic organisms and affect habitat connectivity. We wanted to take historical fish-movement data from the U.S. Forest Service collected in the Ouachita Headwaters watershed during the 1990s and relate it to the SARP barrier score at six different road crossings. Fish movement was assessed seasonally on a bi-weekly scale by VIE-tagging selected species. The SARP barrier assessment tool is a specialized tool that assesses a barrier's probability of hindering fish movement in the Southeast U.S. Each road crossing was assessed to determine the severity of the potential barrier from 2020-2022. The influence of SARP barrier score (and its components) on proportion of fish movement was analyzed using regression modeling. Movement data were collected on 20 species from 6 families. The total proportion of fish movement (number of fishes that moved / number of fishes tagged) across all sites for all species was 0.015 and median (range) proportion of fish movement among sites was 0.017 (0.0-0.036) %. The median of SARP barrier scores across the six sites was 0.65 (0.49-0.89). There was no relation between SARP barrier score and proportion of fish movement ($F_{1, 3} = 1.55$, $P = 0.30$). The best model for barrier components suggests that inlet grade score and depth score impact proportion of fish movement the most; however, this model was not significant (Adj. $R^2=0.61$; $P = 0.20$). Our ability to discern how barrier severity and barrier components influence proportion of fish movement may have been reduced due to a small sample size. These data further aid in our understanding of stream barriers and how they impact fish movement.

An overview of Atlantic Sturgeon conservation efforts in the new millenia- a manger's perspective

Andy Herndon and Lynn Lankshear

Rise of the machines: leveraging side scan sonar and machine learning to enumerate sturgeon in a large river system

Amanda Higgs*(Cornell University/NYSDEC), Rich Pendleton (Cornell University/NYSDEC), Dewayne Fox (Delaware State University), John Madsen (University of Delaware), David Kazyak (USGS), Shannon White (USGS), Amanda Simmonds (NYSDEC), Adam Bonemery (Cornell University/NYSDEC), Tomasz Smolinski (Delaware State University)

Estimating demographic parameters for sturgeon populations remains a fundamental management objective that is often difficult to meet given species' life history and their spatiotemporal scales of habitat use. Newer technologies and methodologies are available to provide enhanced population estimates, including the integration of side-scan sonar and acoustic telemetry with machine learning to provide robust estimates of population size. The large amounts of data collected using side-scan and telemetry makes image and data processing cumbersome, inhibiting their application to sturgeon conservation. Here, we demonstrate using Python programming and machine learning to generate and process side-scan sonar imagery. Applying these methods to two on-going projects in the Hudson River, we show how these methods can improve the speed and reliability of using side-scan sonar imagery to monitor demographic trends in sturgeon populations. As our methods use open-source technologies and simple computer programming, they are poised to improve the efficacy of side-scan sonar for the monitoring of wild sturgeons.

Seasonal Variation of Riverine Habitat Use for Adult Atlantic Sturgeon in South Carolina

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Atlantic sturgeon Acipenser oxyrinchus, populations along the East Coast of North American are threatened or endangered under the Endangered Species Act by the National Marine Fisheries Service. As part of the Federal Energy Regulatory Commission relicensing process for the Yadkin-Pee Dee River Project, Duke Energy contracted the South Carolina Department of Natural Resources to quantify presence, abundance, and seasonal reproductive behavior and habitat use of spawning adult ATS within this system. Between 2016–2022, 160 Atlantic sturgeon were captured, transmitted, and monitored using acoustic telemetry and a stationary receiver array in the Winyah Bay System. Telemetry data are examined to determine to what extent this watershed is being used and how it differs among two distinct spawning cohorts. Observed trends suggest the majority of the unimpounded river (river kilometers 44–265) may be important for spawning. Atlantic sturgeon use this area extensively during the spring and fall spawning runs, with fall sturgeon being detected more frequently in the upper reaches of the river than the spring spawning cohort. These efforts will help quantify and evaluate the quality and use of existing habitat and offer insight to seasonal behavior differences between southern spring and fall spawning populations. Understanding the temporal variations in riverine habitat use helps managers tailor action plans geared to enhance conservation efforts for both populations.

Evaluating the effect of turbidity on foraging by post-larval Paddlefish

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Previous studies evaluating restoration success of Paddlefish (Polyodon spathula) suggested excessive turbidity in lakes and rivers may inhibit foraging by juveniles prior to the development of the rostrum. A paddlefish's rostrum, which contains electroreceptors to help find zooplankton prey, is an essential part of their survival as adults. Our study focuses on the pre rostrum paddlefish at a larval stage and how turbidity may be affecting their foraging. To evaluate this hypothesis, we conducted a laboratory experiment in 10-gallon aquaria. Aquaria were each assigned a water clarity treatment level of clear (tap water clarity), 40, 20, 10, or 5cm of Secchi depth (clearer water has a greater Secchi depth than turbid water). Water clarity levels were created by suspending bentonite clay in water until the desired Secchi depth was created. For each trial, approximately 300 zooplankton were added to the aquaria followed by three post-larval Paddlefish, which were allowed to feed on zooplankton for approximately 18 hours. After the 18-hr period, Paddlefish were removed from the aquaria, euthanized with MS- 222, and preserved in 70% ethanol. In the lab, Paddlefish were dissected and zooplankton in the gut were counted. The Paddlefish were also measured eye to fork for further analyzation. Three trials of each turbidity treatment were conducted on each of three dates (total of nine replicates/treatment). Preliminary results indicate a weak, but positive relationship between number of zooplankton consumed and Secchi depth transparency, suggesting turbidity may inhibit foraging by juvenile Paddlefish before the rostrum is fully developed.

Emerging patterns from the Mussel Host Database: strengths, weaknesses, opportunities and threats for freshwater fish and mussel conservation

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Freshwater fishes and mussels are diverse and abundant constituents of freshwater ecosystems, and the interactions between these two omnipresent assemblages are important to many aspects of ecology. Freshwater mussels are obligate parasites of fishes (and sometimes amphibians) thus fishes are essential to maintaining mussel populations by facilitating reproduction and dispersal. The Freshwater Mussel Host Database, hosted and maintained by the Illinois Natural History Survey is an extensive, open-access resource aimed at standardizing and synthesizing published host-parasite observations between mussels and vertebrate hosts. Given the size, scope, and widespread use of this critical resource we sought to provide a high-level review of the database to identify data strengths, weaknesses, opportunities, and emergent patterns. Strengths include mussel-host records for 386 host species for 185 mussel species from six continents. There is a strong geographic bias toward North American taxa and the identification of 'physiological' hosts rather than ecological hosts (host identified in the lab vs. in the wild). Opportunities to identify mussel-host relationships in natural settings and to improve knowledge in understudied regions exist, but allocating resources and support to this work will be needed. We consider applying the generalized use of the term 'hosts' from laboratory experiments to assess in situ interactions and conservation planning based on laboratory experiments a potential threat, as investigating mussel population-specific hosts may better inform research aimed at creating conditions for self-sustaining mussel populations. The Freshwater Mussel Host Database provides a strong foundation to launch coordinated efforts by fish and mussel conservation and management groups to better understand and manage freshwater mussels, freshwater fish, and their interactions.

Patterns in mussel and fish communities within an upper reach of karst spring-dominated riverine system during extreme drought

Zachary Hutchens* (Texas State University), Dr. Timothy Bonner (Texas State University)

Surface waters in upper reaches of Edwards Plateau (TX) streams are supported primarily by springs from karst aquifers (i.e., flow gaining reaches). As rivers flow east towards the Gulf of Mexico, surface flows can be lost to groundwater via fault lines (i.e., flow losing reaches), evaporation, and water diversions. Objectives of this study were to assess mussel and fish community responses within the upper Guadalupe River basin along an upstream-to-downstream loss of surface flows during a period of extreme drought. Among 21 mainstem and tributary sites, covering about 150 km in river length, three distinct communities were found: 1) generalist species (e.g., Bluegill, Plains Longear Sunfish, Paper Pondshell) within 2nd and 3rd order tributary streams with minimal current velocities and deep depths, 2) small-bodied spring-associated fishes (e.g., Greenthroat Darter, Guadalupe Roundnose Minnow) and Texas Lilliput in flow gaining reaches within 3rd and 4th order tributary and mainstem sites with primarily bedrock substrates, and 3) a mix of large-bodied spring-associated fishes (e.g., Gray Redhorse, Texas Logperch), riverine-associated fishes (e.g., Mimic Shiner, Blacktail Shiner), and basin endemic mussels (i.e., Guadalupe Orb, Guadalupe Fatmucket) in some flow gaining reaches but mostly flow losing reaches in 4th order mainstem sites with sand and gravel substrates. Upper Guadalupe River basin supports a large number of imperiled aquatic species, so documenting reaches susceptible to drying and with large numbers of imperiled species could assist conservation efforts during future extreme drought conditions.

Size-based Evaluation of Population Structure of Bigheaded Carp Through Time in the Tennessee and Cumberland River Waterways

Rachael Irby* (Tennessee Tech University), Mark Rogers (United States Geological Survey)

Invasive carps including Silver Carp (Hypophthalmichthys moltrix) and Bighead Carp (H. nobilis), referred to as bigheaded carps, are present in the Mississippi, Ohio, and Missouri river basins in the United States. Bigheaded carp have successfully migrated from the Ohio and Mississippi Rivers and into tributaries including the Tennessee and Cumberland Rivers. Concern over the rapid spread of bigheaded carp moving into the Tennessee and Cumberland Rivers initiated multi-agency monitoring efforts in 2017. Likewise, commercial fishing incentives have been initiated across Tennessee and Kentucky in an effort to control and reduce bigheaded carp populations. The objectives of my research are to (1) analyze fisheries-independent catch data to assess densities of bigheaded carp in the Tennessee and Cumberland Rivers, (2) conduct a length-age structure analysis from upstream to downstream, and (3) compare population density, size class, and age structure shifts across multiple years. Age data through time will come from lapilli otoliths. I expect increases in bigheaded carp densities and lengths upstream, with downstream reservoirs experiencing reduced density over time due to commercial fishing incentives and fish movements. Results of this research will aid in the prediction of how the bigheaded carp population will continue to need management controls and develop a better understanding of how commercial harvesting has influenced the invasion in the Tennessee and Cumberland Rivers.

A Really Crappie Reunion: Revisiting Length-Limit Model Predictions for Tennessee Reservoir Crappie Populations Two Decades Later

Daniel Isermann* (USGS-Wisconsin Cooperative Fishery Research Unit), Steve Sammons (Auburn University), Phil Bettoli (retired), John Hammonds (Tennessee Wildlife Resources Agency), Todd St. John (Tennessee Wildlife Resources Agency), Tim Broadbent (Tennessee Wildlife Resources Agency), Michael Clark (Tennessee Wildlife Resources Agency), Ted Alfermann (Tennessee Wildlife Resources Agency), Mark Rogers (USGS-Tennessee Fishery Research unit)

Back in the dark days before smart phones and Wi-Fi, I found myself at the Tennessee Cooperative Fishery Research Unit in Cookeville, Tennessee, using models to predict the responses of reservoir crappie populations to different minimum length limits. The research was prompted by the recent implementation of a 10-inch statewide minimum length limit by the Tennessee Wildlife Resources Agency. Our modeling indicated that a 10-inch limit was not necessarily the best regulation for all reservoirs and that there were important tradeoffs between increased size structure and reduced harvest to consider when selecting a regulation. We will provide an entertaining trip down memory lane, revisiting that original research and some of the characters involved, as well as exploring whether those predictions were reasonable based on contemporary data and insights from fishery managers.

Current Status of Oklahoma Long-Term Stream Community Sampling

Samuel Johnston* (Oklahoma Department of Wildlife Conservation), Anthony Rodger (Oklahoma Department of Wildlife Conservation), Drew Wallace (Oklahoma Department of Wildlife Conservation)

Although streams comprise an exceedingly small portion of water on the planet, they contain a high diversity of fish and are used extensively for human recreation and development. Worldwide streams and their contained diversity face many threats including climate change, land use, and human development. In particular, the Midwest and Interior Plains portions of the United States have seen dramatic anthropogenic changes to the landscape. In 2016 the Oklahoma Department of Wildlife Conservation Streams Program began long-term monitoring of lotic fish populations incorporating an occupancy model sampling design. This sampling design allows us to account for imperfect detection when considering rarity and locality of species. Currently 8 out of 14 major watersheds in the state have been completed overall totaling 894 surveys across 298 sites. These surveys produced a total of 120 species with 21 species currently being considered SGCNs. The no SGCNs were collected in the Washita watershed while the Neosho watershed had 14 SGCNs and the highest overall number of species. This work is currently being used to update fish distribution ranges and compared to historical data to determine population trends for SGCNs and non-game fish. Future analysis of this work will inform management, research and conservation of SGCN and native species in addition to identifying stream sport fishing opportunities and monitoring invasive species across the state.

Detection of Walleye Populations in Mississippi Streams using eDNA

Kevin W. Jones* (Mississippi State University), Michael W. Sandel (Mississippi State University), Peter J. Allen (Mississippi State University), J. Wesley Neal (Mississippi State University)

The Gulf Coast strain of Walleye (Sander vitreus) is a genetically unique strain native to the Mobile River Basin and adjacent Gulf of Mexico watersheds. This strain has been threatened by the construction of the Tennessee-Tombigbee Waterway, which resulted in habitat loss, isolation of tributaries, and created the potential for introgression from northern Walleye by connection to the Tennessee River Basin. Historical stocking of northern strain Walleye into the Mobile Basin created further potential for introgression. Populations are now maintained with hatchery-produced Gulf Coast strain Walleye. The efficacy of stocking efforts and the status of remaining wild populations are poorly understood, in part because Gulf Coast strain Walleye habitats can be difficult to sample using traditional gears. During the spring of 2024, tributaries of the Tombigbee River will be sampled for environmental DNA (eDNA) to identify potential remnant populations of Gulf Coast Walleye. This presentation will discuss this upcoming project, as well as evidence for the genetic distinctiveness of the Gulf Coast strain and past and ongoing efforts to restore Walleye populations in Mississippi. By investigating the status of this unique and imperiled Walleye population, this project aims to contribute vital information towards future conservation efforts.

Untangling Angler Opinions: North Carolina Reservoir Striped Bass Fisheries

Casey Joubert* (North Carolina Wildlife Resources Commission), Kelsey Roberts (North Carolina Wildlife Resources Commission), Kathryn Jewell (North Carolina Wildlife Resources Commission), Cristina Watkins (North Carolina Wildlife Resources Commission)

Since 1957 the North Carolina Wildlife Resources Commission has been stocking Striped Bass into lakes and reservoirs to allow for an additional, otherwise unavailable angler opportunity. While biological surveys have been completed to determine the success of these fisheries, little is known about anglers' opinions of the stocking program and their fishing habits. To determine how many Striped Bass and hybrid Striped Bass anglers are utilizing the resource, their fishing habits, levels of satisfaction, and stocking perceptions, a questionnaire was developed. Survey distribution followed a modified Dillman method utilizing both emailed and mailed distribution to 24,918 randomly selected anglers. Respondents were split into two groups, those that did fish for Striped Bass or hybrid Striped Bass in lakes or reservoirs, and those that did not. Results suggest Striped Bass and hybrid Striped Bass anglers are primarily fishing from a motorized boat, have been fishing for Striped Bass and their hybrids for over 30 years, and would support implementing a no culling rule. This presentation will discuss results on Striped Bass or hybrid Striped Bass anglers' fishing habits, stocking perceptions, and expenditures. The agency is currently writing a management plan for Striped Bass and hybrid Striped Bass and these results will also be tied into this larger project. The management plan, and knowledge gained through this survey, will inform future Striped Bass and hybrid Striped Bass fishery management in reservoirs in North Carolina.

Side Imaging: a viable alternative to monitoring of trends in Gulf Sturgeon population abundance

Adam Kaeser* (U.S. Fish and Wildlife Service), Andy Royle (U.S. Geological Survey)

For decades Gulf Sturgeon populations were monitored through labor-intensive, mark-recapture methods that typically yielded estimates too imprecise to detect changes over short time periods. With the advent of low-cost side scan sonar, it is now possible to cover large extents of riverine habitat in short time periods, mark and enumerate large sturgeon, and use models to account for detection probability when estimating abundance in these indexed reaches. In this talk we focus on describing why this approach has been so effective for Gulf Sturgeon, and considerations for transferability to other aquatic systems.

An overview of Gulf Sturgeon conservation efforts in the new millenia- a manger's perspective

Adam Kaeser

Using anonymous location data to evaluate Arkansas' Family and Community Fishing Program

Joseph E. Kaiser* (Arkansas Game and Fish Commission), JJ Gladden (Arkansas Game and Fish Commission)

The Arkansas Game and Fish Commission (AGFC) implemented a R3 action plan in 2020 where specific fishing-related actions were established for the AGFC's Family and Community Fishing Program (FCFP). The FCFP includes 48 ponds (size range = 0.2-35 acres) throughout Arkansas that are stocked seasonally with Channel Catfish and Rainbow Trout. We acquired anonymous location data (ALD) from a telecommunications company, AirSage, to evaluate specific FCFP-related actions in the plan. We used ALD to derive several activity-related metrics for 22 selected FCFP ponds and compared changes in relative activity among ponds before and after implementation of the plan. Additionally, we compared demographic information from ALD to see if demographic groups represented at FCFP ponds changed after implementation of the plan. We are analyzing the relationships between relative activity to stocking intensity and frequency (number of fish stocked per acre and number of months stocked), specific activities at FCFP locations (i.e., fishing derbies), marketing strategies the AGFC uses for the FCFP, and license sales within the state for both Channel Catfish and Rainbow Trout stocking seasons. Findings will assist the AGFC in best management practices for a program that is critical to R3 endeavors within the state.

Coming to fruition: advancing our understanding of Atlantic Sturgeon through decades of data, new tools, and coastwide collaborations

David Kazyak* (U.S. Geological Survey Eastern Ecological Science Center), Brian Kreiser* (School of Biological, Environmental and Earth Sciences, University of Southern Mississippi), Shannon White (U.S. Geological Survey Eastern Ecological Science Center)

Following a century of depleted stocks, Atlantic sturgeon fisheries were closed in the 1990s and the species was subsequently listed under the Endangered Species Act in 2012. However, considerable uncertainty regarding the status, threats, and life history of populations has inhibited recovery efforts. After their federal listing, research activities ramped up dramatically, allowing for numerous studies of regional populations. Building on these, broad-scale collaborations are now providing insights at temporal and spatial scales commensurate with the migratory behavior and life history of the species. In addition, many interdisciplinary advances are allowing existing datasets to be reanalyzed for new perspectives, providing unique insights into sturgeon ecology. These efforts are directly supporting conservation efforts, strengthening opportunities for science-based management in the years to come.

West Tennessee Native Species Initiative: Nature-based is the Solution

Kayla Key* (West TN River Basin Authority), Kimberly Rios Rosado (West TN River Basin Authority), Amy Alford (West TN River Basin Authority), David Blackwood (West TN River Basin Authority)

Clean water, sufficient water resources, flood and drought mitigation, and groundwater recharge, along with the preservation of natural habitats, are of paramount importance for the welfare of both the environment and society. The challenges posed by changing climate and landscape conditions exacerbate the negative impacts on water quality, water quantity, and biodiversity, underscoring the urgency of addressing floodplain restoration in areas that can have the most impact. The floodplain systems of west Tennessee have been significantly impacted by channel alteration and land conversion. Channelization shortened these streams by 44%, lowered bed elevation by 170%, and increased stream gradient by 600%. The West Tennessee River Basin Authority (WTRBA) aims to restore west Tennessee stream functionality, ecological capacity, habitat availability, and natural morphology through scientifically defensible and evidence-based engineering methods. To prioritize restoration activities, WTRBA is in the process of obtaining and creating relevant data products that will be used to create an ecologically informed blueprint to guide on-the-ground restoration efforts to maximize success across west Tennessee floodplains. Restoration and protection of functional floodplains are essential not only for mitigating these adverse impacts but also for providing a multitude of co-benefits to both the natural environment and the human population resulting in increased resiliency to future environmental challenges.

Stocked vs Natural – Assessing the Potential use of Otolith Microchemistry to distinguish Stockton Lake Walleye Stocks

Hae H. Kim* (Missouri State University), Yahua Zhu (Wuxi Fisheries College), T. Ben Parnell (Missouri Department of Conservation), Jian Yang (Chinese Academy of Fisheries Science), and Quinton E. Phelps (Missouri State University)

Stockton Lake, located in southwest Missouri, is a popular angler destination and supports varied fisheries. While most species are supported through natural reproduction, Walleye are annually reared and stocked by the Missouri Department of Conservation (MDC). While most of the fishery is presumed to be supported by stocking efforts, anecdotal evidence suggests some degree of natural reproduction occurs. If chemistry varies between hatchery and the stocked system, otolith microchemistry can help distinguish natural and stocked origins. To explore the utility of this method, we obtained larval Walleye from hatchery reared fish. These otoliths were compared to fall age-0 Walleye signatures collected by MDC during routine standard night-time electrofishing. Insights garnered from this study can help inform stocking decisions and ultimately guide future management actions.

Natal Origin and Broad-Scale Movement Patterns of Northern Snakehead in the Potomac River

Hae H. Kim* (Missouri State University), John S. Odenkirk (Virginia Department of Wildlife Resources), Mike W. Isel (Virginia Department of Wildlife Resources), T. Reid Nelson (George Mason University), and Quinton E. Phelps (Missouri State University)

Understanding fish movement patterns can provide valuable biological and ecological insights for management, particularly when movement across interjurisdictional boundaries and ecologically significant habitats occur. Otolith microchemistry can help elucidate broad-scale movement patterns across a fishes' life, and understanding these patterns can provide valuable management insights and a better understanding of overall life-history. To evaluate Northern Snakehead broad-scale movement patterns, we assessed Sr/Ca and Ba/Ca ratios in juvenile and adult Northern Snakehead otoliths. Fish were collected across Virginia Potomac River tidal freshwater tributaries from Stafford County to the Pentagon Basin. Several models were developed and trained to assign fish to known collection tributaries. Overall model accuracy was high (90%), and both elemental ratios appeared to increase downstream. These models were used to assign a natal origin using core signatures revealed broad-movement patterns and suggested dispersal rates may be high in certain environments. Natal fidelity was high downstream and lower upstream. The evaluated tributaries represent important ecological transition zones influenced by freshwater and estuarine processes. These complex interactions are likely structuring these environments and influencing movement and dispersal patterns. Early-life periods and their associated survival requirements can provide insights into the quality of habitat. These nursery habitats are important for many fishes, and better understanding of these habitats can provide insights into other ecologically and recreationally important fisheries.

Shifts in native species trophic structure associated with Silver Carp invasion in a complex river system

Justin Kowalski* (Auburn University), Dr. Alison Coulter (South Dakota State University), Dr. David Coulter (South Dakota State University), Dr. James Garvey (Southern Illinois University - Carbondale)

Invasive Silver Carp (Hypophthalmichthys molitrix) occur in a large portion of the Mississippi River basin and are threatening to expand their range. Understanding how the interactions between this species and physical and biological processes of rivers affect native fish communities will help managers mitigate negative impacts and predict how uninvaded communities may be affected. We examined isotopic niche (carbon and nitrogen ratios), trophic relationships, and body condition of native species to determine how Silver Carp may affect the trophic niche of native fish along the longitudinal gradient of tributaries of the Ohio River. Both Largemouth Bass (Micropterus salmoides) and Gizzard Shad (Dorosoma cepedianum) had lower relative weight and larger isotopic niche breadth in downstream areas where Silver Carp were more abundant compared to upstream areas with low Silver Carp abundance. Among native fish species, $\delta 15N$ was compressed in downstream tributaries of the Ohio River where Silver Carp were most abundant. Trophic dynamics of native species that rely on planktivorous resources changed in ways contradictory to what would be expected based on current theory describing longitudinal changes in river systems, but did change in a manner consistent with what would be expected from competition with Silver Carp suggesting that Silver Carp may be influencing native species trophic dynamics in the Ohio River basin. However, it is important to consider that complex interactions between Silver Carp and physical and biological processes, longitudinal changes, and differences in habitat along the expanse of the Ohio River may also play an important role in the trophic dynamics of native species in the Ohio River.

Status of Black Carp Mylopharyngodon piceus in the Mississippi River Basin; pathways to Tennessee-Tombigbee Waterway

Patrick Kroboth* (U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO), Duane Chapman (U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO), Matthew Neilson (U.S. Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL), Joshua Tompkins (Kentucky Department of Fish and Wildlife Resources, Murray, KY), Robert Bourgeois (Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA), Cole Harty (Tennessee Wildlife Resources Agency, Nashville, TN), Evan Boone (U. S. Fish and Wildlife Service, Lower Mississippi River Fish and Wildlife Conservation Office, Tupelo, MS), Dennis Riecke (Mississippi Department of Wildlife Fisheries and Parks, Jackson, MS)

Black Carp were imported to North America in the 1970s and 1980s from eastern Asia for use as a biological control of snails in aquaculture, which are the intermediate hosts of trematode parasites that affect aquaculture fish stocks. Black Carp escaped into the wild and since initial undocumented captures in the 1990s, over 1,000 records have been reported from the Mississippi River Basin. Because of the fish's molluscivorous diet and large size (exceeding 50 kg), it is considered a potential threat to North America's diverse mollusk species. Black Carp have been reported from Keokuk, IA to downstream in the mainstem Mississippi River, with one record into the Gulf of Mexico. Regular reports occur in the lowest portions of the Ohio River near the confluence of the Tennessee and Cumberland rivers, with some additional sporadic reports in the reservoirs of Kentucky and Barkley lakes. The species range is primarily monitored through commercial and biologists' reports lacking alternative established methods of detection. Prior research has identified that Black Carp possess a somewhat opportunistic diet and that wild reproduction represented by several year classes of wild fish has been documented in parts of the mainstem Mississippi River. On-going research has adapted reported methods of commercial capture developing Black Carp specific methods in large river systems. Additional pathways of fish transfer beyond individuals' movement in freshwaters, particularly during potadromous reproduction, are a concern. These include the potential for movement through salt or brackish waters of the Gulf of Mexico or human mediated inter-basin transfer.

The Tenn-Tom Waterway: the worst location for conserving the best of southeastern U.S. aquatic biodiversity

Bernie Kuhajda* (Tennessee Aquarium Conservation Institute)

The southeastern United States is a global hotspot for aquatic biodiversity, but this diversity is not evenly distributed. Using range maps for 1043 fish, mussel, and crayfish species derived from museum and research collections as well as state natural heritage databases, a conservation priority score for each watershed was derived that incorporates biodiversity, endemism, and imperilment. By far the highest-scoring HUC 8 watersheds are Pickwick and Wheeler in the middle Tennessee River drainage. Other high priority watersheds include those in the Mobile Basin. Because these two basins have been separated for approximately 3 million years, endemic species and genetically distinct populations have evolved within each basin. There are over 70 endemic species of fishes and mussels in the Mobile Basin and over 20 endemic species found in the middle Tennessee River drainage. The Tennessee-Tombigbee Waterway provides an artificial large river connection for gene flow between the Tennessee River and Tombigbee River of the Mobile Basin that threaten the genetic integrity of these endemic species and distinct populations, as well as altering the native aquatic ecosystems. Funds to address this and many other threats to southeastern U.S. aquatic biodiversity are scare compared to the rest of the U.S. On average, federal and state spending under the Endangered Species Act is 2.1-46.6 times greater on aquatic species found outside the region than on southeastern endemics.

Clarification of Candy Darter (Etheostoma osburni) distribution and exploration of the comparability of electrofishing, snorkeling, and eDNA methods on the Monongahela National Forest

Chad Landress* (USDA Forest Service - Monongahela National Forest)

We conducted a status assessment for the endangered candy darter (Etheostoma osburni) on the Monongahela National Forest (MNF) from June 2021 to October 2021. An additional effort to document candy darter presence/absence via eDNA collections was begun in 2019 and continued through the duration of the 2021 field efforts associated with this study. The primary objective of this study was to increase knowledge about candy darter occupancy, habitat suitability, and population demographics at the sub-watershed scale on the MNF. These efforts are the most comprehensive evaluation of candy darter demographics on the MNF to date. A secondary objective achieved during this study includes an assessment of the relative efficacy of electrofishing and snorkel methods for assessing candy darter presence and population characteristics as well as the efficiency of these physical methods in detecting candy darter presence compared to environmental DNA (eDNA) sampling.

We surveyed habitat conditions in 82.4 km of streams with known or potential candy darter occupancy. Sites for eDNA collections overlapped the physical surveys and covered additional areas of the MNF which were unable to be physically sampled in a single field season. Electrofishing using seines and snorkeling were found to be comparable methods for the detection of candy darters within the stream network and determinations of relative abundance within habitat units. Physical capture techniques and eDNA methods were highly corroborative in their efficiency in detecting candy darter and in the determination of the limit of upstream occupancy. In this study, candy darters exhibited an apparent upstream longitudinal threshold based on stream size. A logistic model supports an approximate 5-meter wetted width to predict the potential for candy darter presence within the 95% confidence interval.

Density and Body Size influence Emigration Patterns of Stream Fish

Ashley LaRoque* (University of North Carolina at Greensboro), Seoghyun Kim (Kangwon National University), Akira Terui (University of North Carolina at Greensboro)

Movement of species across habitat patches is a key process behind gene flow, species distribution, disease spread, and population dynamics. Both extrinsic (e.g., competition with other species) and intrinsic factors (e.g., body condition) may stimulate movements, ultimately driving the spatial organization of ecological communities. However, these extrinsic and intrinsic factors are often assessed in isolation, limiting our ability to understand how multiple factors combine to shape movement patterns in nature. Streams represent an excellent system to address this knowledge gap because they provide a one-dimensional plane space for species to move across, thus restricting movement to only two directions. Therefore, patterns of movement driven by the interaction of extrinsic and intrinsic variables can be evaluated progressively over time. In this study, we used a capture-mark-recapture framework using 12mm passive integrated transponder (PIT) tags to individually track movement of six target fish species in the Piedmont area of North Carolina. Here, we used emigration from an individual's initial point of capture as a proxy for movement. We evaluated whether body size or local density had an impact on emigration rates using a generalized linear model (GLM). We found variable responses based on species. Most notably, creek chub emigration most often occurs when high densities of green sunfish and is least likely to occur when bluehead chub densities are low ($P = 0.01$; $P= 0.01$). Weight at initial capture was marginally significant for bluehead chubs displaying emigration for smaller fish ($P = 0.05$). To conclude, multiple variables are likely to be responsible for emigration and more detailed modeling approaches that integrate the interaction of variables need to be performed.

Habitat assessment on peripheral populations of two imperiled aquatic species within the Colorado River (TX) basin

Elibardo Leal* (Texas State University), Josh Tivin (Texas State University), Dr. Timothy Bonner (Texas State University)

Aquatic organisms generally inhabit geographic ranges that encompass favorable environmental conditions (e.g., water quality, habitat preferences); however, historical processes can lead to the formation of peripheral populations, where individuals potentially persist in aquatic environments very different from a central population. With imperiled species, failure to recognize central and peripheral populations could yield inaccurate assessments of environmental needs (e.g., habitat generalist vs. habitat specialist) necessary for conservation efforts. Objectives of this study were to quantify abundances and habitat associations of peripheral populations of two imperiled species (Texas Shiner Notropis amabilis and Texas Fatmucket Lampsilis bracteata) within the Colorado River basin of central Texas. Although Texas Shiner was not detected and Texas Fatmucket was detected only in one of the peripheral populations during our field surveys, Texas Fatmucket was persisting in a prairie stream with greater specific conductance, turbidity, and hydrological variability than those in the central population (i.e., streams of the Edwards Plateau with lower specific conductance, high water clarity, and more stable flows attributed to outflows of large karst aquifers). We highlight how stated environmental needs for Texas Fatmucket are likely not protective or feasible for either the peripheral population or the central population, thereby illustrating the value of recognizing peripheral populations in imperiled species management.

Spatial Drivers of Variance in the Diets of Redbreast Sunfish (Lepomis auritus) in the Savannah River basin

Patrick Lewis* (Georgia Southern University), Dr. Jamie Roberts (Georgia Southern University)

Physical habitat, structured by in-stream and basin-wide processes, are known to influence the composition of stream fish communities and the ecology of individuals, notably through diet composition. Understanding the linkage between different feeder types and the character of their surrounding habitat forms the basis of biomonitoring protocol nationwide. However, different habitat character between populations of widely distributed species may create intraspecific niche variation that confound generalities about their trophic ecology. The River Continuum Concept (RCC) predicts variation in macroinvertebrate communities as stream size increases due to shifts in primary productivity facilitating the proliferation of certain feeder groups. The application of the RCC to streams, however, may be complicated by differing physicochemical character of streams outside of the upland ecoregions where the theory has been tested extensively. The lowland streams of the Coastal Plain differ from upland streams in water chemistry, habitat complexity, and hydrology. Whereas fish diet variation in an upstream-to-downstream gradient is known to occur, intraspecific ecological variation in response to longitudinal changes via ecoregion is not as fully understood, complicating the transferability of hypotheses proposed by the RCC. We assessed diet composition of Redbreast Sunfish (RBS, Lepomis auritus), a generalist invertivore, across stream sizes and across its range from the Blue Ridge to the Coastal Plain, examining variations in prey order richness, the relative contribution of terrestrial prey, and the composition of macroinvertebrate functional feeding groups in their diets. We found that prey richness increased, and reliance on terrestrial prey items decreased, from upstream to downstream, as predicted by the RCC. Further, we found that ecoregions influenced these interactions, likely through broad differences in habitat structure between different ecoregions. Our findings emphasize the connection between aquatic habitat and their terrestrial surroundings, its influence on the population health of stream fishes, and the plasticity of ecologies of stream fishes.

Benefits of long-term monitoring on predominant freshwater systems in Florida

Rachel Liebman* (Florida Fish and Wildlife Conservation Commission), Kim Bonvechio (Florida Fish and Wildlife Conservation Commission)

The Florida Fish and Wildlife Conservation Commission (FWC)'s long term monitoring program for freshwater fisheries has continued to develop since its debut in 2006. Long-term monitoring data routinely shows its value to assess changes in sportfish populations, fish communities, angler use, and aquatic vegetation coverage in selected priority waterbodies. This data also supports other freshwater projects throughout the state and helps them to extend their reach. Additionally, Florida's long-term monitoring data has led to several publications, lake management plans, and public access to information. Over the years, studies have been conducted to evaluate its effectiveness and efficiency that have helped lead to its continued success today. This program's adaptability and commitment to quality data is an important part of its outstanding design. Gaining traction throughout the state, the freshwater fisheries research long-term monitoring program works with other FWC divisions (Habitat Restoration, Invasive Plant Management, Freshwater Fisheries Management, Marine Fisheries Management, and Law Enforcement) and with multiple agencies (federal, state, and local). The quality data collected and shared has strengthened FWC's partnerships and informed decision-making for a multitude of conservation projects. The program does have its limits and has adjusted to continue to meet the data quality benchmarks that have been set. The long-term monitoring program has substantial potential and with additional resources one can only wonder as to what that potential looks like.

Advancing Nonlethal Age Estimation Methods and Applications for Florida Bass

Summer Lindelien* (Florida Fish and Wildlife Conservation Commission), Drew Dutterer (Florida Fish and Wildlife Conservation Commission)

Florida Bass Micropterus salmoides are typically aged by counting annuli in sagitta otoliths, but extraction can only be accomplished by lethal dissection. Advancing methods for Florida Bass age determination using fin rays and spines complements the Florida Fish and Wildlife Conservation Commission's Trophy Bass Project, as well as high voluntary release rates practiced by recreational anglers of black basses Micropterus species. We incorporated a nonlethal ageing method in several no-kill situations to increase the breadth and application of age data. Our research suggests that a two-structured age sample may be suitable, where Florida Bass <56 cm MTL are sacrificed for their otoliths, and the third dorsal spine is removed from individuals ≥56 cm MTL. Total annual mortality estimates fell within 1–2% of estimates from the otolith-only age sample. Using the TrophyCatch database, we identified anglers to participate in a pilot program where they collected the third dorsal spine from Florida Bass ≥61 cm MTL. From January 1st, 2023 to June 30th, 2023, we received 33 dorsal spines from eight anglers across five water bodies. Most samples came from Kingsley Lake (N = 20), where we documented the highest mean growth per year (1.21 lbs./yr.). We recorded the longest (68 cm MTL) and the oldest (13 years) Florida Bass from Kingsley and Porter Lakes. We will continue collecting samples from the pilot-program water bodies and train a new angler(s) on Lake Placid, an important fishery, that produced the third most approved catches for the Season 11 TrophyCatch program. Citizen-science age data will help biologists uncover where trophy bass are long-lived or fast-growing across Florida which will also lead to further research and applied management for trophy bass. Age estimates produced from dorsal spines dynamically serve fisheries scientists and increase stakeholder engagement in Florida.

HYBRID STRIPED BASS *Morone saxatilis* X *M. chrysops* and LARGEMOUTH BASS INTERACTIONS IN DEGRAY LAKE, ARKANSAS

Steve Lochmann* and Jeremiah Salinger (University of Arkansas at Pine Bluff)

Hybrid Striped Bass and Largemouth Bass co-exist in DeGray Lake, Arkansas. Black bass anglers perceive a negative effect of hybrid Striped Bass on Largemouth Bass. We studied habitat use and diets of the two populations. Radio telemetry allowed assessment of seasonal habitat use. Habitat categories included shoreline (barren, rocky, or vegetated), flooded areas, and open water. Gastric lavage was used to assess diets on a seasonal basis. Pianka's index of overlap for habitat use during spring, summer, fall, and winter was 0.56, 0.94, 0.99, and 0.83, respectively. Schoener's Index for diet overlap was greatest (61%) during summer and lowest (16%) in fall. Although there is no evidence that shad production is limited, if competition were occurring, it would likely be in the summer, when Largemouth Bass seem to occupy open water and forage on shads, as do hybrid Striped Bass. We used population and bioenergetic modeling to determine, in the absence of a hybrid Striped Bass population, the proportion of surplus shad potentially consumed by Largemouth Bass. The maximum proportion of the surplus shad (22%) consumed by Largemouth Bass would occur during a modest increase in proportion of maximum ration consumed and a 68% increase in population size (i.e., a 1.5 SD increase in recruitment. We found no evidence hybrid Striped Bass negatively influenced Largemouth Bass. Largemouth Bass are unlikely to consume a high proportion of surplus shad in the absence of a hybrid Striped Bass population. An increase in shad biomass, especially in larger size classes, could alter the dynamics of the existing forage base in unintended ways.

On the surface or down below: the ecology of a primary burrowing crayfish determined through video surveillance

Zachary Loughman* (West Liberty University), Zackary Graham (West Liberty University)

We conducted a behavioral study of the Little Brown Mudbug, Lacunicambarus thomai using video surveillance to determine their degree of surface activity and behavioral patterns. Throughout 664 hours of footage, we observed a surprisingly high amount of activity at the surface of their burrows both during the day and night. The percentage of time that individual crayfish were observed at the surface ranged from 21% to 69% per individual, with an average of 42.48% of the time spent at the surface across all crayfish. Additionally, we created an ethogram based on six observed behaviors and found that each behavior had a strong circadian effect. For example, we only observed a single observation of foraging on vegetation during the day, whereas 270 observations of this behavior were documented at night. We observed L. thomai sitting atop their burrow engaging in sit-and-wait predatory behavior. This ambush predatory behavior was used on several different animal prey items, including spiders (Lycosidae), slugs (Philomycidae), and dragonfly nymphs (Aeshnidae). We also recorded crayfish cutting terrestrial vegetation near their burrow entrance and pulling it down into their burrow. Additionally, we analyzed the gut contents of 23 L. thomai from 4 populations to understand the generality of our foraging observations. Indeed, gut content analyses confirmed that all populations consumed both animal prey and vegetation. Overall, our results suggest that burrowing crayfish may exhibit higher levels of surface activity than previously thought. To increase our understanding of burrowing crayfish behaviors ecology, we encourage the continued use of video-recorded observations in the field and the laboratory.

Microhabitat Use of Turquoise Darters (Etheostoma inscriptum) in South Carolina Piedmont Streams

Kathryn Lusk* (Clemson University Wildlife and Fisheries Student), Brandon Peoples (Advisor, Clemson University), Mark Scott (SCDNR), and Kevin Kubach (SCDNR)

Conservation of stream fishes requires conservation of their habitats. However, we lack critical knowledge of the habitat associations of many species. This is true for the Turquoise Darter (Etheostoma inscriptum), a species of greatest conservation need in South Carolina. To improve our understanding of the species' habitat associations, we quantified Turquoise Darter microhabitat use in seven South Carolina Piedmont streams in which they had been previously detected by stream fish community monitoring efforts. At each site, 30 to 35 1 m2 quadrats spaced at least 2 meters apart were sampled to collect Turquoise Darters and microhabitat data. Fish species and their numbers were recorded along with darter total length if present. Five points of substrate data consisted of samples from four corners and the center of each quadrat, along with depth and velocity at the center of these quadrats. Turquoise darters occupied all sites and were overrepresented in microhabitats with greater current velocities and more erosional substrata. Pending analyses will use a generalized linear modeling approach to estimate the effects of various microhabitat variables on darter presence and counts. Results from this study have increased understanding of Turquoise Darter habitat use and will be useful for managers working to protect or restore habitat for the species.

Movement patterns of Bighead Carp Hypophthalmichthys nobilis and Silver Carp Hypophthalmichthys molitrix in the Lower Red River

Aiden Maddux* (Alabama Cooperative Fish and Wildlife Research Unit, Auburn University), John Dattilo (Alabama Cooperative Fish and Wildlife Research Unit, Auburn University), Shannon Brewer (U.S. Geological Survey, Alabama Cooperative Fish and Wildlife Research Unit, Auburn University, Auburn, AL)

Invasive species tend to have traits that improve their ability to survive and reproduce in new environments. The ability for some individuals within a population to move long distances in challenging environments is a common trait among invasive species such as Bighead Carp Hypophthalmichthys nobilis and Silver Carp Hypophthalmichthys molitrix. Knowledge of the movement patterns and timing associated with these two species may provide insights into possible future invasions or strategies for removal. The lower Red River is an understudied catchment in the context of Bighead and Silver carps; thus, we lack information on the timing, magnitude, and frequency of movements for both species. Using acoustic telemetry, we determined movement patterns of Bighead and Silver carps during the spring and summer seasons. Preliminary results show the Silver Carp moved an average of 0.57 (SD=.74) kilometers per day and Bighead carp moved an average of 1.3 (SD= 2.07) kilometers per day. We also found that female Bighead Carp and male Silver Carp moved greater distances than male fish. The maximum distance moved between consecutive detections by a Silver Carp was 202.8 kilometers and 336.6 kilometers by a Bighead Carp. There also seemed to be a clear separation between sedentary individuals and mobile individuals as 21 of the 41 located fish moved on average less than 1 kilometer. Across both species there were 31 movements over 10 kilometers. Of those movements, 21 occurred within the summer months (June, July, August) and 10 within the spring months (March, April, May). This study will continue through summer 2024 allowing examination of a longer time frame and different environmental conditions over time.

Fish communities at islands populated by Interior Least Tern (Sternula antillarum athalassos) colonies along the Arkansas River in Arkansas

Nathan Mansor* (Arkansas Tech University), Tom Nupp (Arkansas Tech University)

The Interior Least Tern (Sternula antillarum athalassos, hereafter ILT) is a previously federally listed, piscivorous bird that breeds on sandbars in large river systems. While much is known about the physical habitat requirements of those sandbars, little research has looked at connections between fish communities and ILTs. We used boat electrofishing to sample fish populations at nine islands that had active ILT colonies, across more than 400 km of the channelized McClellan Kerr Arkansas River Navigation System (MKARNS), as well as the unchannelized, lower section of the Arkansas River. We captured a total of 34 species (n=3645) across 12 families, with a mean of 13 405 individual fish per island sampled. Gizzard Shad (Dorosoma cepedianum) and Threadfin Shad (Dorosoma petenense) were most prevalent, being 51.6% and 25.0% of the total captured fish, respectively. Spatial trends of fish communities and ILT productivity were analyzed along the river as well. Knowledge of fish-bird interactions serves to further management for both taxa.

Keywords: piscivorous birds; fish community; islands; large river

The Florida Trophy Bass Project

Allen D. Martin* (Florida Fish and Wildlife Conservation Commission), Jason Dotson (Florida Fish and Wildlife Conservation Commission), Drew Dutterer (Florida Fish and Wildlife Conservation Commission)

The Florida Trophy Bass Project is a new Florida Fish and Wildlife Conservation Commission (FWC) initiative with a directed focus on trophy bass. Through trophy bass management, research, documentation, and promotion, the main goal of the Florida Trophy Bass Project is to ensure Florida is the Trophy Bass Capital of the World. Florida is the home of Florida Largemouth Bass, which are known to grow to trophy size. Due to the presence of quality habitat, Florida Largemouth Bass genetics, and a long growing season, thousands of trophy-sized bass are caught in Florida each year. Even though management of Florida's resources has not traditionally focused on trophy bass, FWC's TrophyCatch program documented the catch and release of almost 15,000 bass over eight pounds during its first 11 seasons, including 143 Hall of Fame fish weighing over 13 lbs!

The Florida Trophy Bass Project focuses on managing certain resources specifically for trophy Florida Largemouth Bass, better documenting trophy bass catches through TrophyCatch and other means, and promoting those catches, and the resources that produced them, throughout Florida and the rest of the country. Through the Florida Trophy Bass Project, not only should the number of trophy bass being caught in Florida be better documented and celebrated, but projects are underway at certain resources to focus management on the production of trophy bass. This presentation will provide an overview of the Florida Trophy Bass Project and current management efforts by FWC to grow more trophy bass.

Bass management at Kentucky and Barkley Lakes: Attempts to understand and reduce the inconsistency in trophy bass production at two major reservoirs

Adam Martin* (Kentucky Department of Fish and Wildlife Resources), Nick Simpson (Kentucky Department of Fish and Wildlife Resources), Justin Graben (Murray State University), Scott Starr (Kentucky Department of Fish and Wildlife Resources)

All waterbodies typically have at least one limiting factor which lowers their potential to produce trophy sized bass. Broadly speaking these potential factors are the same in every fishery: growth, mortality, and recruitment. In many waterbodies the limiting factor is excessive recruitment. However, in Kentucky Lake and Lake Barkley there is more evidence which suggests that low recruitment is the primary bottleneck limiting the production of trophy Largemouth and Smallmouth bass. This presentation will focus on the research identifying recruitment as the bottleneck and our efforts to increase recruitment by placing spawning habitat structures. We will present our designs for bass spawning structures as well as results from multiple years of snorkel surveys which evaluated their usage rates by bass and other centrarchids. The variable success of year classes of Largemouth and Smallmouth bass has been studied by other researchers; however, many questions remain. To address this, we will also present nearly 40 years of electrofishing data and multiple years of hatch date analyses to highlight and discuss the potential importance of spawn timing as a mechanism for mediating recruitment success in large reservoirs. We will also discuss the usage of spawn timing as a potential measure of the utility of adding spawning structures in large reservoirs.

Optimizing Sampling Protocols: Evaluating how electrofishing settings affect the capture of Flathead Catfish in the field

Jacob Martin* and Tyler Thomsen, Arkansas Game and Fish Commission

Understanding how varying duty cycle affects capture efficiency and length distributions of Flathead Catfish can aid fisheries managers in data collection and subsequent management decisions. Two pools of the Ouachita River and a segment of the White River were sampled for this project. River kilometers were randomly selected within each study area for low frequency electrofishing. At each randomly selected river kilometer, two 10-minute long electrofishing runs were conducted using a duty cycle of 10% and a duty cycle of 30%, pulse-width was held constant at 15Hz. Length distributions among the two settings varied significantly in Felsenthal Pool and the White River, but did not differ in Thatcher Pool. Catch per unit effort (CPUE) did not differ significantly among duty cycles for Flathead Catfish overall. However, a zero inflated negative binomial model revealed CPUE of quality sized (≥ 510 mm) Flathead Catfish was 28% higher with a duty cycle of 10 than a duty cycle of 30 (P=0.004). Furthermore, the likelihood of not catching any Flathead Catfish ≥ 510 mm during a sampling run was 58% higher when using a duty cycle of 30. These data suggest that a length bias associated with duty cycle for Flathead Catfish may exist and it appears that a duty cycle of 10% is superior at sampling larger Flathead Catfish.

Migratory dynamics of adult Atlantic sturgeon in the Cape Fear River

Joseph A. Mathews* (University of North Carolina, Wilmington), Joseph J. Facendola (North Carolina Division of Marine Fisheries), Aaron Bunch (Clemson University), Troy Farmer (Clemson University), and Frederick S. Scharf (University of North Carolina, Wilmington)

The Atlantic sturgeon, Acipenser oxyrinchus oxyrinchus, is endangered throughout much of its geographic range due primarily to historic overfishing and impediments to migration. The Cape Fear River in southeastern North Carolina previously supported a commercial fishery but the current status of the population is unknown and migration timing and pathways used by adult sturgeon in this system have not been described. Beginning in 2021, targeted sampling for adults (> 1300 mm FL) in the hypothesized spawning area (< 3km below the first dam) was conducted each spring and fall. Acoustic tagging (Innovasea model V16) was used to monitor the timing and pathways of riverine entrance/exit, duration of riverine residency, repeat migratory behavior, and oceanic movements. The spring (Mar/Apr) spawning period produced nineteen (19) adult Atlantic sturgeon that were captured in the Cape Fear River (2021: n = 5, all males, 1620 – 1820 mm FL; 2022: n = 9, 6 males, 1 female, 2 unknown, 1480 – 1940 mm FL; 2023: n = 5, all males, 1680 – 1970 mm FL), with one capture occurring during fall (Sep/Oct) sampling (2022: 1435 mm FL, male). Temporal patterns of detection in the lower river indicated entrance in Feb/Mar and directed upriver movements toward the hypothesized spawning area throughout March. The duration of residency in the region < 3km below the lock and dam varied from 1-2 up to several weeks, with riverine emigration occurring between late April and early May each year. Three of the five adult males tagged in 2021 returned in the spring of both 2022 and 2023, and the single female tagged in 2022 also returned in spring 2023. Oceanic detections of adult Atlantic sturgeon tagged in the Cape Fear River, NC have been reported from as far as Long Island, NY and Winyah Bay, SC with many detections occurring between Onslow Bay, NC and Sandbridge, VA. Knowledge of adult migration timing and pathways can inform conservation plans to protect specific habitats and restrict activities that can negatively impact fish during vulnerable periods.

A Case History of Striped Bass Management at Lake Texoma

Matt Mauck* (Oklahoma Department of Wildlife Conservation)

Striped bass were stocked into Lake Texoma from 1965-1974 to create a sport fishery and help control abundant shad populations. Nearly 60 years later, we look back and summarize the development, adjustment, and maturity stages of this nationally respected fishery. Continued natural reproduction without hatchery augmentation sets this lake apart from most inland populations. The efforts of numerous fishery scientists have contributed a wealth of knowledge regarding the biological and social aspects of this fishery. Environmental challenges and evolving angler expectations have called for improved understanding of recruitment dynamics, water quality, interspecies competition, human interactions, and harvest characteristics. Of note, a 30-year data set illustrates how the population has responded to environmental challenges of droughts, floods, and forage limitations. A retrospective study is important for current managers and the angling public to fully understand and appreciate this fishery.

Evaluating Associations Between Riverine Habitat, Biotic Assemblages, and Spread of a Non-native Minnow Species in the Little Tennessee River System

Garrett McCarson* (Western Carolina University), Jennifer Dunn (Western Carolina University), Keith Gibbs (Western Carolina University), and Bill McLarney (Mainspring Conservation Trust)

The yellowfin shiner (Notropis lutipinnis) is a small leuciscid fish native to the Atlantic Slope watersheds of Georgia and South Carolina. However, their native range extends into North Carolina within the headwaters of the Savannah River basin. In 1998, yellowfin shiners were documented for the first time in the Little Tennessee River (LTR) in Macon County, Georgia. Continuous sampling of the LTR Watershed over the past thirty-four years reveals a pattern of dispersal typical of invasive species. Yellowfin shiners have been discovered in tributary streams more than thirty river kilometers downstream from their southernmost documented occurrence in 1990. In these tributary streams, native minnow species, particularly the Tennessee Shiner (Notropis leuciodus), are increasingly outcompeted, hybridized with, and displaced by the yellowfin shiner. The impacts of this invasion are more pronounced in tributaries where the instream habitat has visible degradation from surrounding land-use changes. Changes in biotic assemblages and habitat degradation linked to land-use practices have been observed in conjunction with the expansion of yellowfin shiners. The expansion of the yellowfin shiner seems to have stalled, with the more established populations occurring in the highly disturbed areas of the upper LTR. Protected riparian zones in the lower reaches may be inhibiting their further spread. However, ongoing habitat degradation and the impacts of climate change could promote the expansion of this non-native species throughout the LTR basin, adversely affecting this hotspot of aquatic biodiversity. Further field and laboratory experiments could elucidate the mechanisms allowing yellowfin shiner proliferation outside their native range.

Using Human Dimension Data to Help Manage Florida's Lake Istokpoga

Sara Menendez* (Florida Fish and Wildlife Conservation Commission)

Applications of human dimension data have become increasingly accepted as a mixed-method approach to resource management. Specifically, fisheries biologists can utilize human dimensions data to incorporate anglers' needs into management decisions. Because of the high variability in results, it is imperative that resource managers incorporate a multifaceted approach that incorporates data from both the biological and social sciences. The use of human dimensions data as a catalyst for lake management can aid in rebuilding trust and angler's attitudes towards fish and wildlife agencies. Lake Istokpoga, Florida, has experienced stakeholder frustrations (specifically anglers) based on lake management tactics instituted over the past 10 years. As a result, the Florida Fish and Wildlife Conservation Commission created the stakeholder-driven Lake Istokpoga Habitat Management Plan (LIHMP) implemented in 2020. Through the use of the Lake Istokpoga Working Group (LIWG), comprised of multi-divisional biologists and external partners, lake management strategies are proposed and vetted in a collaborative partnership set forth by the guidelines of the LIHMP. The LIWG utilizes human dimensions data in the form of surveys, comments from public meetings, and lake tours, along with biological data from the lake's subject matter experts. Specifically, fisheries management of Lake Istokpoga uses human dimensions data gathered from public meetings, airboat tours, Largemouth Bass tournaments, and feedback from newsletters as a method of understanding angler's needs while implementing innovative management strategies. Fisheries biologists gather various human dimensions data and consider issues proposed via data collection when lake management proposals are discussed in the LIWG. Together with biological data, human dimensions data can generate valuable information that benefits fisheries biologists' management practices while maintaining good stakeholder relations.

Age and Growth Comparison of White Bass Among Three Southeastern U.S. River-Reservoir Systems

Thomas Miles* (Tennessee Tech University), J. Wesley Neal (Mississippi State University)

White bass (Morone chrysops) are a popular sport fish native to the Mississippi River basin and widely introduced elsewhere. We examined population characteristics of this species in three systems (Kentucky Lake, Tennessee; Tennessee-Tombigbee Waterway, Mississippi; and Grenada Lake, Mississippi) with different habitats and fishery characteristics to evaluate whether population dynamics varied sufficiently to require system-specific management. Using white bass collected from these three systems in 2019–2020, we tested two aging techniques and found sectioning of otoliths provided more precise age estimates compared to using whole otoliths. We collected white bass up to 9 years of age, representing the oldest maximum age reported for southern populations. However, populations were composed of mostly younger fish, with 84% four years old or younger. All fish reached preferred size (300 mm TL) by age 3 across study areas. We found differences in length-at-age among populations, but we do not believe that these differences were large enough to justify system-specific management regulations.

Efficacy and Effects of Internally Placed PIT Tags in Freshwater Mussels

Kendall R. Moles* (Arkansas Game and Fish Commission), David H. Nichols (Arkansas Game and Fish Commission), Maxwell L. Hartman (Arkansas Game and Fish Commission)

Recovery of and accurately identifying unique individuals is paramount to many ecological studies and conservation projects. Passive Integrated Transponders (PIT) tags have afforded researchers this ability and have been used routinely in mussel conservation over the past decade. While these tags have traditionally been affixed externally to the shell, there has been little evaluation of their use inserted into the internal cavity of the animal. We evaluated tag retention of 12-mm and 8-mm PIT tags inserted into the extrapallial space and the effects on survival and growth of Plain Pocketbook (Lampsilis cardium) and Arkansas Fatmucket (Lampsilis powellii) in a captive study. We assessed tag retention for 120 d in all individuals at 30 d intervals and tag encapsulation at 30 d intervals in a subset of individuals. We examined all individuals that rejected tags to evaluate the tagging procedure and to identify causes of tag rejection. Tag rejection occurred primarily during the first 24 hr after tagging and was attributed to over-insertion of the tag. Overall mortality was low (0.6%), tag retention was high (97–100%) and a thin layer of nacre coated internal tags in < 30 d after insertion. We evaluated tag retention of 12-mm and 8-mm PIT tags inserted into Mucket (Actinonaias ligamentina) and Ouachita Kidneyshell (Ptychobranchus occidentalis) in an in-situ field study. At 120 d post insertion, tag retention was high (95-100%) and a layer of nacre coated internal tags, confirming that internal placement is a reliable method for PIT tagging mussels.

Spatial and environmental factors contributing to ecosystem and regional variation in Smallmouth Bass growth: A hierarchical approach

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Individual growth characteristics are central to both the foundations of ecology and applied population dynamics. Identifying broad-scale growth patterns and associated sources of variation inform both ecological research and natural resource agency actions. For example, individual growth rates and body size potential are fundamental to sportfish demographic studies and long-term management strategies. We modeled variation in individual growth characteristics of Smallmouth Bass across the United States. Age-at-length data were compiled from both lentic and lotic populations ($n = 58$ and $n = 77$, respectively). We fit the data to a von Bertalanffy growth equation using a hierarchical Bayesian modeling structure. The hierarchical approach provided a way to accommodate unequal sample size, missing information, and methodological bias common to large, combined datasets. We used covariates associated with spatial position and landscape characteristics to identify sources of variation in asymptotic length L_∞ both among management regions and between lentic and lotic ecosystems. On average, both L_∞ and the Brody growth coefficient (k) was higher in lotic populations. There was more variation in L_∞ among individual populations than regions. Covariate relationships for L_∞ were strongest with land use, with weaker relationships for spatial position. There was also a high negative correlation between L_∞ and k, suggesting a trade-off in Smallmouth Bass between growing fast at early life stages and achieving a large body size. Our population growth estimates are informative to regional Smallmouth Bass management by documenting similarities and differences among a large number of populations. We also provide ecological insight on drivers of variation in Smallmouth Bass growth potential. Our hierarchical approach generalizes to both growth models for other fishes and a variety of ecological state variables. In addition to the numerous benefits, we also discuss caveats and often-overlooked assumptions of hierarchical modeling.

Assessing silver carp passage at three locks and dams on the Tennessee and Cumberland Rivers

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Silver carp continue to expand their range in North American river basins, necessitating efforts to limit the spread with a combination of management actions. Within the Tennessee and Cumberland River Basin, lock and dams serve as bottlenecks that slow range expansion of invasive carps. With a single exception, dams in the Tennessee and Cumberland rivers are high-head dams that restrict upstream passage to the lock chamber except for Cheatham which overtops during major floods. These locations could play an integral control point for minimizing the spread of silver carp in the Tennessee and Cumberland Rivers and are possible candidate sites for deterrents. We sought to determine if lock traffic and environmental variables explain successful fish passage (upstream and downstream) at three focal locks and dams (i.e., Kentucky, Pickwick, and Cheatham). We evaluated fish passage of silver carp using an Innovasea Vemco-type acoustic receiver array in the Tennessee and Cumberland Rivers over three years. Acoustic transmitters were surgically implanted into 1,520 silver carp during 2020-2022. We documented 159 upstream and 212 downstream passages over the three years. Results from this study could provide insights into movement of invasive carps through high-head dams on large rivers and help to inform decisions on optimal management actions within this river system.

Hierarchical relationship between regional and local environmental on stream fish life history

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The functional makeup of stream fish communities is, in part, a product of environmental filtering – only those species with traits favorable to the stream conditions can persist. Filters, including instream microhabitat, the flow regime, land cover and geology can operate directly on taxa, or they can work synergistically with each other to shape functional diversity. When modeling the combined effects of multiple filters, it is helpful to consider a spatial hierarchy. Regional environmental gradients, land cover, and geology influence local conditions, the flow regime, and instream microhabitat. In this study we used structural equation models (SEMs) to model causal pathways linking these environmental factors and the functional diversity of life history in stream fish. Describing the hierarchical relationship between environmental filters is critical to understanding how local functional assemblages as determined and maintained through space and time. Broadly we predict the effect of regional gradients on functional diversity will be indirect and mediated through the local environment. To this end we utilized a dataset of South Carolina stream fishes, an ideal system as it contains a high diversity of not only fishes but also stream conditions. Specifically lowland streams had more seasonably predictable flows patterns, while upland streams had greater heterogeneity in substrate composition. We predicted that SEMs would reveal that functional diversity is maintained directly by local environmental effects, namely the flow regime and instream microhabitat. Furthermore, we expect to find that regional environmental gradients, i.e., geology and landcover, contribute indirectly to functional diversity, by constraining these local conditions.

Seasonal Movements of Yellow and Silver American Eels within the Pensacola Bay Complex

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The American Eel (Anguilla rostrata) is a facultatively catadromous species that occurs from Greenland to Venezuela and comprises a single panmictic population that exhibits random mating across its range. American Eels have a complex life history and undergo several morphological and physiological stages. For the majority of their lives, American Eels remain in their yellow stage as sexually immature adults until they mature into silver eels during their downstream migration to spawn. Life history information on all life stages and habitat requirements of American Eels is limited, particularly for South Atlantic and Gulf of Mexico populations. American Eels face a broad range of threats including dam construction, degradation and pollution of habitats, introduction of invasive parasites contaminants, and oceanic changes that have resulted in dramatic declines over much of their range. In the 2017 American Eel Stock Assessment, the Atlantic States Marine Fisheries Commission cited a need for tagging studies of eels at different life stages to address habitat use, movement, migration, and behavior. Furthermore, little information exists on seasonal movements and out-migration information of yellow and silver eels in Gulf Coast rivers. Therefore, this project will provide important information on movement patterns for American Eel populations within the Pensacola Bay complex by 1) examining movement patterns of yellow American Eels within the Escambia and Yellow Rivers; 2) examining if seasonal upstream and downstream movements are associated with environmental cues (i.e., stream flow, water temp, lunar phase); and 3) determining timing of outward migration of mature (silver) eels within the Pensacola Bay complex.

Understanding Smallmouth Bass Recruitment in Relation to Nest Fishing along Wisconsin's Door Peninsula

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Smallmouth bass support important fisheries along Wisconsin's Door Peninsula, but recent declines in catch rates for smallmouth bass ≥ 18 inches have prompted stakeholder concerns. While these declines may reflect inherent variation in recruitment, some stakeholders believe that angling during nesting may be detrimental to recruitment. Determining reasons for declining catch rates is difficult because the Wisconsin Department of Natural Resources lacks a method for indexing smallmouth bass recruitment before bass enter the fishery at ages 3 and 4. Our research objectives are to determine if: 1) nest success varies in relation to a suite of abiotic and biotic variables, including angler effort and nest disturbance; 2) sampling effort required to detect changes in catch-per-effort (CPE) of age-0 and age-1 smallmouth bass at end of summer varies among selected sampling gears, and 3) location-specific estimates of age-0 CPE measured at end of summer are related to abiotic and biotic variables. We deployed underwater cameras and monitored nests along transects within four different spawning locations along the Door Peninsula, including a reference location where fishing was closed during the nesting period. We also compared modified boat electrofishing, hand-held anode electrofishing, and mini-fyke nets as methods for sampling age-0 and age-1 smallmouth bass. Embayments on the Green Bay side of the Door Peninsula exhibited higher nest success rates (range = 30%-55%) in 2022 and 2023 than embayments on the Lake Michigan side (range = 12.1%-20%), despite higher angler effort and nest disturbance rates allocated in bayside embayments. Age-0 bass catch rates were highly variable, with bayside embayments displaying higher catch rates in 2022 but lakeside embayments having higher catch rates in 2023. Our research will help fishery managers determine a sampling method to index recruitment before smallmouth bass enter the fishery and address concerns regarding the effects of nest fishing on recruitment.

Evaluating the Statewide Largemouth Bass Regulation Change in Florida

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The Florida Fish and Wildlife Conservation Commission (FWC) adopted a Black Bass Management Plan in June 2011 which required a review of all current bass regulations. A team of FWC biologists reviewed social information and biological data for Largemouth Bass Micropterus salmoides and recommended a new statewide regulation for Largemouth Bass in 2015. The new regulation of a five fish bag limit with only one bass greater than or equal to 16 inches began in 2016. A comprehensive ten-year evaluation of this regulation was designed to assess changes to the Largemouth Bass population, angler satisfaction, angling behavior, and opinions regarding the regulation's effect on bass populations. Forty-five Florida lakes were selected to assess trends for these parameters. Statewide tagging of Largemouth Bass across 79 waterbodies (including many of the population assessment lakes) accompanied sampling efforts. Through seven years, there have been no apparent trends in any of the Largemouth Bass population metrics related to the regulation change. Similarly, there have been no trends in angler harvest of Largemouth Bass under the new regulation. Over seven years, awareness of the new regulation for all anglers remains just over 50%, while awareness for bass anglers has peaked at 81%. No bass population changes have been detected in response to the regulation change thus far. Biologists did not expect large-scale changes, although the evaluation was warranted to provide concerned anglers with valuable data showing no negative impacts. Additionally, the regulation allows for more harvest opportunity and simplified regulation statewide.

Growth and survival of larval to juvenile White Crappie (Pomoxis annularis) in three different pond densities and growing conditions

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Due to increasing popularity of crappie as sport fish, improved rearing techniques are needed to provide a consistent supply of fish for stocking. Crappie are frequently pond-spawned or stocked into ponds as fry, yet little is known about pond fertilization effects or optimal stocking densities. Although organic fertilization techniques are commonly used, fertilization using inorganic nitrogen may yield higher planktonic blooms and more dependable growing conditions. Therefore, conventional organic fertilization, inorganic nitrogen fertilization, and non-fertilized (control) ponds were compared for zooplankton density and diversity, and growth and survival of larval to juvenile White Crappie (Pomoxis annularis) in 4 ponds/treatment. Fish were also evaluated for optimal stocking density by stocking each treatment at densities of 77,575 fish/ha (31,103/acre) (high), 25,000 fish/ha (10,000/acre) (medium), or 7,425 fish/ha (2,970/acre) (low), with three ponds/density. The experiment was conducted over 14 weeks, with zooplankton sampled at biweekly intervals via Wisconsin-net tows. Fish were subsampled once every 4 weeks and were individually weighed, measured, and counted at the end of the study (week 14). Fish (n=100/pond) were individually weighed, measured, and counted, and the remainder were weighted in batches of 50 to determine growth and survival. Also, water quality (i.e., pH, temperature, dissolved oxygen, hardness, alkalinity, NO2, Total Ammonia Nitrogen) was measured twice weekly from each pond to determine if fertilizers directly affected water conditions. Results will be discussed in the context of guidance for management of white crappie stocking, rearing, and growth in ponds.

Coastal migratory behavior of juvenile Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) natal to the South Atlantic Distinct Population Segment

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Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus; ATS) are an anadromous fish native to the rivers and coastal ocean of eastern North America. The species is managed as five distinct population segments (DPSs) divided by latitude: the South Atlantic, Carolina, Chesapeake, New York Bight, and Gulf of Maine. Although each river hosts a genetically distinct population, migratory juveniles mix with fish of all life stages from other DPSs when they enter coastal environments. As such, understanding spatiotemporal characteristics of migration has been identified as a key research objective for species management. To date, few studies have investigated the movement patterns of young juvenile ATS after outmigration from their natal estuary. Between 2014–2016, 117 river-resident juvenile ATS from four rivers in the South Atlantic DPS were implanted with V7-4x acoustic transmitters to study riverine nursery habitat use and the timing of outmigration. During this time, 31 individuals were observed to undergo the ontogenetic shift to the marine-migratory life stage. Detections of these fish acquired from other researchers through acoustic telemetry data-sharing networks indicates that these juvenile ATS have greater migratory capabilities than previously documented. For example, one individual migrated over 1,300 kilometers in less than 8 months, moving through three non-natal DPSs. Furthermore, we observed differential migratory strategies based on river of initial capture, which aligns with recent studies that suggest unique movement patterns among populations. However, the river of initial capture for our tagged juveniles did not always align with genetically assigned population of origin. These results highlight the need for further delineation of differential migration of ATS from the South Atlantic DPS as well as additional validation for river of origin assignments using the genetic baseline.

Impacts of COVID-19 on Angler Pressure at Three Small Impoundments in Northwest Oklahoma

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Early in 2020, fish and wildlife resources were impacted as people were seeking outdoor recreation in response to the COVID-19 pandemic and restrictions put in place. Due to visitation of public places being restricted, the outdoors was a promising place for many to social distance. Oklahoma Department of Wildlife Conservation observed this and, in an effort to reduce negative impact on isolated individuals, campaigned the statement of "The outdoors is always open". In both 2020 and 2021, contactless angler pressure counts were conducted on three public small impoundments in Northwest Oklahoma (American Horse Lake, Lake Watonga, and Lake Elmer). The objective of this study was to examine angler pressure on these impoundments and to determine if the pressure differed among lockdown status, air temperature, and impoundment. Generalized linear mixed models (GLMMs) were used to examine and determine the influence of lockdown status, air temperature, and impoundment on angler pressure. Angler pressure was examined in categories of total, male, female, boat, and shore anglers. All the GLMMs had suggested that 2020 had higher angler pressure compared to 2021, and that angler pressure demonstrated a quadratic relationship with air temperature. Among the three impoundments, total angler pressure varied. Male and Female predicted angler pressure varied among the three impoundments, as well as boat and shore angler pressure. Results suggest that variation in angler pressure may be due to fishing strategy and angler demographics. Results from this study may be used to improve individual's knowledge of changes in license sales as well as recruitment of new anglers and retention of current anglers.

Using Environmental Variables to Predict Water Temperature on a Longitudinal Scale

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Brown Trout are considered a coldwater species. Temperatures where they reside should generally remain below the Brown Trout upper thermal tolerance (20-22°C). A variety of factors affect temperature in cold tailwaters below dams, including dam release patterns, ambient air temperatures, and distance downstream of the dam. A model predicting water temperature at different locations along a river would support management decisions and improve communication with stakeholders. Mean daily water temperatures were collected with Hobo temperature loggers from 2019 to 2023 at eight locations on the tailwater below Greers Ferry Dam on the Little Red River. Mean water temperature at the most upstream location ranged from 5.75°C to 17.13°C. At the downstream most location, temperature ranged from 4.19°C to 23.86°C. Downstream locations appear to be influence more by ambient environmental factors, while upstream locations seem influenced more by dam release practices. Using a stepwise multiple linear regression model in RStudio, we were able identify environmental variables that best predicted water temperatures. Predicted water temperatures were highly correlated with observed water temperatures ($R=0.72$, $p<0.001$). Residual analysis suggested that warmer water temperatures were not as well predicted as cooler water temperatures.

Use of trace elements in pectoral fin spines of juvenile Gulf Sturgeon (Acipenser oxyrhynchus desotoi) to identify early age habitat use and movement patterns in the Pearl and Pascagoula River systems

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Recovery of Gulf Sturgeon (Acipenser oxyrinchus desotoi) has been sought across the distributional range of the species; however, populations in western river systems, (i.e., the Pearl and Pascagoula) have shown comparably moderate success. A better understanding of natal origin and early life movements are essential to informing conservation efforts on how to best allocate resources that would be crucial to their recovery. Sclerochronology-based studies have proven beneficial for retrospectively tracing early life histories of Acipenseriformes, such as Gulf Sturgeon. By comparing trace element concentrations in calcified biological structures to the concentration in water samples, movement patterns can be estimated. In this study, fin spines were collected from juvenile (age 1-3) Gulf Sturgeon in the Pearl and Pascagoula river systems and analyzed using laser ablation -inductively coupled plasma-mass spectrometry (LA-ICP-MS). Analyses quantified changes in elements known to change within river systems and coastal regions, in particular, strontium, barium, manganese, and zinc. Age-based patterns of these elements in fin spines will be compared with watershed maps in these river systems and discussed in the context of Gulf Sturgeon recovery.

A Case Study in Reintroducing the Critically Imperiled Magnificent Ramshorn Snail

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The Magnificent Ramshorn, Planorbella magnifica, is a large freshwater snail endemic to the lower Cape Fear River basin in North Carolina. The species was federally listed as Endangered in 2023 and believed extirpated from the wild since 2004. What began as a private landowner's personal commitment to save the snail in the mid-1990s has turned into a multi-partner effort to recover this unique species, spanning decades. The Magnificent Ramshorn provides a case study in persistence and cooperative efforts in the recovery of imperiled species. After over 20 years in captivity, which included many years of refining husbandry techniques, and searching for and preparing suitable habitat for reintroduction, the first individuals were released back into the wild in October 2023, where they immediately began reproducing. Creative propagation techniques, shared cooperative research data, and multiple funding sources aiding this animal's progress towards recovery has been critical to the advancement of the project. The snail is an example of a positive, hopeful conservation story using grant funding from the National Fish and Wildlife Foundation and an innovative regulatory tool in the form of a programmatic Safe Harbor Agreement.

Movement patterns of Black Drum and Sheepshead between subsystems in Mississippi Sound

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Black Drum (Pogonias cromis) and Sheepshead (Archosargus probatocephalus) are both estuarine dependent species that are of commercial and recreational interest in the Gulf of Mexico (GOM). Within Mississippi's waters there is limited data on the following: how connected each species' populations are between estuarine subsystems, when spawning runs are initiated (GOM spawning occurs Feb–Apr), and where each species emigrates from and returns to. The objective of our study is to address these data gaps using acoustic telemetry. A total of 65 Black Drum (29.2–86.8cm total length; TL) and 43 Sheepshead (33.8–56.2cm TL) were captured, measured, and tagged with internal acoustic transmitters in St. Louis Bay and the Pascagoula River Estuary from 2021–2023. Tagged individuals were monitored year-round by a collaborative telemetry array within St. Louis Bay, the Pascagoula River Estuary, and Mississippi Sound. Of our tagged population, seven Black Drum (34.5–80.6cm TL; avg 50.61cm TL) and 16 Sheepshead (33.8–55.3cm TL; avg 42.52cm TL) traversed between subsystems whereas 52 Black Drum (29.2–86.8cm TL; avg 37.28) and 26 Sheepshead (34.5–56.2cm TL; avg 38.35cm TL) remained in the system of initial capture. Of the fish that moved between systems, only one Black Drum (80.6cm TL) and nine Sheepshead (36.6–55.3cm TL) traveled to the barrier island habitats. These fish were detected between February–May each year, consistent with their known spawning period. Sheepshead that migrated to island habitat tended to be larger than those that stayed, albeit non-significantly. Our examination of Black Drum and Sheepshead space movement patterns indicates few individuals traverse between subsystems outside of potential spawning runs, except for subsystems bordered by relatively intact marsh edge. For Sheepshead, we found not all individuals of spawning capable size migrated to island habitats during the spawning season, perhaps suggesting nearshore spawning may occur.

Molecular surveillance of larval silver carp (Hypophthalmichthys molitrix) in Tennessee rivers and reservoirs

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Resource agencies invest a considerable amount of effort and cost into monitoring and controlling invasive carps (Hypophthalmichthys spp.). Invasive carps have expanded their distribution into two Tennessee rivers that include Kentucky Reservoir in the Tennessee River and Kentucky Reservoir in the Cumberland River. Although much of the life history and biology of this species is well documented from other systems, information and data concerning the reproductive ecology is lacking in Tennessee. While juvenile individuals have been captured in both reservoirs, larval carp have not been known, nor has specific spawning conditions or areas been identified in either reservoir. Beyond monitoring and detection, taxonomic identification of larval fishes is time consuming and difficult. We used molecular barcoding to identify the presence of silver carp larval in bulk samples from Kentucky Reservoir and Barkley Reservoir. The presence of carp larvae and eggs were detected in several locations of both lakes. Furthermore, several factors (e.g., collection method, collection timing, and site location) were tested for effects on molecular detection of carp larvae and eggs. Our results indicate successful spawning of silver carp in Tennessee reservoirs, however there has been no indication of recruitment to the existing population. Results from this study will be used to inform and assist agencies with developing more efficient monitoring approaches for larval carp species as well as rapid response to limit potential further population expansion. Future research will include sample design optimization to assess occupancy and site-level scale parameters to develop predictive spawning models in Tennessee reservoirs.

Bigheaded carp distribution patterns in oxbow lakes of the Lower Mississippi Alluvial Valley

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Large populations of Silver Carp (Hypophthalmichthys molitrix) and Bighead Carp (H. nobilis), collectively called bigheaded carps, can result in significant ecological, economic, and human safety impacts. In the Lower Mississippi Alluvial Valley (LMAV), bigheaded carps have been documented in major bodies of water including the Mississippi, Arkansas, Illinois, and Ohio rivers. However, knowledge of bigheaded carp distribution in oxbow lakes of the LMAV is lacking. The goal of this study was to increase understanding of bigheaded carp distribution patterns throughout permanent oxbow lakes in the LMAV, a crucial step in effective invasive species management. Species distribution models are a common tool used to estimate species distribution based on presence data and environmental predictor variables. Onsite surveys for bigheaded carps are impractical given the size of the LMAV. Local ecological knowledge (LEK) uses the knowledge of local professionals and local people about the presence and relative abundance of species. As an alternative to onsite surveys, we administered a questionnaire to fisheries biologists to gain LEK about carp presence in the LMAV. Environmental covariates were obtained from existing datasets. Maximum Entropy (Maxent) is considered a top performing presence-only species distribution modeling method. We used Maxent to develop a species distribution model to illustrate predicted bigheaded carp distribution and identify environmental covariates that are significant drivers of that distribution. The model predicted carp presence in ~40% of lakes in the LMAV, with no geographic patterns found. We found that very wide and very narrow lakes that have greater connectivity seasonality and are connected for more months in a year were most predicted to have carp present. Moving forward, potential carp management strategies will be identified and recommended based on these results.

Delaware River juvenile Atlantic Sturgeon: An unforeseen result of long term monitoring

Ian Park*

The Delaware Division of Fish and Wildlife has been conducting Atlantic Sturgeon surveys in the Delaware River since 1991. Originally targeting sub-adults, in 2009 the focus switched to sampling for young of year and has remained consistent in effort and location since 2014. Sturgeon are collected in anchor gill nets set at depths of approximately 14 meters and fished for an hour and a half through slack tide. Collections are done twice a week from mid-October through the end of December. There is a high interannual variability in year class strength which is believed to be the result of varying dissolved oxygen levels during the summer months. The current water quality standard of a daily average of 3.5 mg/L was established in 1967, in 2022 the Environmental Protection Agency determined that the current water quality standard violated the Clean Water Act and does not provide for the propagation of fish. Data collected from the sturgeon survey was used to help calibrate a Habitat Suitability Index and suggest a new water quality standard that is projected to increase sturgeon biomass.

A range-wide assessment of Gulf Sturgeon population viability using a metapopulation approach

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Gulf Sturgeon Acipenser oxyrinchus desotoi stocks were significantly reduced in the mid-to-late 20th century due to a combination of factors (i.e., overfishing, dam construction, and habitat degradation), which led to listing as a threatened species under the US Endangered Species Act in 1991. Gulf Sturgeon have been managed as a single stock (i.e., range-wide as a species) under the ESA, as the species is considered threatened over most, if not all, of its range. If extirpation risk differs among river populations, targeted restoration actions may be appropriate to prevent population collapse in vulnerable rivers. To assess this, we used population viability analysis (PVA), a wide-ranging suite of quantitative analytical methods for assessing threats to fish and wildlife populations that commonly uses simulation-based methods of evaluating population persistence in the context of differing population dynamic rates, given some initial conditions (e.g., population size). Most imperiled species lack important life history information needed to inform PVA, but Gulf Sturgeon research dates back several decades, and recent efforts to synthesize and model these multi-decadal data have generated the population dynamic estimates needed to forecast Gulf Sturgeon population fates. Previous studies identified differences in population dynamic rates among these river populations. We developed a metapopulation approach in which the population dynamic rates (e.g., adult survival, movement between rivers) for each river were informed by mark-recapture estimates from a common analytical framework. Our results suggest that the risk of losing all seven river populations is low. However, simulated increases in mortality represented by increasing baseline rates and catastrophic events (e.g., hurricanes) increase Gulf Sturgeon extinction risk. Our results also suggest that the rivers in the western Gulf of Mexico are more prone to extirpation than rivers in the central and eastern Gulf. Future conservation planning should consider these viability differences when determining possible restoration actions.

Maximizing learning opportunities through data workflow modernization: a case history of Gulf Sturgeon monitoring

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Cooperative Gulf Sturgeon research has been ongoing throughout the species' range since the 1970s. Most research efforts have focused on basic ecology and life-history questions or short-term assessments of population status and trends. Gulf Sturgeon are long-lived, and these discrete studies were all conducted over much shorter periods of time. Because Gulf Sturgeon have low catch rates, low capture probabilities, and may demonstrate skip-spawning behavior, uncertainty persists regarding how well short-term snapshots of population status may reflect overall trends in Gulf Sturgeon demography at the generation time scale. The Standardized Gulf Sturgeon Mark-Recapture Database was developed to unify these disparate datasets for use in population models to assess restoration and management options for Gulf Sturgeon, identify future research needs, and forecast time to population recovery. After enduring the necessary but arduous process of compiling, cleaning, normalizing, and storing these data, this database now contains capture history information for >21,000 Gulf Sturgeon marked with >59,000 different tags. This dataset has already been used to inform our understanding of Gulf Sturgeon survival and movement rates over unprecedented spatiotemporal scales. To allow this dataset to be seamlessly appended by future sampling, we partnered with Big Fin Scientific to integrate their electronic logbooks into each Gulf Sturgeon monitoring program throughout the Gulf of Mexico. To minimize the errors inherently associated with paper datasheets, we've implemented QA/QC protocols into our data collection process that enhance data integrity and reduce fish handling time in the field. We've also incorporated an alert system that prevents unnecessary surgeries on fish with viable tags. This modernization of the Gulf Sturgeon monitoring workflow has enhanced our ability to learn from these data by facilitating data sharing, reducing time lags between data collection and analysis, and providing the standardization that is necessary to compare separate datasets within a common framework.

Utilizing Fisheries Management Data to Implement On-Farm Conservation Practices in the Upper Chattahoochee Watershed

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Since 2017, UGA Extension and the Georgia Department of Natural Resources (DNR) Wildlife Resources Division (WRD) have increased efforts on the conservation of native black bass (Micropterus sp.) and their habitats in the Upper Chattahoochee watershed. Specifically, our research has sought to investigate concerns regarding introgressive hybridization from non-native invasive Alabama bass on native Chattahoochee and Shoal bass, assess effects of urbanization and poor agriculture practices on aquatic habitat, and engage and educate stakeholders of the river system about its unique, endemic fishery resources.

This research has provided critical information needed to implement management strategies to conserve native riverine black bass in the Upper Chattahoochee River basin. Collaborations with the Southeastern Aquatic Research Partnership (SARP) and new project partners have opened doors to fund even more restoration work in the watershed. To date, $748,770 have been granted to the Upper Chattahoochee watershed for assisting agronomic crop farmers and livestock producers to implement better land management practices aimed at reducing sedimentation into surface waterways.

County Extension agents in this watershed are not only administrators of the grant dollars, but are actively collaborating with the Natural Resources Conservation Service (NRCS), Master Gardeners, high schools, technical schools, and other grassroots organizations to establish education sites, host educational workshops, and grow a bank of plant material to be used for future restoration sites. This case study provides a developing template for enacting meaningful stream restoration efforts across a watershed by leveraging the skills, knowledge, and buy-in from a diverse group of resource stakeholders.

One Fish, Two Fish, or Maybe Nine? Confirmation of Host Fishes for the Federally Endangered Choctaw Bean, Obovaria choctawensis (Bivalvia: Unionidae)

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Knowledge of host fish requirements is a vital component in understanding and managing freshwater mussel populations. In Florida, there are 61 known species of unionids, and host fish requirements are confirmed for only 35 of these species. Here, we present an overview of our methods and experimental findings from two host fish trials for the federally endangered Obovaria choctawensis, Choctaw Bean. We tested fish hosts by inoculating 26 fish species across 10 families with glochidia from three O. choctawensis females. We recovered completely metamorphosed juveniles from nine host fish species representing three families (Percidae, Fundulidae, and Petromyzontidae). Given the importance of these fishes in mussel development and dispersal, evaluating the recent distribution of confirmed host fishes may help explain population trends of O. choctawensis. Our findings can help facilitate future conservation and recovery efforts, particularly those involving improved fish passage, habitat restoration, and captive propagation for augmenting extant or reestablishing extirpated populations.

Aging Reservoirs: Where Do We Go From Here?

Mark Pegg* (School of Natural Resources, University of Nebraska-Lincoln)

Aging infrastructure is prevalent throughout the world, but water control management structures, specifically dams, are of growing concern. Dams and their corresponding reservoirs have inherent, but separate, lifespans. The proportion of dams around the world that continue operation beyond their intended lifespans is growing at an alarming rate. Society will have to navigate the tradeoffs associated with the deterioration of services provided by reservoirs and dams (e.g., recreation, power supply, consumption, etc.), and the impending structural failures. We are nearing a critical pinch point where society will have to decide how to deal with dams and reservoirs at scales that range from a single system to multiple systems in large watersheds. Recreational capacity is often low on the list of services, meaning fisheries management is forced into reactionary responses to infrastructure operation decisions. Worrisome, no comprehensive strategy exists to inform both the range of actions that can be applied to such infrastructure and how such actions would influence biophysical, socioeconomic, and geopolitical tradeoffs. Herein, we present an overview of actions and considerations for aging dams and reservoirs and their implications to fisheries management.

Seasonal migration cues differ for dual spawning Atlantic Sturgeon in the Great Pee Dee River

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We investigated environmental variables associated with spawning migration behavior for a dual spawning population of endangered Atlantic Sturgeon Acipenser oxyrinchus oxyrinchus in the Great Pee Dee River, South Carolina. From 2016 to 2021, 147 Atlantic Sturgeon were captured, implanted with acoustic transmitters, and monitored using a stationary array of 40 receivers located every 5-20 km along a 302-km section of the Great Pee Dee River from the river mouth at Winyah Bay to the first movement barrier at Blewett Falls Dam, North Carolina. We observed 47 Atlantic Sturgeon attempt 74 spring migrations and 39 Atlantic Sturgeon attempt 76 fall migrations across four years of telemetry observations (2018-2021). Mixed effects models indicated that discharge interacted with water temperature to affect both migration initiation and upriver movement, and these interactions differed between spring and fall runs. Spring runs were cued by rising temperatures and high river discharge, whereas fall runs were cued by falling temperatures and low discharge. Within migrations, spring-run fish migrated further upriver when discharge was falling, and fall-run fish moved further upriver when discharge was rising. Overall, fall-run sturgeon migrated significantly further upriver than spring-run sturgeon. Differences in migratory behavior among runs suggest potentially unique adaptations to ambient river conditions during respective spawning seasons. Identifying the environmental factors that drive, and thereby limit, Atlantic Sturgeon migrations in the Great Pee Dee River informs regional recovery efforts and highlights the importance of studying and managing this species at the population level.

Long-Term Trends and Demographics of Spotted Bass in Table Rock Lake

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Missouri Department of Conservation (MDC) regularly conducts standardized night-time electrofishing to assess and monitor black bass (Micopterus spp.) populations. Long-term standardized sampling provides temporal insights into status and population trends. Adding age estimates can provide further insights into the population. Additionally, age estimates can be used to quantify vital rates (i.e., recruitment, growth, and mortality). To better understand Spotted Bass long-term trends and evaluate the current demographics we aged a subset of fish collected during MDC standardized sampling. All fish were measured in the field and retained fish were sexed and sagittal otoliths were removed. All ovaries were retained for fecundity estimates. Demographics and fecundity estimates were used to construct models and evaluate exploitation. These models will help guide future management actions and help managers evaluate impacts.

Growth and Abundance of Reintroduced Lake Sturgeon in the Coosa River, Georgia – Alabama

Matt Phillips* (University of Georgia), Martin Hamel (University of Georgia), Brian Irwin (U.S. Geological Survey, Georgia Cooperative Fish and Wildlife Research Unit)

Since the turn of the 20th century, Lake Sturgeon populations throughout their native range have experienced drastic declines. At the southern extent of their range, the Coosa River population in Georgia-Alabama became extirpated during the 1970's. The Georgia Department of Natural Resources began stocking Lake Sturgeon in 2002 to reestablish a self-sustaining population in the Coosa Basin. Although annual stocking events have continued to occur, little is known about the status of this reintroduced Lake Sturgeon population. We used a combination of historical and present mark-recapture data to assess annual growth rates and to estimate abundance of Lake Sturgeon. Furthermore, age estimates from fin spines and field observations allowed us to characterize dynamic rate functions and life history attributes. Stocked cohorts have survived and recruited to the population, although catch rates were indicative of low initial stocking survival rates. Initial cohorts have continued to grow sufficiently to reach sexual maturity, suggesting suitable conditions for population re-establishment. We estimated juvenile abundance in 2022 and 2023 to be 272 (70 – 1380, 95% C.I.) and 280 (176 – 513, 95% C.I.) individuals using Huggins Closed-Captures models. Growth rates, age to sexual maturity, and von Bertalanffy model parameters were compared to other populations across their native range. Mean annual growth of juvenile and sub-adult Coosa River Lake Sturgeon was faster (64.9 mm yr -1) and matured at an earlier age (12 and 13 years for male and female lake sturgeon). The von Bertalanffy growth model of the reintroduced population predicted a maximum mean total length of 1,306 mm (+/- 58.7mm) that would be reached at approximately 50 years old. Collectively, these data will help to fill knowledge gaps for managing reintroduced Lake Sturgeon populations at the southern extent of their range.

Population growth of threatened Gulf Sturgeon may be limited by frequency of adult episodic mortality events

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Understanding demographic rates of species of conservation concern and how these rates influence the intrinsic rate of population growth (λ) can inform management actions to promote species recovery. For the threatened anadromous Gulf Sturgeon Acipenser oxyrinchus desotoi, knowing whether λ is driven more by adult survival or recruitment into the adult population may assist managers in prioritizing actions to address life stage-specific limiting factors. For example, model results showing λ<1 and seniority >0.5 would suggest a declining population driven by adult survival (mortality rate exceeds the recruitment rate). We compiled Gulf Sturgeon capture-recapture data collected from 1990 to 2022 across seven river systems encompassing the species' range and estimated recruitment, seniority, and λ using a temporal symmetry model. We found Gulf Sturgeon λ to be driven by adult survival in all seven rivers. In four rivers, we found a declining trend in λ between 2010 and 2022, a period characterized by anthropogenic impacts and disturbances that are not easily managed. We suggest these additional mortality sources be considered part of the baseline mortality rate in future Gulf Sturgeon recovery planning to reflect the growing portfolio of mortality sources limiting the species' population growth.

OPTIMIZING COLONIZATION AND PROLIFERATION OF BLUE CATFISH (Ictalurus furcatus) DONOR STEM CELLS FOR THE CREATION OF XENOGENIC CATFISH; DETERMINING THE OPTIMAL DONOR STEM CELL QUANTITY

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The hybrid catfish (♀ channel catfish, Ictalurus punctatus, × ♂ blue catfish, I. furcatus) accounts for ~70% of the catfish market due to its superior performance over parent species. Techniques such as xenogenesis are being developed to continue advancing the industry. Xenogenesis has successfully enabled the production of hybrid catfish embryo by transplanting undifferentiated stem cells from donor diploid blue catfish into a triploid channel catfish. The present study is focused on identifying the optimal quantity of stem cells for transplantation to produce xenogeneic catfish. Triploid channel catfish fry were injected with 80,000 or 100,000 blue catfish stem cells labeled with PKH26 dye at 4-, 5-, and 6-days post-hatch (DPH). At 45 and 90 DPH, total length, weight, and survival of recipients were evaluated. Colonization of donor cells in recipients was evaluated by calculating percent cell (<150 µm2) and cluster areas (>150 µm2). PCR was used to determine percentage of xenogens from gonadal tissues. Quantity of stem cells injected had no overall significant impact on survival (p>0.05) of recipient fish. No significant difference was seen for percent cell area fluorescing (p>0.05), but cluster area was found to be significantly higher in individuals injected with 100,000 stem cells (p=0.001 & 0.003). PCR analysis showed, 83.7% and 79.3% of xenogens were detected when recipients were injected with 80,000 and 100,000 cells, respectively. Overall, introduction of 100,000 cells/fry led to better proliferation and colonization. These findings will enhance the feasibility and efficiency of germ cell transplantation for commercial-scale hybrid catfish production.

New Insights Reveal a Temporally Distinct Two-Stock Genetic Structure for Suwannee River Gulf Sturgeon

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Understanding population genetic structure and patterns of gene flow is crucial for effective decision making and the preservation of genetic diversity, especially when managing protected species. Historically, Gulf sturgeon have been managed by river system, with early evidence supporting spatially distinct genetic structure across seven natal populations. However, an increasing number of studies recognize that some rivers possess two genetically distinct stocks residing within the same drainage. Combined with evidence of both spring and fall spawning in these drainages, this suggests the distinction between genetic stocks may be temporally mediated, as similarly exhibited by the closely related Atlantic sturgeon. We analyzed the movements of 90 individuals within the Suwannee River between 2008 and 2022 using acoustic telemetry. We assessed migratory patterns and presence within known spawning locations to categorize individuals as exhibiting either fall or spring spawning behaviors each year. We then used genotype data for 14 microsatellite loci to assign each acoustically-tracked individual to a genetic group. Our results indicate that the two-stock genetic structure within the Suwannee River basin is driven by fidelity to temporally distinct spawning events, with one stock spawning only in the spring and the other only in fall. The existence of two temporally distinct stocks within the same river basin has immediate management implications for the recovery of this species.

Growth estimations of Gulf Sturgeon across their range using length-at-age data

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Gulf Sturgeon, (GS, Acipenser desotoi), are an anadromous species found in the northern Gulf of Mexico and are federally listed as threatened. They have a range that spans from the Pearl River, Louisiana to the Suwannee River, FL. Growth estimations for GS have intermittently occurred for different rivers, but not across all natal rivers. This work aims to provide growth estimations from observed length-at-age data and length-weight comparisons across the entire range of GS. A total of 1,109 individuals were sampled across all rivers from 2020–2022 with ages ranging from 0.5 to 7 and fork lengths that range from 370–995 mm. Four growth models were fitted to the data from the six drainages: a two-parameter von Bertalanffy growth function (VBGF), a three-parameter VBGF, a power model, and a Gompertz model, all of which have been used for GS previously. The three-parameter VBGF and Gompertz model did not converge for all populations. Based on the two-parameter VBGF, juvenile growth appears to be similar across all river populations with preliminary growth rate estimates, k, ranging from 0.37 (the combined rivers of the Pensacola Bay system) to 0.52 (for the Pascagoula River population). The Apalachicola River (AR) is an exception with a k value of 0.9789. There were 284 sampled individuals from AR, of which 261 were Age-1 or Age-2, driving the mean asymptotic length (L_∞) of the juvenile population down and the k value up. This work is a part of a larger GS juvenile dynamics project where additional samples from each river for 2023 will be included in the final analysis. These results will help to better inform how growth across all systems should be modeled when making recovery and management decisions.

Movement and tournament dispersal of Largemouth Micropterus salmoides and Alabama Micropterus henshalli Bass in Neely Henry Reservoir, Alabama

Marcus Prull* (Auburn University), Dr. Matt Catalano (Auburn University)

Both Largemouth Micropterus salmoides and Alabama Micropterus henshalli Bass are popular targets for anglers across their respective native ranges and are the subject of numerous fishing tournaments at large reservoirs. Fishing tournaments translocate fish to areas near weigh-in sties, yet few studies have investigated the magnitude of this spatial redistribution in the context of natural movements. We implanted 75 Largemouth and 75 Alabama Bass with radio transmitters and high value reward tags in December 2022 and January 2023 at Neely Henry Reservoir, Alabama, to assess movements, tournament associated spatial redistribution, and dispersal rates from weigh-in sites. Tournament caught fish were self-reported by anglers or visually identified by Auburn fisheries staff at tournament weigh-ins. Of the 150 telemetered fish, 32 (21%) were confirmed to have been weighed in at Black Bass tournaments at Neely Henry Reservoir. Twenty-seven of the 32 (84%) were released at Coosa Landing boat launch located in Gadsden, AL. Dispersal rates from Coosa Landing have been highly variable at the individual level, but a steep decline in fish around the launch has been observed. We found that 71% of fish located <2 weeks after release were within 3 km of Coosa Landing which declined to 40% for 2-4 weeks post release and further declined to 18% within 3 km after 10-12 weeks post release. This movement data will be critical in understanding the magnitude of stockpiling of Largemouth and Alabama Bass around tournament weigh-in sites. Additionally, we will test for differences in movements between the two species and will compare movement of tournament caught fish to non-caught fish.

Catch-and-release angling effects on two black bass populations at an Alabama Reservoir

Thomas J. Pullen* (Auburn University), Matthew J. Catalano (Auburn University)

The potential for size-selective catch-and-release angling to affect the size distributions of black bass (Micropterus spp.) populations is not well understood. Angling is highly size selective, and some types of angling, such as competitive fishing events, may be particularly size selective by incentivizing the capture of large fish. We are conducting research on Largemouth and Alabama Bass at Neely Henry reservoir in Alabama to assess the potential for size selective angling to affect population size structure. This system is characterized by high fishing effort, a high proportion of fish captured in tournaments, and a high rate of catch-and-release fishing. Size selectivity of tournament and non-tournament angling was estimated from a high reward tagging study. Variation in growth trajectories among individual fish was estimated by ageing samples of fish from the creel and from standardized electrofishing surveys. An age- and size-structured equilibrium model that accounted for individual variation in growth trajectories within these populations revealed that under typical reservoir capture rates and Ricker stock-recruitment dynamics, catch-and-release angling could reduce the abundance of memorable size Black Bass by 27% relative to an unfished population. Under Beverton-Holt recruitment, reductions were more severe with a predicted 38% decline.

Comparing the Distribution of Macroinvertebrate and Ichthyoplanktonic Communities Above and Below a Sill in the Lower Bouie River, Mississippi

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The Bouie River, located in southern Mississippi, is a tributary of the Pascagoula River. The lower 6 rkm of the Bouie River contains a series of deep gravel pits from historical aggregate mining and is further altered by the presence of a concrete and earthen sill. The lower 3 rkm of the Bouie River is the only known spawning site for the Pascagoula River Gulf Sturgeon population and serves as habitat for other species of concern in Mississippi (i.e., Pearl Darter, American Paddlefish, Alabama Shad). The objective of this study was to determine if there were differences in evidence of aquatic macroinvertebrate and ichthyoplanktonic communities and Gulf Sturgeon spawning above versus below the sill. In April–June of 2021 and 2022, a series of drift nets were simultaneously set above and below the sill. Net contents were preserved in formalin and all macroinvertebrates and ichthyoplankton were sorted and identified to lowest possible taxonomic level. A total of 180 samples were sorted with 91 from above the sill and 89 from below. Mann-Whitney U tests were performed to determine if there were differences in abundance of taxa above and below the sill. The most abundant macroinvertebrates above and below the sill were Cladocera, Diptera, Ephemeroptera, and Trichoptera. Of those, only the abundance of Diptera differed ($p = 0.01$), with higher abundance above the sill. The most abundant ichthyoplankton included Perciformes and Cypriniformes larvae as well as other unidentified embryos; none of which exhibited differences in abundance related to the sill. Evidence of Gulf Sturgeon spawning (1 larva and 2 embryos) was only found below the sill, likely because habitats directly above the structure are not suitable for spawning. Somewhat unexpectedly, we found little impact of the sill on macroinvertebrate and ichthyoplanktonic communities, but this is perhaps indicative of the taxonomic resolution.

Assessment of the status and distribution of Swainia darters in Arkansas, with emphasis on Percina nasuta

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Using electrofishing and snorkeling, we sampled 150 sites at 20 rivers and detected 459 Swainia darters (i.e., Percina nasuta, Percina phoxocephala, Percina brucethompsoni) from 2019-2023, and our sampling efforts were mostly directed at Percina nasuta forms. We contributed 131 specimens and 289 fin clips to genetic studies that diagnosed multiple new species in the Swainia complex. However, we did not implement multiple occupancy studies over their large combined range and this continues to prevent quantification of the extent that each species is rare or difficult to detect. Because of the ESA petition for Percina nasuta and possible listing of newly discovered lineages, we are directing future efforts towards determining effective population size (Ne) estimates to better understand extinction risk. By combining our data with other surveys since 2000 (N = 652 individuals), we suggest that Percina nastuta appears reasonably secure with 128 individuals widely distributed throughout the four upper forks of the Little Red River basin – a basin that receives limited sampling due to presence of endangered Nothonotus moorei. The Percina nasuta lineage in the upper White River basin does not appear to be at risk of immediate extinction because 103 specimens were detected at two rivers and its distribution appears stable since 1970; however, this preliminary conclusion needs to be reevaluated with Ne estimates. A total of 421 individuals were detected of the Percina sp. cf. nausta lineage in Arkansas River basin tributaries, primarily from 6 streams. However, only 16 specimens of Percina sp. cf. phoxocephala have been detected since 2000 at three streams in the Black River basin, despite intensive sampling by multiple community studies. An emerging conservation priority is a targeted assessment of Percina sp. cf. phoxocepha in the Black River due to its perceived global rarity.

Metabarcoding Diet Analysis of Grass Carp (Ctenopharyngodon idella) in the Great Lakes

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Aquatic nuisance species (ANS) prevention and mitigation is a high priority for natural resource management. ANS are of particular concern to resource managers in selected aquatic habitats that support delicate ecosystems or important commercial and recreational fisheries. Grass Carp (GC; Ctenopharyngodon iIdella) were first introduced in the U.S. in 1963 as a macrophyte control tool as they can consume more than their body weight daily and are considered herbivores. They have since proliferated in the Mississippi River watershed and beyond, with multiple confirmed reproducing populations. An interjurisdictional Grass Carp Advisory Committee (GCAC) has identified dietary analysis tools as both important to GC management and readily and immediately investigable through coordinated GCAC efforts. Amplicon sequencing methods use a set of genetic barcodes to amplify all contributing components in a DNA sample at one time, and high throughput sequencing (HTS) platforms can analyze thousands to hundreds of thousands of individuals per run. These technologies allow detectability and quantification of diet components at levels not achieved with microscopy. While such sequencing techniques have been successfully employed with carnivores, herbivorous animals present additional challenges due to chemical inhibitors present in plants, and fewer genetic barcoding resources for local plant communities. As such, field collected plant samples were selected and identified via the ITS-2 gene region and the PLANTiTS reference database. To-date, 71 stomach samples were completed (fish captured from 2017-2019) and an additional 149 subsampled for HTS. At the time of abstract submission over 200 unique plant species were identified in stomach samples, despite only ~33% of total samples having been completed. Diet was primarily represented by species associated with relatively shallow (<6m) slow flowing water or lentic habitats. Targeted diet can provide further insight into GC foraging preferences and allowing for more focused management decisions.

AquaDePTH-Aquatic Disease and Pathogen Repository: a New Public Resource

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Infectious disease significantly impacts commercially and ecologically relevant aquatic animal populations in the United States. Federal, state, tribal, academic, and private entities expend considerable resources to survey for aquatic pathogens but, there is no infrastructure to facilitate sharing or tracking of aquatic pathogen surveillance data at a regional or national scale. The effort for the Aquatic Disease and Pathogen Repository (AquaDePTH) is led by three USGS centers, including the Wetland and Aquatic Research Center in Gainesville FL, the Western Fisheries Research Center in Seattle WA, and the Eastern Ecological Science Center in Kearneysville WV. With the spread of aquatic pathogens/disease and invasive species being key priorities within aquatic ecosystems, AquaDePTH will expand on the success of the USGS Nonindigenous Aquatic Species (NAS) database. The new database will expand the NAS framework to curate spatially referenced biogeographic accounts of priority freshwater and marine animal diseases and pathogens to support national USGS biosurveillance efforts. Datasets will be provided by USGS research efforts, and from partnerships with federal, state, tribal, and academic institutions. AquaDePTH sets out to curate existing and new aquatic pathogen data within a single sharable source and to ensure interoperability with other existing pathogen databases. By collating historically published data, plus new aquatic pathogen and disease information, stakeholders will be able to monitor aquatic pathogen trends spatially and temporally in freshwater and marine environments. AquaDePTH Database will distribute information to stakeholders and the public through an online portal, providing custom data queries and downloads, distribution maps, and a data dashboard for generating data summaries. The USGS invites partners to directly engage in the development of this new repository.

Movement characteristics of endemic Sandhills Chub Semotilus lumbee in headwater streams of the Sandhills ecoregion of North Carolina

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The Sandhills Chub (Semotilus lumbee) is a Leuciscid endemic to headwater streams in the Sandhills ecoregion of North and South Carolina, and restricted to the Cape Fear, Pee Dee, and Wateree River basins. Due to their limited range, the Sandhills Chub is considered a species of special concern and is vulnerable to population losses and decline from habitat modification and development within the region. Little is known about the behavior and ecology of Sandhills Chub. Therefore, the objective of this study is to quantify Sandhills Chub movement via mark-recapture methods using passive integrated transponder (PIT) tags. Specifically, we are quantifying movement of fish at the individual level in 900-m reaches of two study streams, as well as investigating if factors such as water temperature, water flow, and size are related to movement. We will also be investigating if Sandhills Chub exhibit seasonal and spawning movement patterns. From October 2022-October 2023, 521 Sandhills Chub were captured via backpack electrofishing and tagged. We have recaptured 196 (37.6%) of the 521 tagged Sandhills Chub at least once, with most of these individuals being captured at least twice. The median individual distance moved was 25-m, and mean distance moved was 67-m. Sampling will continue through October 2024. Results from this study will provide information about the ecology of Sandhills Chub that can be used to guide conservation of the species.

Systematic distributional survey of endemic and invasive crayfishes in the upper Saint Francis River drainage, Missouri

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Crayfish invasions are among the top global threats to native crayfish populations. The Saint Francis River crayfish (Faxonius quadruncus) and Big Creek crayfish (F. peruncus), endemic to the upper Saint Francis River (USFR) drainage in Missouri, are currently under threat of extinction due to invasion of the Woodland Crayfish (F. hylas) from nearby drainages. Previous research has documented reduced abundances and range reductions for both native species in reaches invaded by F. hylas. However, the entire ranges of the native species have not been systematically sampled, and the most recent data documenting F. hylas invasions are over 13 years old. Management agencies need updated distributional data to create an informed recovery plan for the two threatened species. We used stratified random sampling to select 96 sites across the USFR basin for a distributional survey conducted in 2022-2023. Our analyses will incorporate presence-absence data from this survey with coarse-scale GIS data into random forest, boosted regression, and spatial stream network models to create probability of presence maps for the invasive and two endemic crayfish species. Field sampling also resulted in the discovery of F. hylas invasions in two major tributaries to the USFR drainage. Additionally, we used targeted sampling to locate the leading edges of invasion in six streams and documented a range expansion of F. hylas 1.4 km upstream from the 2009 leading edge in Orr Hollow Creek. Results from this study could be used to identify refugia for the endemic species and locate barriers to further invasion.

Distribution and Population Dynamics of Peppered Shiner, Miniellus perpallidus

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Miniellus perpallidus, the Peppered Shiner, is a rare minnow endemic to eastern Oklahoma and southern Arkansas that has faced population declines and range contraction. We sampled 68 sites across the historic range in Arkansas but have only detected the species at 13 sites in the Saline River. Our data suggest Peppered Shiner may be extirpated from the Ouachita, Caddo, and Little Missouri rivers, but still inhabiting the Saline River. Three sites with persistent populations in the Saline River were sampled monthly to bimonthly when accessible with seines to quantify temporal changes in abundance, distribution, and size frequency distribution within wadeable pool/run complexes beginning February 2022. Individuals ranged from 10.1 mm to 53.4 mm standard length (SL) with evidence of sexual maturity in individuals as small as 33.5 mm SL. We confirmed gravid females from May to July and tuberculate males from May to September. Since February 2022, we noted yearly and seasonal changes in overall abundance and age class structure. Overall abundance trended lower during 2023 sampling events compared to 2022, with the greatest difference being a smaller year-one age class during 2023. Peppered Shiner tends to be most abundant in wadeable pool/run habitats from July to September. In 2022, the majority of individuals were generally found near upstream and downstream transition zones between runs and pools, but this pattern varied with age class. For example, age-0 individuals trended to be most abundant in downstream run/pool transition areas. Fish were more evenly distributed throughout habitats in reaches during 2023. Peppered Shiner use of run/pool complexes was temporally and spatially dynamic and may be related to variability in stream hydrology. With continued sampling, we aim to further understand the distribution and population dynamics of Miniellus perpallidus to aid conservation.

Innovation in Recreation-Grade Technology for Assessing and Monitoring Silver Carp

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Side-scan sonar can be a cost effective, non-invasive approach to assess and monitor fish populations and their habitat. We used recreation-grade side-scan sonar (SSS) in conjunction with semi-autonomous watercraft as a method to survey Silver Carp in riverine backwater habitats. A small vessel (i.e., sit-on-top kayak approximately 4 m in length) with a relatively quiet propulsion system (i.e., electric trolling motor with GPS capabilities) should reduce fish-boat avoidance and likewise have less influence on normal fish behavior. In addition, multiple watercraft may be deployed simultaneously to follow preprogrammed transects and survey areas with less time and effort relative to a traditional survey vessel. We used two semi-autonomous watercraft to survey a semi-closed population of Silver Carp in Creve Coeur Lake, St. Louis, Missouri, USA—130 Ha natural oxbow lake of the Missouri River. Surveys were conducted at night, starting one hour after sunset, and concluding approximately 2 h later. Fish targets in SSS images (N = 1440) were enumerated and measured (total length > 400 mm) using image-processing algorithms. Fish targets, enumerated manually from a subset of images (n = 20) via systematic-random selection, were highly correlated with algorithm counts (r2 = 0.983) and a correction equation was applied to account for an overestimation (y = 0.94x) in the algorithm counts. The ensonified water volume was computed using bathymetry data and to estimate fish density (0.162 targets/m3). We assume Silver Carp are the dominant species in the lake. Paired capture data (i.e., species, length, weight) will be used to validate species makeup and accuracy of Silver Carp density estimates. Repeated surveys within and across seasons are planned for 2023–2024. Final density estimates will be scaled to a full-lake biomass estimate and used to inform harvest goals for managing Silver Carp in Creve Coeur Lake.

You Are Not Alone: Using Resolutions and Organizations as Advocacy Tools

Dennis K Riecke* (Mississippi Department of Wildlife, Fisheries, and Parks)

The situation my agency faced in 1999 was the intentional stocking of a nonnative fish, black carp, Mylopharyngodon piceus, in aquaculture ponds as a means of biological disease control. No other disease treatment options were available to combat a new disease. My agency used science in the form of an USGS risk assessment and AFS resolutions to inform the permitting agency, the Mississippi Department of Agriculture and Commerce (MDAC) and the aquaculture industry that stocking black carp posed a potentially serious threat to native mussel resources should black carp escape from the stocked ponds. An interstate organization, the Mississippi Interstate Cooperative Resource Association (MICRA), became aware that the permitting agency decided to allow the stocking of black carp in Mississippi. MICRA members debated the issue and petitioned the US Fish and Wildlife Service in 2000 to list black carp as an injurious species of wildlife under the Lacy Act. Notices appealing for information on this proposed Lacy Act listing were published in the Federal Register in 2002, 2003 and 2005. The MDAC and the aquaculture industry opposed this listing. Black carp were added to the Lacy Act as an injurious species of wildlife in November 2007.

Dealing with the Press: Being Reactive and Proactive

Dennis Riecke* (Mississippi Department of Wildlife, Fisheries, and Parks), Cecil A. Jennings (US Geological Survey, GA Cooperative Fish and Wildlife Res Unit, Retired)

This presentation will cover the two types of media situations which are reactive and proactive. Reactive media communications involve being requested to respond to some emerging event, such as a red tide outbreak. Tips for preparing for a media interview on a reactive event will be provided. Proactive media communications consist of publicizing what you want the public to know such as the results of a research study or the announcement of a new state record fish. The benefits of having a formal media policy will be discussed. The appropriateness of using various forms of written communications such as announcements, news releases, fact sheets and magazine articles will be reviewed. It is important to adhere to all established procedures for all media contacts. Examples of when and when not to provide comments will be discussed. In all media situations, it is vitally important to keep your supervisor fully informed of what information the media sought and what you provided. Fisheries professionals should always seek to respond in a factual manner that is simple, concise, and free of technical jargon, personal views, and speculation. Your focus should be on what the public, your ultimate audience, needs to know. Typical media lead times and the importance of knowing and meeting media deadlines will be covered. All media contacts are marketing efforts that should be addressed in a professional manner while maintaining your composure and emotions.

Collaborative Approach to Large-Scale Restoration on War Eagle Creek: Breaking Through Barriers & Not Giving a Dam

Becky Roark*, Beaver Watershed Alliance, Daniel Hagood, Beaver Watershed Alliance, Tim Burnley, Arkansas Game and Fish Commission, Sean Saunders, Arkansas Game and Fish Commission, Jonathan Baxter, Partners for Fish and Wildlife

War Eagle Creek (WEC) is the largest tributary to Beaver Lake, drinking water source for 550,000 residents in Northwest Arkansas. Segments of WEC are listed on the 303(d) list for nonattainment due to turbidity and pathogens and twenty-seven Species of Greatest Conservation Need (SGCN) occur in WEC, including two federally protected species. A collaborative partnership between Arkansas Game and Fish Commission, Beaver Watershed Alliance, Partners for Fish and Wildlife, U.S. Fish and Wildlife Service, landowners, nonprofits, state, local governments, and others are working together to remove four stream barriers, including a large dam, to reconnect 434 miles of stream on War Eagle Creek, restore approximately 11,000 linear feet of streambanks, create 6 acres of wetlands, install instream habitat structures, supplement populations of SGCN and T&E species, and reduce flood and safety hazards for residents and visitors. Efforts also include monitoring and providing community services such as conservation education, training, and sharing informative quantitative data on the benefits of dam removals in the central United States.

The project will restore habitat for target species, as well as provide beneficial outcomes for drinking water supplies, watershed function, wildlife, outdoor recreation, farming, and education. Learn from this presentation on the multiple benefits of stream barrier removal, critical steps taken to move through the first year of a complex process and how partnerships and education are key to achieving large-scale efforts for restoration.

The Carpiodes Conundrum: Molecular and Morphological Patterns of a Putative Undescribed Catostomid, the Llano River Carpsucker

Hayden Roberts* (Department of Ecology and Conservation Biology, Texas A&M University), Preston Bean (Inland Fisheries Division, Texas Parks and Wildlife Department), Kevin Conway (Department of Ecology and Conservation Biology, Texas A&M University), Gary Voelker (Department of Ecology and Conservation Biology, Texas A&M University), Henry Bart (School of Science & Engineering, Tulane University), and Joshuah Perkin (Department of Ecology and Conservation Biology, Texas A&M University)

In the Colorado River of Texas, there is evidence of an undescribed species of carpsucker, the Llano River Carpsucker (Carpiodes sp. cf. carpio). The Llano River Carpsucker (LRCS) is thought to possess a more elongated body compared to sympatrically occurring River Carpsucker (Carpiodes carpio). Published accounts of LRCS are limited, and molecular relationships to valid species of Carpiodes are currently unknown. The objective of this study was to assess morphological and molecular variation among members of the genus Carpiodes inhabiting central Texas river basins. Sampling resulted in whole body and tissue preservation of 260 specimens. Seventeen homologous landmarks from photographed specimens were used to perform a morphological analysis assessing gradients of body shape variation. Specifically, a principal component analysis (PCA) was performed on the landmarks to determine shape features that best explained the morphological variation. DNA from tissue samples were extracted and amplified using Polymerase Chain Reaction (PCR) protocols unique to the Mitochondrial Cytochrome b (CYTB) gene and Nuclear IRBP2 gene and sanger sequenced. The aligned DNA sequences were used as input to develop minimum spanning haplotype networks for each gene. For the CYTB gene, a common haplotype was revealed that was generally restricted to the Edwards Plateau Region of Texas where LRCS are common. Three dominant haplotypes encompassing over 75% of the specimens were used as predictor variables for a permutational multivariate analysis of variance (PERMANOVA) with morphological principal components (PC) from the PCA as response variables. A significant relationship between haplotypes and the first PC, which itself demonstrated variation in body depth, was revealed. This study provides insight into the morphological and molecular covariance among members of Carpiodes within Texas and can be used to inform taxonomists whether LRCS are in fact genetically and morphologically unique, or simply an anomalous morph of a valid member within Carpiodes.

Recovery of endangered Roanoke Logperch (*Percina rex*): key lessons on teamwork, persistence, and dealing with uncertainty

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In late 2022, the U.S. Fish and Wildlife Service initiated the delisting process for Roanoke Logperch (*Percina rex*; "RLP"), a riverine darter considered "Endangered" under the Endangered Species Act since 1989. Such recovery designations are quite rare for southeastern fishes: if delisting is successful, RLP would become only the third delisted darter species. In this talk we tell RLP's recovery story, highlighting (1) the evolution of our scientific understanding of RLP ecology, from its initial description to its being listed as Endangered to the present day, (2) the potential influences of various conservation actions – including regulations, sediment control, barrier removal, fish translocation, and public education – on species recovery, (3) two decision-support tools we developed in collaboration with other biologists and stakeholders to help guide sound recovery – one a Species Status Assessment for RLP and the other a sophisticated but user-friendly PVA model to adaptively plan translocation actions and forecast future resiliency, and (4) most importantly, key lessons learned along the way that may prove applicable to recovery planning for other fishes.

Balancing nonnative trophy Smallmouth Bass management with the conservation of endemic Neosho Bass in the Ozark Highlands

Anthony Rodger* (Oklahoma Department of Wildlife Conservation), Kobe White (University of Southern Mississippi, Hattiesburg), Trevor Starks (Kansas Department of Wildlife and Parks), Andrew Taylor (University of North Georgia, Dahlonega)

Researchers elevated Neosho Bass from synonymy with Smallmouth Bass based on past morphological descriptions and recent phylogenomic analyses. Neosho Bass only inhabits streams in the Central Interior Highlands within the Arkansas River basin. Prior to a recent paradigm shift prioritizing black bass diversity conservation, state agencies widely introduced black bass species outside their native ranges. Oklahoma stocked nonnative Smallmouth Bass in Tenkiller Lake within the Illinois River watershed in the early 1990's. Over time, Smallmouth Bass invaded Tenkiller's tributaries and hybridized with native Neosho Bass. Noticeable changes in lotic black bass populations prompted research to better understand and manage the popular stream fisheries. Creel surveys assessed how stream size and accessibility related to angler demographics, effort, catch rates, and harvest. Furthermore, we evaluated how fish size and catch rates influenced stream fishing demand and economic value. To characterize the spatial extent and directionality of introgressive hybridization, we genotyped 1,272 fish with a low-density SNP panel. Next, STRUCTURE estimated member coefficients and NewHybrids assigned each fish to a hybrid class (i.e., parental species, F1, F2, or backcross). In addition, we aged 650 individuals to isolate the role of genetic identity on growth rates. Genetics results revealed an ongoing hybrid swarm in the largest tributary, but upstream reaches of smaller tributaries contained relatively pure native genomes. We found Smallmouth Bass exhibited growth rates among the fastest in the country and provided trophy fishing opportunities. Conversely, Neosho Bass grows slower and rarely surpasses 356 mm. Human dimensions data highlighted distinct angling demographic groups varying in opinions related to harvest. However, anglers generally valued larger fish over higher catch rates. Based on data from this research, we discuss potential watershed-level management approaches and the nuances of balancing trophy angling opportunity with native species conservation.

Modeling Invasive Silver Carp Population Characteristics and Management Alternatives in the Tennessee and Cumberland rivers

Alexanderia Lacey* (Tennessee Tech University), Mark Rogers (USGS Tennessee Cooperative Fishery Research Unit), Richard Erickson (USGS Upper Midwest Environmental Science Center)

Silver Carp Hypophthalmichthys molitrix can cause considerable damage to aquatic ecosystems and create potential human harm due to their jumping behaviors. Silver Carp have invaded the Tennessee and Cumberland Rivers in the southeast U.S. Multiple agencies and federal plans call for control and removal to minimize ecological harm. By creating a spatially explicit model, we can determine and compare methods to manage the Silver Carp invasion. As part of the model building process, we used demographic data to estimate population rates, which showed spatial variability across the Tennessee and Cumberland Rivers. We are using this model to compare management strategies to control the metapopulation of Silver Carp that include movement deterrents and harvesting. We will be sharing preliminary results and seeking feedback from managers and stakeholders on possible strategies.

Seasonal movement variability in riverine Shoal Bass and Largemouth Bass populations in the lower Flint River, GA

Jamie L. Rogers* (Alabama Cooperative Fish and Wildlife Research Unit, Auburn University and The Jones Center at Ichauway), Shannon K. Brewer (U.S. Geological Survey, Alabama Cooperative Fish and Wildlife Research Unit, Auburn University), Steven M. Sammons (School of Fisheries, Aquaculture, and Aquatic Sciences, Auburn University), and Stephen W. Golladay (The Jones Center at Ichauway)

Understanding fish movements is important to managing populations because they reflect changing resource needs throughout the life cycle. Generalizing movement patterns is challenging due to changing availability of resources and variation within and among populations. This is especially true for narrow-range endemic species where ecological knowledge is often lacking relative to the evolving species designations. Moreover, efforts to understand more broadly distributed species, such as Largemouth Bass Micropterus salmoides, have been mostly focused on reservoir or lake populations. Thus, our study objective was to determine the seasonal movement variability of endemic Shoal Bass, M. cataractae, and native Largemouth Bass in the lower Flint River to better understand and manage riverine populations. We tracked 37 Shoal Bass and 35 Largemouth Bass using radio telemetry from March 2022 to May 2023. Preliminary results indicate that Shoal Bass had greater average daily movement rates than Largemouth Bass, but both species exhibited upstream movements of more than 50 km in the spring, likely associated with spawning. We also observed sedentary and mobile individuals in both species with mobile individuals displaying less movement and site fidelity during non-spawning times. Tagged fish of both species congregated at the tailwater-shoal area below Flint River Dam in Albany, GA during presumed spawning each year but dispersed throughout the study area during other seasons. Overall, both species exhibited heterogenous movement dynamics with some individuals moving throughout a significant portion of this river corridor. Additionally, seasonal movement timing, magnitude, and destinations were similar across years indicating the presence of important environmental cues and spawning areas for these species. Knowledge of Shoal Bass and Largemouth Bass movement dynamics over multiple seasons will provide information useful to agencies concerned about connectivity requirements, the effects of dam operations, and important spawning locations for these populations.

Estimating mortality components in a high effort Black Bass fishery using reward tags and radio telemetry

Max Rubino* and Matthew Catalano - Auburn University

In recreational fisheries with high voluntary release rates, post-release mortality could exceed harvest mortality and negatively affect abundance and size structure. For reservoir Black Bass species (Micropterus spp.) tournament post-release mortality rates are higher than that of non-tournaments and could be a significant component of total fishing mortality. To quantify components of mortality, we conducted a tagging study to estimate natural, harvest, tournament release, and non-tournament release mortality rates. Over a two-year period, we tagged 800 Largemouth (Micropterus salmoides) and 800 Alabama Bass (Micropterus henshalli) with variable reward ($100-$300) external dart tags. In addition, 125 fish of each species were implanted with a radio transmitter that indicated mortality if tags remained motionless for 8 or 24 hours. Fish were collected for tagging using standard electrofishing procedures in January and February of 2022 and 2023. Telemetered fish were manually tracked monthly in 2022, and bi-weekly in 2023. Telemetry data and angler tag returns were analyzed with a Bayesian multi-state mark recapture model that accounts for telemetric mortality misclassification and angler non-reporting. Results from year one tag returns indicate that the annual capture rates for Alabama Bass and Largemouth Bass exceed 0.49 and 0.33 respectively. For both Largemouth and Alabama Bass, non-tournament capture rates (56%, 64%) were higher than those of tournaments (44%, 36%). Additionally, estimates of post-release tournament mortality were 0.17 for Largemouth Bass and 0.29 for Alabama Bass, which are consistent with literature values. The annual harvest rate for both species is less than 0.1 indicating catch-and-release mortality exceeds that of harvest. Results from this study will inform better recreational fishing management on high effort bass reservoirs in the southeastern US and beyond.

The New Oklahoma Bass Tournament Exemption and Reporting Program

Cliff Sager* (Oklahoma Department of Wildlife Conservation)

In September of 2022, the Oklahoma Department of Wildlife Conservation (ODWC) implemented a new statewide bass length limit regulation and companion Bass Tournament Exemption Program. The new regulation, limiting the possession or harvest of bass over 16 inches to one fish/day, would have greatly impacted the traditional bass tournament weigh-in format. The exemption process allows anglers fishing in a permitted bass tournament to exceed the daily length limit if conditions of the permit are met. Conditions include best management practices for fish care and a mandatory post tournament report. Data collected from these reports will aid ODWC with monitoring and managing bass populations statewide. The cooperation of tournament directors is critical to the success of this new program and its future. Preliminary data collected and lessons learned from the rollout of this program will be discussed.

Investigating the effects of an eye nematode infection on age, growth, and condition of sunfishes in the Yellow River Watershed

Mark P. Lougee* (Georgia Gwinnett College), Peter C. Sakaris (Georgia Gwinnett College)

Recent fish sampling surveys in the Yellow River Watershed (Georgia, USA) have revealed an increased frequency in eye nematode infection in Bluegill Sunfish, Lepomis macrochirus, and in other Lepomis spp. To further investigate this infection, we conducted a census of all sunfish populations along five transects in the watershed in winter/spring and summer/fall 2023. We used backpack electrofishing to sample each transect on three occasions (a total of 15 sampling trips). After each sampling event, we identified all sampled fish to the species level, measured each fish (mm TL), and recorded the presence or absence of the eye nematode in each fish that was sampled. If a fish was infected in both eyes, we recorded it as a double infection. Field-determined infection rates were computed and compared across all sunfish species. In summer/fall 2023, a sub-sample of Bluegill Sunfish (infected and uninfected) was also collected and processed in the laboratory to assess the effects of eyeworm infection on sunfish age, growth, and condition. Based on previous observations, we hypothesized that the Bluegill Sunfish would exhibit the highest infection rates, and that the probability of infection in other species would increase in transects with more infected bluegill. We also predicted that infected fish would exhibit a younger age structure, lower body condition, and slower growth compared to uninfected individuals. In winter/spring 2023, field-estimated infection rates were significantly greater ($P = 0.01$) in Bluegill Sunfish (28.6-55.0% range) than in Redbreast Sunfish (7.5-33.3%), although the infection rates were not significantly correlated between the species. Worm infection was also observed in Green Sunfish and Mosquitofish, but at much lower rates. Laboratory dissection of sunfish revealed that field-determined infection rates were likely underestimated, as we noted fish with milder infections with worm(s) behind the eye. Age, growth, and condition analyses of sunfish are currently underway.

Assessing the effectiveness of APEX backpack electrofisher settings on estimates of fish catch, abundance, and diversity in a suburban watershed

Peter C. Sakaris* (Georgia Gwinnett College), Lisa Bachtel (Auburn University)

We experimented with three different electrofishing settings on the APEX backpack electrofishing unit: “low” (12% duty cycle, 20 Hz), “medium” (20% duty cycle, 30 Hz), and “high” (30% duty cycle, 50 Hz) power and frequency. We conducted three rounds of sampling at low, medium, and high settings, respectively, at 4-5 transects in the Yellow River Watershed, Georgia (USA), from fall 2021 through spring 2023. We compared our catch (fish abundance and species composition) to the expected catch outlined in the electrofisher manual. For example, at low settings, we expected to catch a higher percentage of scale-less, electrosensitive fishes (e.g., catfish) and lower overall fish abundance, while observing little to no mortality during sampling. At high settings, we expected to catch a higher percentage of scaled, robust fishes (e.g., sunfish) and greater overall abundance of fish, while observing higher mortality rates during sampling. We also compared diversity estimates across the three settings. Species composition, species richness, and the relative abundances of different species varied significantly across the three settings. We observed effects of both season and electrofisher setting on fish mortality, with higher mortality observed in later summer/early fall and on medium settings. We suggest that higher mortality at medium settings was potentially a result of increased duration of exposure to the electrical field, as well as higher water temperatures. We also observed a highly significant species*setting interaction on catch (CPUE), with species varying in their relative sensitivities to the different settings. For some species, sensitivities also varied by season; for example, more Bluegill Sunfish were caught at the high setting in fall while more Bluegill Sunfish were sampled at the medium setting in spring. Data collected during fall 2023 (current) sampling will be included in this analysis.

An Investigation of Genetic Markers Associated with Gender and Ultimate Size in Florida Bass

Joshua Sakmar* (Red Hills Fishery), Klara Verbyla (The Center for Aquaculture Technologies)

Detailed knowledge of any genetic bases for gender and individual size offers value for organizations wishing to culture, stock, and maintain trophy bass systems. We examined the potential of genetic control for sex determination in Florida bass (Micropterus floridanus) through repeated genome wide association (GWAS) analyses carried out using traditional statistical and cutting-edge machine learning algorithms. Utilizing whole genome data, multiple studies did not identify any single marker or set of markers that could definitively predict sex. The initial study identified markers that could be used to identify females approximately 80% of the time, however the association between these markers and sex deteriorated with subsequent studies. Machine learning approaches also identified sets of predictive markers which again were not prognostic in subsequent generations. Testing of published markers for Largemouth bass (Micropterus salmoides) also failed to accurately predict sex highlighting the complexity of sex determination in Florida bass. This work has the potential to shed light on complications sometimes observed in the long-term maintenance of gender specific bass populations. Markers for Trophy Status, or growth to trophy size (>8 lbs.), in Florida bass were identified through a large, robust, GWAS study. More than 250 control, non-trophy fish, and 250 fish of trophy size were sequenced with more than 3.8 million markers tested for association with the Trophy Status trait. The results revealed a set of markers highly predictive of Trophy Status. A likelihood test based on the markers was developed to identify bass with a high genetic likelihood of becoming Trophy sized. This finding offers potential advances in developing trophy specific fisheries and conserving the trophy potential of populations via long term monitoring and stocking operations.

Beyond the Borders: Challenges in Reservoir Management in the North-Central and Southern Divisions – Summary

Steven M Sammons*, Auburn University

Reservoirs are large-scale landscape features that are widespread across the North Central and Southern Divisions of the American Fisheries Society. Reservoirs transform lotic systems into a variety of lacustrine environments that can variously resemble natural lakes or slow-moving rivers, depending on morphology, inflows, and operational protocols. Many of them support popular and economically valuable fisheries for a variety of sportfishes. Likewise, these systems can provide habitat and refuge for a number of fishes not commonly targeted by anglers but that are important components of aquatic ecosystems. Reservoir systems differ from most natural aquatic systems in that they are usually managed for multiuse, many of which are not compatible with optimal management strategies for fisheries. Challenges faced by reservoir fisheries managers are similar across the country, offering opportunities for biologists across AFS Divisions to learn from each other as they try to overcome management issues common to all. This symposium offers biologists in the Southern Division a rare opportunity to network and learn from their counterparts in the North Central Division, and vice versa. Talks are expected to cover innovative strategies that biologists have used to address these challenges and should demonstrate that we are all, quite literally, in the same boat. But hopefully not the Titanic.

Genomic Homogenization in the Tenn-Tom Waterway

Michael Sandel* (Mississippi State University)

The Mobile River and Tennessee River Basins are inhabited by the greatest diversity of freshwater fishes in North America, including over 100 species that are threatened with extinction. Many of these taxa represent peripatric species pairs, with congeners isolated by the Mobile-Tennessee drainage divide. Recent studies funded by the National Fish and Wildlife Foundation quantified conservation priority scores for 290 USGS subbasins comprising the Southeast based on endemism and imperilment of native fishes, crayfishes, and mussels. These reports identified two subbasins of the middle Tennessee River (Pickwick Reservoir and Wheeler Reservoir) with the highest overall endemism and imperilment scores. Pickwick and Wheeler Reservoirs were constructed to facilitate construction of the Tenn-Tom Waterway, and the Pickwick subbasin includes the intersection point with the Tombigbee River. Thus, the Tenn-Tom Waterway is a gateway for biotic homogenization of the two most imperiled river basins in the United States. In lieu of extensive modification of existing infrastructure and operations, invasive lineages and hybridization across the Tenn-Tom Waterway are posed to further imperil some of the most endangered fishes and invertebrates in the world. The goal of this project is to assess the 40-year impact of potential gene flow across the Tenn-Tom Waterway among freshwater fish and mussel populations of Alabama, Mississippi, and Tennessee. Specifically, we propose a multiomic approach to map the geographic spread of nonindigenous genotypes, to identify the phenotypic consequences of genomic elements that introgress and propagate most quickly through native fish populations, and to measure the effects of host-fish introgression on the reproductive fitness of endemic unionid mussels. Preliminary results yield evidence of genomic homogenization among populations of Walleye, Bullhead Minnow, and Brook Silverside.

INVESTIGATING LONG TERM FISH COMMUNITY CHANGE IN THE HEADWATER STREAMS OF BAYOU PIERRE

Matthew Aiken* (University of Southern Mississippi, Hattiesburg), Loren Stearman (University of Southern Mississippi, Hattiesburg), Scott Clark (U.S. Fish and Wildlife Service, Baton Rouge Fish and Wildlife Conservation Office, LA), Brian Kreiser (University of Southern Mississippi, Hattiesburg), and Jake Schaefer (University of Southern Mississippi, Hattiesburg)

Identifying fish community changes is necessary to better manage ecosystems. Disturbances may cause community changes directly or through altered habitat. Bayou Pierre is a highly diverse but geomorphically unstable watershed in west-central Mississippi. Most specialized species struggle to cope with habitat changes due to natural and anthropomorphic ecological disturbances such as storms, floods, headcutting, gravel and sand mining, and bridge construction. Failure to cope with these disturbances drives fish community change. Shifts in fish communities can therefore help demonstrate geomorphologic instability. Although well understood in the mainstem Bayou Pierre, fish community and geomorphologic changes in the headwaters are poorly understood. The purpose of this project was to investigate changes in headwater fish diversity and community structure over time. We analyzed nine decades of historical data and contemporary data to better understand headwater fish community change over time.

Development of a Regulatory Framework for Management of Native Nongame Fishes Targeted by Bowfishing

Jason D. Schooley* (Oklahoma Department of Wildlife Conservation) and Dr. Dennis L. Scarnecchia (University of Idaho)

Management and regulatory limitations on the take of native nongame (NNG) fishes targeted by bowfishing has lagged behind the rapid growth of the sport. Recent life history findings suggest that these NNG fishes have high conservation value, despite few protections. Multiple studies were completed in Oklahoma to inform the development of an initial framework for this previously unregulated sport fishery. A statewide survey on Oklahoma bowfishers in 2021 provided data on individual take and species, in addition to key insights on the social value and disposal outcomes of shot fishes. A second study in 2022 investigated the short-term mortality of fishes shot with a bow and arrow to close a regulatory loophole failing to prohibit the accepted practice of shoot and release by bowfishers. Specific data on status and abundance of Oklahoma NNG fishes remains inadequate to implement individual bag limits, though research is in progress. Therefore, an aggregate daily bag limit for NNG fishes taken by all methods was proposed for 2024 within a suite of related statutory changes. Key among the justification for proposed regulations is the common concern for wanton waste and a confrontation of the legality and ethics of unlimited sport killing of NNG fishes within a fishery that to-date has been unmanaged and understudied. Topics discussed will provide insights on the challenges and legal processes of upgrading the conservation protection and social status of historically underappreciated NNG fishes (which are now de facto sport fishes) within a movement guided by the tenets of the North American Model of Fish and Wildlife Conservation.

Analysis of acceleration data from acoustically tagged Gulf Sturgeon (Acipenser desotoi) around Ship Island, Mississippi

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Mississippi barrier island habitats are within the footprint of Gulf Sturgeon (GS; Acipenser desotoi) federally designated critical habitat. One of these islands, Ship Island (SI), underwent a major restoration project from 2019–2020 in which a shallow island pass was filled to reunite the island that had been separated by large-scale hurricanes. A pre- and post-restoration study regarding the impact of habitat restoration on GS is ongoing and made use of acoustic telemetry; however, this technology is limited in that habitat use is inferred from presence-absence data rather than observational or physiological data. Therefore, we aim to understand foraging by GS post-restoration using specialized telemetry tags that record accelerometer (m/s2) and temperature data. A total of 15 adult (n=9; >1250 mm fork length; FL) and subadult (n=6; 891–1249 mm FL) GS from the Pearl River (PE) and 13 adult (n=7) and subadult (n=6) GS from the Pascagoula River (PR) were implanted with accelerometer and temperature transmitters between November 2021–October 2022. Seven tagged PE GS (4 adult; 3 subadult) and 13 tagged PR GS (7 adult; 6 subadult) were detected around SI during the cooler months of 2021–2023 by an array of receivers divided between five monitoring zones (corresponding with island passes and the north and south island faces). Acceleration data indicated stationary and probable foraging behavior (0.058–0.826m/s2) and did not vary by time of day. High (1.0–4.0 m/s2) and burst activity (4.9 m/s2; sensor limit) were observed, most often in island passes, and may indicate jumping behavior. Differences in acceleration between populations and size classes were minimal and was not restricted to presumed areas of foraging or migration corridors. Future direction of this study includes analysis of temperature influence on acceleration or use behavior around SI.

Mitochondrial and nuclear genetic markers suggest at least three introductions of Weather Loach (Misgurnus anguillicaudatus) introductions in Georgia

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The Weather Loach (Misgurnus anguillicaudatus), a popular food and aquarium fish from East Asia, has been introduced in several countries and 22 states in the USA. They were first recorded in Georgia in 2020 and have since been documented in nine tributaries in the Ocmulgee and Oconee River watersheds. The number and sources of these introductions are unclear, as is scale and magnitude of natural dispersal. We sequenced the mitochondrial control region to assess genetic structure across tributaries and compare with published data. We also genotyped individuals at eight microsatellite loci to characterize nuclear genetic structure and relatedness. Sixteen variable positions resolved six control region haplotypes, all belonging to clade B2 described from Japan (via China). All Ocmulgee individuals shared the same haplotype (CR1), which has not been found in the Oconee watershed. The four haplotypes recorded in Oconee River tributaries during 2021-2022 were all found in Indian Creek, consistent with it serving as the source of all downstream tributaries. However, the 2023 discovery of Weather Loaches in Little Sandy Creek, a tributary of the Apalachee River that feeds Lake Oconee, yielded a novel haplotype six mutational steps from the most common Indian Creek haplotype (CR6 and CR5, respectively). This implicates a potential third introduction. Fish purchased as Weather Loaches in Athens aquarium stores were determined to belong to a related species, the Large-scale Loach (Paramisgurnus dabryanus), based on their control region sequences. STRUCTURE analyses of the microsatellite data indicated two genetic clusters formed by Ocmulgee and Oconee Basin individuals. Parentage testing linked juveniles and adult females within tributaries but has not yet detected dispersal between tributaries. Continued sampling along with congruent aging and otolith microchemistry analyses should provide additional context for refining dispersal inferences to aid aquatic nuisance species managers.

Evaluating daytime and nighttime hydroacoustics for assessing shad abundance in reservoirs

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Vertically migrating Chaoborus create large amounts of acoustic backscatter at night, making it difficult to gain accurate fish abundance estimates from nighttime hydroacoustic data. During the 2022 field season, we evaluated the use of daytime sampling as an alternative to traditional nighttime sampling, with particular attention to evidence of boat avoidance and acoustic shadowing (attenuation of acoustic signal) when dense schools were present, which are reasons commonly cited for why shad sampling should be conducted at night. We sampled the same transects during day and night using a 200kHz transducer during the months of July - October 2022 at Beaver and DeGray Lakes, and in October 2022 at Lake Carl Blackwell. We evaluated the movement of acoustic targets while in the sound beam to infer the body tilt (assuming fish moved head-first) to assess if fish dove deeper to avoid the boat. We used the bottom echo strength before, during and after the occurrence of dense schools of fish to determine if fish schools attenuated the signal strength that reached the bottom. During September and October samples, a forward facing-facing multibeam DIDSON echosounder was also used to further evaluate boat avoidance in the horizontal plane (parallel to surface). Boat avoidance was slightly greater during daytime than nighttime but was not significant enough to cause a problem in analysis (mean vertical tilt angle was < 0.65o of horizontal and the mean number of fish targets moving horizontally away from the boat was at most 3% greater the null value for random movement). We also saw no evidence of acoustic shadowing using the strength of bottom returns under schooling fish. Preliminarily, we believe daytime sampling may therefore be preferable to nighttime sampling.

A Statewide Evaluation of Smallmouth Bass Exploitation in Tennessee Rivers and Streams

Brandon Simcox* (Tennessee Wildlife Resources Agency), Justin Spaulding (Tennessee Wildlife Resources Agency), Alex Bybel (Tennessee Wildlife Resources Agency), Will Collier (Tennessee Wildlife Resources Agency), Sally Petre (Tennessee Wildlife Resources Agency), Jim Habera (Tennessee Wildlife Resources Agency)

Smallmouth Bass represent one of the most widespread and important sport fisheries in Tennessee. However, in depth stock assessments can be logistically challenging and are historically directed toward "high-priority" waterbodies. Therefore, Smallmouth Bass in most lotic systems fall under a general statewide regulation of a 5-fish creel and no size limit. To evaluate the utility of the current suite of black bass regulations, we marked 501 Smallmouth Bass with high-reward ($100) tags in 13 rivers and streams across the state that ranged in size, productivity, physiographic region, and fishing regulation. After 1 year, 92 Smallmouth Bass captures (18% of all fish) were reported from resident and non-resident anglers from 10 different states across 17 different waterbodies. Of those captures, only 10 (11%) Smallmouth Bass were harvested. Three additional anglers indicated that they would have harvested the fish, but the tag influenced their decision and were released in hopes that they weren't impacting a research study. Although catch and harvest rates can vary among waterbodies, catch and release remains the primary ethic among most anglers in lotic systems in Tennessee. Our results suggest that the current statewide 5-fish creel limit and no size limit provides adequate protection across many of Tennessee's rivers and streams.

Effects of Morphology on Darter Swimming Speeds

Ridge Sliger* (Clemson University), Brandon Peoples (Clemson University)

The swimming abilities of most fish species are unknown. Darters (subfamily Etheostomatinae) are particularly understudied, and knowledge of their swimming abilities is valuable for multiple reasons. With around 250 described species, darters represent a significant portion of North American freshwater fish diversity. Many darter species are benthic specialists with restricted movement and are therefore particularly susceptible to habitat fragmentation. To help fill this knowledge gap, our goal was to model swimming speeds across a diversity of darter species. Specifically, we measured the critical swimming speeds (Ucrit) of nine darter species, used geometric morphometrics to create principal component (PC) variables for body shape, and conducted stepwise multiple regression to identify variables affection Ucrit. Mean Ucrit by species ranged from 59.0 to 136.9 cm/s. Our final model for predicting Ucrit retained only PC1 and PC3 as significant predictors (RSE = 37.2, df = 90, Adj. R2 = 0.166, p-value = 0.0003). Along the PC1 axis, faster individuals were characterized by a shorter anterior portion of the body with a more downturned head, a longer middle and posterior part of the body, pectoral fin insertions located higher up on the body, and caudal fin insertions that are closer together in relation to slower individuals. Along the PC3 axis, faster individuals were characterized by a more contracted dorsal surface, a more elongated ventral surface, more widely separated pectoral fin insertions, and a more anterior lower pectoral fin insertion in relation to slower individuals. Neither standard length nor species identity were identified as significant predictors of swimming speed. Our results will be useful to basic ecologists concerned with factors affecting fish swimming abilities and applied ecologists concerned with effects of instream structures and flows on darter movement.

Evaluating a Trophy Florida Bass Regulation on Lake Phelps, a Naturally-Formed Coastal North Carolina Lake

Christopher A. Smith* (North Carolina Wildlife Resources Commission)

Lake Phelps is the second largest (6,480 ha) naturally-formed lake in northeastern North Carolina. Lake Phelps is a shallow (mean depth = 1.4 m), oligotrophic lake with very little habitat in the open water portion of the lake. For decades, the North Carolina Wildlife Resources Commission (NCWRC) has partnered with Pettigrew State Park to manage a recreational fishery for Florida Bass Micropterus salmoides. Since 2002, Florida Bass in Lake Phelps have been managed with the goal to produce trophy-sized fish. These trophy management measures include a minimum size of 14-inches (356 mm), a protective slot limit from 16-inches to 20-inches (406 to 508 mm), and a five fish daily creel limit. Several NCWRC survey reports have questioned the effectiveness of the protective slot limit and have recommended changes to the management of Florida Bass within the lake. This presentation will discuss the most recent electrofishing, creel, and genetic data, the effectiveness of the current regulations, and the future direction of Florida Bass management within Lake Phelps.

A tale of two dams: evaluating efficacy of modified barrier operations on Silver Carp movements

Joshua D. Stafford* (Mississippi Cooperative Fish and Wildlife Research Unit), Corey G. Dunn (U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit), Michael E. Colvin (U.S. Geological Survey, Columbia Environmental Research Center), Leandro E. Miranda (U.S. Geological Survey, Mississippi Cooperative Fish and Wildlife Research Unit), and Dennis Riecke (Mississippi Department of Wildlife, Fisheries, and Parks)

Silver Carp (Hypophthalmichthys molitrix) have spread throughout the Mississippi River basin and threaten native species and recreational fisheries. The Lower Mississippi Alluvial Valley has extensive levee systems with numerous water-control structures for managing floodwaters. These structures could potentially be operated to limit expansions of invasive fishes, including Silver Carp. Our goal was to evaluate the efficacy of barrier operations on passage rates of Silver Carp through two water-control structures with contrasting operations in the Yazoo River basin (MS, LA). The Yazoo River and Steele Bayou are separated by Steele Bayou Water Control (SBWC) structure, which is not operated to restrict the passage of Silver Carp. In contrast, Muddy Bayou Water Control (MBWC) structure is managed to prevent movements of Silver Carp from Steele and Muddy bayous into a recreationally important oxbow (Eagle Lake) by ensuring exiting water velocities exceed the burst swimming species of Silver Carp. We established an acoustic array spanning Yazoo River, Steele Bayou, Muddy Bayou, and Eagle Lake. Beginning in spring 2022, we monitored 95 acoustically tagged Silver Carp with a stationary acoustic array and bi-monthly active tracking. High percentages (>60%) of acoustically tagged fish were detected challenging downstream sides of both structures in fall and winter, indicating invasion pressure was similar at both structures. There were 12 passage events through SBWC structure, but no fish passed through the MBWC structure, demonstrating operations of MBWC structure effectively limited carp invasions into Eagle Lake. Movements through SBWC structure occurred when i) the structure was opened, ii) the hydraulic head differential on both sides of the structure was near zero, and iii) Silver Carp are reportedly staging and spawning in winter and spring, respectively. Ultimately, our findings could help managers tailor operations of similar water infrastructure to slow the spread of Silver Carp into recreationally and ecologically important waterbodies.

Using Radio Telemetry to Identify Seasonal Habitat for Striped Bass in Lake Talquin and the Lower Ochlockonee River

Stephen Stang* (Florida Fish and Wildlife Conservation Commission), Andy Strickland (Florida Fish and Wildlife Conservation Commission), Ryan Henry (Florida Fish and Wildlife Conservation Commission), Chris Paxton (Florida Fish and Wildlife Conservation Commission), Jacob Cunningham (Florida Fish and Wildlife Conservation Commission), Sam Burke (Florida Fish and Wildlife Conservation Commission)

Lake Talquin and the tailrace located below the Jackson Bluff Dam provide a popular Gulf Striped Bass Morone saxatilis fishery in the Florida Panhandle. The system also serves as an important broodfish repository for hatchery programs participating in Gulf Striped Bass restoration efforts. In recent years, larger Gulf Striped Bass, herein referred to as Striped Bass, required for spawning purposes have become increasingly rare. This system currently offers marginal summertime habitat for adult Striped Bass, and high levels of natural mortality during the summer months is likely contributing to the reduction of larger size classes. High densities of aquatic plants in several tributary creeks around Lake Talquin were shredded in 2022 in efforts to improve flows and provide thermal refuge for Striped Bass. This study sought to identify thermal refuge areas located in Lake Talquin and the lower Ochlockonee River utilized by Striped Bass, evaluate the impact that shredding projects have had on providing thermal refuge in Lake Talquin, and identify thermal refuge areas in need of aquatic habitat restoration efforts. Forty-three Striped Bass were implanted with radio tags before being released into Lake Talquin from February 15, 2023, to March 1, 2023. Survival 30 days post-tagging was 90% and 40 of the 43 fish radio-tagged Striped Bass were detected via active and/or passive radio receivers. Dam escapement was evident, and 35% of the tagged sample size emigrated through the Jackson Bluff Dam. Several thermal refuge areas were identified via active tracking in Lake Talquin and the lower Ochlocknee River, and one fish was found in a location that was part of the 2022 shredding project. While fish were successfully tracked through early summer, radio tags appeared to lose battery power prematurely and survival in the refuge areas throughout the entirety of the summer could not be estimated.

Thermal optima, critical swimming speed, and respiration rate of hatchery raised juvenile paddlefish

Ehlana G. Stell* (Auburn University SFAAS), Dennis R. DeVries (Auburn University SFAAS), Russell A. Wright (Auburn University SFAAS)

Freshwater systems are experiencing rapid thermal changes due to anthropogenic causes. As poikilotherms, fishes are particularly susceptible to the metabolic changes induced by warming waters. Because of this, it is becoming increasingly important to understand freshwater species' thermal tolerance and their metabolic response to changing thermal regimes. Multiple approaches exist to determine a species' thermal optimum and tolerance range, including CTmax and chronic exposure studies. However, these methods are not always logistically possible (e.g., for at risk species, or very large individuals) and other alternatives must be considered. Here we use an enzyme assay approach to evaluate thermal tolerance of juvenile (< 1 year old) paddlefish Polyodon spathula acclimated at three temperatures (12, 20, 25°C). We used critical swimming speed trials to determine the swimming capacity and respiration rates of juvenile paddlefish acclimated to those three temperatures. We collected skeletal muscle samples from three areas of each fish: dorsal epaxial skeletal muscle (white fibers), abdominal hypaxial skeletal muscle (mix of white and red fibers), and a combination of epaxial and hypaxial skeletal muscle tissue from the caudal peduncle (mix of white and red fibers). Temperatures at peak enzymatic activity differed for tissue from these collection sites (range was 23.12-35.55°C), suggesting that tissue collection site should be carefully considered, with white epaxial muscle temperature optimum occurring at the higher range (33-35.55°C). Critical swimming speed was significantly higher at 20 and 25°C compared to 12°C (61.79, 66.74, 42.11 cm/s respectively). While respiration rates increased with swimming speed, maximum metabolic rate did not differ across acclimation temperatures in critical swimming trials. These results represent the first such measures for juvenile paddlefish, and such knowledge will be increasingly important as temperature increases become more widespread.

Juvenile and Subadult Gulf Sturgeon (Acipenser desotoi) Residency in the Pascagoula River Estuary

Sarah G. Stovall* (Division of Coastal Science, The University of Southern Mississippi), Michael J. Andres (Division of Coastal Science, The University of Southern Mississippi), Mark S. Peterson (Division of Coastal Science, The University of Southern Mississippi)

Gulf Sturgeon (Acipenser desotoi; GS) were federally listed as threatened under the Endangered Species Act in 1991, with the Pascagoula River (PR) designated as critical habitat in 2003. Despite this designation, GS continue to face threats from coastal habitat alteration including dredging, channelization, and hardening of shorelines. The PR estuary/delta provides a juxtaposition of natural saltmarsh to the west versus the industrialized Pascagoula Ship Channel to the east. With few studies of juvenile and subadult GS movement in estuarine environments, analyzing time spent within each side of the PR estuary on a seasonal scale can provide insight into GS behavior and habitat selection. The goal of this project is to assess estuarine habitat use of juvenile and subadult GS during emigration, winter residency, immigration, and summer resting from 2020–2023. Within the study period, 99 juveniles and 106 subadults were implanted with acoustic transmitters and tracked across an array of 44 receivers in the PR estuary. A three-way ANOVA was performed to compare time (days) spent within the estuary in relation to distributary side, year, and size class. Duration in the estuary varied based on distributary, generally with more time spent in the western distributary. However, during the fall of 2021 to spring 2022 more variability in use was observed with older juveniles (Age-3–4) spending more time in the east distributary while Age-1–2 juveniles and subadults spent more time in the west. Overall, estuarine residency was variable across years potentially in response to river discharge. When taken together, this study demonstrated GS habitat selection varies for non-spawning individuals but emphasizes the importance of protecting more natural habitats. Our results can assist resource managers when making recommendations regarding regions of potential conflict between GS and the timing of maintenance dredging or fisheries activities (e.g., bait trawling).

Digging Deep: Distribution and Habitat Dynamics of Burrowing Crayfish in Illinois

Dusty Swedberg*, Dr. Christopher Taylor, Molly Carlson (Prairie Research Institute - Illinois Natural History Survey)

Crayfish species, especially burrowing crayfish, play pivotal roles in terrestrial and aquatic ecosystems, yet their comprehensive study and understanding remain limited. Our research addresses the knowledge gap by focusing on burrowing crayfish in Illinois and exploring their distribution and habitat preferences. The study aims to understand the presence of burrowing crayfish, identifying six primary species—Lacunicambarus chimera, Lacunicambarus erythrodactylus, Lacunicambarus polychromatus, Procambarus gracilis, Creaserinus fodiens, and Lacunicambarus spp.—through extensive field sampling across 106 sites during three seasons in 2021 to 2023. We used generalized linear regression models examining burrowing crayfish habitat and identified elevation as a crucial factor influencing coarse-scale habitat relationships for five species. The study emphasizes the significance of considering temporal factors and watershed characteristics in understanding suitable habitats for burrowing crayfish. These results not only enrich our understanding of burrowing crayfish in Illinois but also have broader implications due to the wide-ranging nature of the studied species. The insights provided by this study will guide future conservation and management strategies for these vital but often overlooked species in both terrestrial and aquatic ecosystems.

DNA-nacing with the Devil: phylogenetics of a primary burrowing species complex in Illinois

Molly C. Carlson (Illinois Natural History Survey/University of Illinois), Christopher A. Taylor* (Illinois Natural History Survey/University of Illinois), Dusty A. Swedberg (Illinois Natural History Survey/University of Illinois)

The Devil Crayfish (Lacunicambarus diogenes) has been identified as a species complex for several decades. Recent phylogenetic work has recognized several new taxa within the complex and presented range estimates for those taxa. This work has identified the lower Midwest as a region of potential range overlap for many recognized species but with little fine-scale range resolution within the state. To address this deficiency, we set out t to elucidate the ranges and taxonomic statuses of the speculated Devil Crayfish complex species in Illinois. We conducted a state-wide survey of complex members and recorded both genotypic and phenotypic variation and generated a phylogenetic hypothesis using maximum likelihood analysis. Our results suggest that at least four described species occur in Illinois and one potentially undescribed species. Potential hybridization within the central and southern parts of the state was also suggested. Our results confirm some previous range hypothesis and highlights the need for continued research on a wide-ranging, primary burrowing crayfish lineage

Fish stocking destabilizes ecological communities

Akira Terui* (University of North Carolina Greensboro), Hirokazu Urabe (Salmon and Freshwater Fisheries Research Institute), Senzaki Masayuki (Hokkaido University), Bungo Nishizawa (National Institute of Polar Research)

Fish stocking is a widely practiced method for conservation and natural resource management. However, there is limited understanding of its potential consequences for the entire ecological community. In this context, we demonstrate that fish stocking undermines community stability with limited demographic benefits to the enhanced species. Both theory and data support that fish stocking destabilizes community dynamics by facilitating competitive exclusion while suppressing the natural recruitment of the enhanced species. The effect size of intentional releases is remarkably significant, doubling temporal fluctuations of enhanced communities compared to those without fish stocking. Our findings highlight major limitations of fish stocking as a primary tool for conservation and sustainability.

Restoring the Source - A Decade of Assessing and Removing Stream Barriers Through Collaborative Partnerships

Ben Thesing* (Central Arkansas Water), Raven Lawson (Central Arkansas Water)

Central Arkansas Water (CAW) is the largest provider of drinking water in the state, supplying a half-million people with high-quality, safe, and reliable services from two water sources, Lake Maumelle and Lake Winona. The goals of CAW's Watershed Protection Program are to protect, restore, and enhance the natural watershed environment of these two water sources through a variety of pollution prevention, watershed, and source water protection approaches. Our overall strategy is to maintain and enhance ecological and community sustainability and ultimately ensure CAW can provide excellent drinking water with minimal treatment. Hundreds of structures have been constructed on the rivers and streams of these watershed's ranging from vented ford dams to multi-culvert concrete driveways to State Highways. These anthropogenic changes to the river corridors have occurred over several decades and continue to adversely impact the natural function of these systems and impair water quality. With momentum from the Arkansas Stream Heritage Partnership in collaboration with the Southeast Aquatic Research Partnership, more attention has been brought to the many stream barriers impacting these resources. This presentation will highlight barrier removal projects in the Lake Maumelle watershed, which began in 2013, and the first comprehensive assessment of barriers in the Upper Saline River watershed, part of the Lake Winona system. Partners in these efforts include the Arkansas Stream Heritage Partnership, U.S. Fish and Wildlife Service, Arkansas Game and Fish Commission, Arkansas Energy & Environment Division of Environmental Quality, Arkansas Department of Transportation, Arkansas Natural Heritage Commission, US Army Corp of Engineers, and The Nature Conservancy of Arkansas.

Abundance and richness drivers differ for nonnative stream fishes

Lily Thompson* (Clemson University), William Annis (Clemson University), Stephen Midway (Louisiana State University), Julian Olden (University of Washington), Brandon Peoples (Clemson University)

Large extent studies on invasion drivers in stream fish assemblages typically use species richness values from community surveys. While nonnative richness can quantify invasion levels experienced by a community, it is a coarse metric that focuses on introduced species diversity. When individual counts are available, the relative abundance of nonnative individuals might be a better metric for characterizing invasion levels because it more directly quantifies the dominance of introduced individuals in a community. Communities dominated by nonnative individuals may be experiencing greater impacts from nonnative species and could be the communities most at risk of future native extirpation events. Therefore, we want to understand whether the factors influencing nonnative species richness and nonnative relative abundance are the same. We used stream fish community data from across the United States in a Bayesian hierarchical framework to model nonnative richness and relative abundance as a function of native richness and hydrologic alteration at the stream segment level. We assessed whether model results differed by comparing the difference between the posterior distributions of the effect sizes in the model outputs. In addition to overall effects, we also assessed differences among major watershed regions (HUC2). Our results reveal credible differences in how native richness impacts nonnative richness and abundance—increased native richness reduced the relative abundance of nonnative individuals, but had region-dependent impacts on nonnative richness. Increased hydrologic alteration increased nonnative richness and had region-dependent effects on nonnative relative abundance. Although differences between the models were apparent in most regions, we did not find overall differences in the effect of hydrologic alteration between models. Our results suggest that different mechanisms may be shaping the composition and relative abundance of nonnative stream fish. Increasing our understanding of the differences between these responses will guide future work assessing the effect of nonnative fish on native communities.

Largemouth Bass movement, mortality, and habitat use within the Little River and Millwood Lake

Katie Thomsen* (Arkansas Game and Fish Commission), Dylan Hann (Arkansas Game and Fish Commission), Sean Lusk (Arkansas Game and Fish Commission), Vic DiCenzo (Arkansas Game and Fish Commission), Jeremy Risley (Arkansas Game and Fish Commission), Elizabeth Chambers (Arkansas Game and Fish Commission)

Millwood Lake is known for its Largemouth Bass fishing and ranks among the top 5 lakes in Arkansas based on fishing quality indicators gathered from tournament data within the past 5 years. Despite its reputation, results of standardized sampling along with angler observations have indicated that the Millwood bass fishery is not reaching its historical potential. Although it is believed that habitat degradation is the likely culprit, assessing habitat utilization has proven very difficult due to the complex network of backwaters and main lake structure. Identifying, protecting and enhancing critical habitat areas are of paramount importance to managing this fishery. The purpose of this study is to inform biologists on Largemouth Bass movement, behavior, mortality, and habitat use within large, complex lake/riverine systems using a combination of radio telemetry and live imaging sonar over a two-year time period. Our approach will entail capturing fish via electrofishing and angling (including tournament caught fish) and tagging them with radio transmitters (ATS model F1170, 4g) and an external T-bar or floy tag. Two weeks after initial release, fish will be tracked bi-weekly for the next two years, or when either battery life fails or a fish is considered expired. Fish locations will be determined with an ATS Model R410 receiver and 3-element yagi antenna. Location of each fish will be recorded with a global positioning system (GPS, Garmin Echomap UHD 93sv) when the transmitter signal was strongest directly below the boat. Garmin Panoptix Livescope will then be deployed to characterize habitat utilization and determine the depth of the fish. Findings from this study will help inform future management decisions, sampling procedures, and build rapport with anglers.

Evaluating the Habitat Suitability Index for Bluenose Shiner Populations in Panhandle Florida Rivers

Kallie Thornhill* (Florida Fish and Wildlife), Chelsea Myles-McBurney (Florida Fish and Wildlife)

The Bluenose Shiner (Pteronotropis welaka) is a small member of the minnow family (Cyprinidae) that is found from Florida to Louisiana, extending northward into Georgia. In Florida, Bluenose Shiners have a disjunct distribution with populations in the St. Johns River drainage of peninsular Florida and Gulf coast drainage rivers in the western panhandle. The Florida Fish and Wildlife Conservation Commission (FWC) has designated it as a Threatened species due to the disjunct populations and sporadic distribution throughout its range. Water quality decline due to nutrient pollution, heightened turbidity, and water withdrawals are all possible threats that could lead to habitat loss and population decline. While a Habitat Suitability Index (HSI) has been developed for Bluenose Shiners via expert opinion, this HSI has not been empirically validated. This is further exacerbated by the fact that there is some conflicting evidence regarding their preferred habitats. Therefore, this project will provide important information on Bluenose Shiner distribution data and the microhabitats they are associated with, resulting in the development of a HSI in select river sections. This will be completed by 1) Developing range-wide water velocity, water depth, and cover/substrate HSIs; 2) Identifying new locations and update extent of occurrence for Bluenose Shiners; and 3) Delineating upland and wetland areas bordering areas of Bluenose Shiner occurrence, informing areas to be conserved through habitat enhancement and restoration.

Lower Alabama River Fish Passage - Reconnecting the Gulf of Mexico to the Appalachian Mountains

Jason Throneberry* (The Nature Conservancy of Alabama)

The Mobile River Basin drains more than 32,000 square miles in Alabama, equating to approximately 63% of the total land area. Within this vast watershed, the Alabama River is one of the most biodiverse ecosystems in the Southeastern United States. Many species supported by these rich waters are migratory, either from the Gulf of Mexico upstream into the Alabama River and its tributaries or locally migrant within the river and tributaries. The Cahaba River boasts the most aquatic biodiversity in the Alabama River system and is critical for many of these migratory fish species.

Since dam construction at Claiborne and Millers Ferry on the Alabama River, a historic and ecologically important migratory corridor was closed. Several species rely on this corridor for completion of life history requirements (i.e., fish and freshwater mussels). Recent studies by Auburn University have yielded that past efforts have not been successful, despite decades of effort. In response to species decline and recognition of critical timelines for species survival, The Nature Conservancy of Alabama (TNC) entered into an agreement with the U.S. Army Corps of Engineers (USACE) to complete a Feasibility Study for fish passage at these sites. Implementation of fish passage at these structures would yield ecological reconnection of approximately 600 miles of priority rivers, including 236 miles of the Alabama River and 152 miles of the Cahaba River. With this reconnected migratory corridor and given the monumental aquatic biodiversity of this system, this will be the most ecologically significant river restoration in North America.

TNC and USACE have reached the Agency Decision Milestone. USACE has moved forward with the decision to implement natural bypass channels at each lock and dam. TNC and USACE are in the planning and implementation phase of the Project and preliminary design has been completed.

Experience matters: Commercial fishing can reduce relative biomass of invasive silver carp

Matt Acre (United States Geological Survey), Joshua Tompkins* (Kentucky Department of Fish and Wildlife Resources), Michael Colvin (United States Geological Survey), Jesse Fisher (United States Geological Survey), Cole Harty (Tennessee Wildlife Resources Agency), Eric Ganus (Tennessee Wildlife Resources Agency)

Invasive silver carp generally occur in high densities and compete with native species for resources. Kentucky Lake and Lake Barkley, interconnected reservoirs, have an unknown population abundance of silver carp but support a thriving commercial fishery. Since 2015, commercial fishing harvest of silver carp has increased over 1200%, accompanied by a rise in commercial fishers. These commercial fishers spend large amounts of time harvesting these fish and possess expert knowledgeable about their fishery. Incorporating their knowledge can aid resource managers through more accurate abundance models and provide “best practices” to control the spread of this invasive species. Surveys were conducted by the Kentucky Department of Fish and Wildlife Resources to assess the opinions of commercial fishers on stock status and harvest variables, and then incorporated into harvest rate models as catch-per-unit effort (CPUE). Fishers identified 11 variables of importance affecting their harvest and 68% of survey respondents, representing the most experienced fishers, reported a belief that the population size has decreased. Silver carp harvest rate was best explained by individual fisher ID, indicating harvest success is likely a product of experience. Results suggest fishers are highly knowledgeable and can aid resource managers in developing accurate abundance models and effective control measures.

Length-based Bayesian Biomass (LBB) estimation models evaluated the current stock status and the impact of annual harvest, which indicated fishing mortality (F) likely exceeded natural mortality (M; $2.5 < F/M < 6.8$). Relative biomass was low, suggesting a reduction in stock size and potential overfishing. Probability density functions corroborated this trend, demonstrating a reduction in total length and weight variance and a general trend towards smaller individuals in the population. However, continued monitoring will be useful in confirming these results as there may be other factors affecting the population that are not currently monitored like immigration from riverine sources. Multiple lines of evidence, including fishers' perspectives, CPUE, and LBB analysis, indicate that current management actions and commercial harvests effectively reduce silver carp relative biomass.

Status of Invasive carp in Kentucky and management actions update

Joshua Tompkins* (Kentucky Department of Fish and Wildlife Resources), Matthew Dollenbacher (Kentucky Department of Fish and Wildlife Resources), Tyler Befus (Kentucky Department of Fish and Wildlife Resources)

Invasive carp have been established in Kentucky waters since the early 2000s. Kentucky Department of Fish and Wildlife Resources has been able to utilize a rich commercial fishing industry to manage invasive carp impacts throughout our waterways, however most of the management focus has been directed towards the Tennessee and Cumberland River systems. Through incentive programs, partnering with economic development groups, and expanding tools for commercial removal of invasive carp Kentucky's invasive carp harvest programs are removing millions of pounds of invasive carp per year. Are these efforts reducing the biomass of invasive carp? Several lines of evidence suggest management actions are working. However, as resource managers look for new ways to improve harvest and the utilization of invasive species, resource managers must be proactive to protect any detrimental impacts to native fish species or other unintended consequences.

Response of red swamp crayfish (Procambarus clarkii) to increasing current velocities: attraction or repulsion?

Tripp, N.* (Auburn University), Allert, A.L. (U.S. Geological Survey, Columbia Environmental Research Center), Cupp, A.R., Wildhaber, M.L. (U.S. Geological Survey, Columbia Environmental Research Center), and Stoeckel, J.A. (Auburn University)

Invasive crayfish can harm ecosystems through habitat alteration, competition with native species over resources, and introduction of diseases. Red swamp crayfish (RSC; Procambarus clarkii) have successfully invaded ecosystems across North America and globally. Researchers are creating effective control methods for RSC to suppress and remove this species from invaded areas and to reduce negative impacts on local ecosystems. Previous research in our lab suggested RSC could be attracted to low flow, but the range of this flow was not known leading to our current study. We conducted flume experiments to evaluate water flow rate as a control tool to either attract RSC for more efficient collection and removal, or as a repellent to reduce RSC immigration rates. We first implanted a 12 mm PIT tag into the cephalothorax of each of 15 crayfish and monitored survival for 12 weeks. Survivorship was 100%, indicating that PIT tags were a viable methodology to monitor crayfish movement in laboratory experiments. Then, we exposed three-size classes of tagged crayfish to a flow gradient that varied between trials ranging from 0-1.3 m/s in 2.36-m long flumes and monitored their movement over a period of 2 h. Initial results showed weak evidence for attraction of the smallest RSC (27-32 mm) to low flows (0.1-0.25 m/s) but no evidence for attraction of the RSC medium (35-40 mm) or largest (40-43 mm) size classes to low flows. All three size classes showed evidence of repulsion by higher current velocities (>0.3 m/s) but differed in the velocity thresholds correlated with reduced movement. Determination of the responses RSC have to water flow, and how these responses may differ among RSC size-classes, are important first steps toward developing flow as a tool to control invasive RSC and to predict dispersal patterns in invaded systems.

Prioritization of HUC12 Sub-watersheds for Road Stream Crossing Field Surveys

Lesley Twiner* (Clemson University), Brandon Peoples (Clemson University)

Anthropogenic barriers such as dams and culverts have led to aquatic habitat fragmentation and decreased fish diversity across the world. Low-head structures such as culverts are far more abundant than large dams and have a larger cumulative impact on river connectivity. Due to the high variation in road-stream crossing structures, researchers and conservation practitioners must rely on field surveys to determine an individual crossing's impact on aquatic organism passage (AOP). Due to limited resources and the large number of road-stream crossings, managers and researchers must rely on systems that prioritize evaluation efforts. We will create an index that prioritizes HUC 12 sub-watersheds for road-stream crossing field surveys throughout the southeastern region of the United States. The index will consider both levels of fragmentation and habitat quality. Each HUC 12 will be given a score between 0-1. A score of 1 will represent the highest priority HUC 12 while a score of 0 will denote the lowest priority. We will use land use as a metric for habitat quality. The dendritic connectivity index (DCI) and the stream continuity index (SCI) will be used to represent levels of fragmentation. We will also use slope, stream order, and road size to predict the spatial distribution of crossings that act as barriers to AOP. Using a standardized protocol to prioritize HUC12 sub-watersheds for road-stream crossing field surveys will allow managers and researchers to better identify high-priority areas that will reap the most benefit from the evaluation of road-stream crossings.

Reforming the NC Fisheries Reform Act of 1997: Past Lessons and Present Status

Apria N. Valenza* (University of North Carolina at Wilmington), Frederick S. Scharf (University of North Carolina at Wilmington)

The North Carolina Fisheries Reform Act of 1997 (FRA) was enacted to “protect, enhance, and better manage coastal fisheries in North Carolina” when the state recognized the need to conserve coastal fishery resources and achieve balance between the commercial and recreational sectors. The FRA mandated the creation of fishery management plans for state-managed species, with annual updates on the status of managed stocks, as well as re-assessment of the management plans every 5 years. Now, 26 years after the adoption of the FRA, the NC General Assembly has tasked the NC Collaboratory to evaluate the status of our coastal and marine fisheries and to develop policy recommendations to better manage the overall health and viability of NC’s fisheries and habitats. To meet this objective, we developed an “Index of Management Intensity” (IMI) to assess the types of management strategies and the frequency of regulatory actions applied to several coastal fisheries in both North Carolina and other states in the southeastern US (Maryland, South Carolina, Georgia, Florida, Louisiana, and Texas. The IMI will be applied to score the management intensity for individual fisheries managed by each state and also to create a broad score for each state. Specifically, the IMI will be applied to NC’s 13 state-managed fisheries at present as well as through time, covering the 26-yr history of the FRA, and then compared with the IMI scores for the same fisheries in other southeastern states in the region. The primary goal is to quantify the evolution of fisheries management in NC, identify regulatory tactics with effective outcomes, and determine if management intensity is consistently linked to stock status. Additionally, we explored alternative socioeconomic and biological factors of stock status (beyond traditional biomass and harvest rate reference points) to inform stock status in the absence of a formal stock assessment. Focused case studies of specific fisheries will examine the social, biological, and economic factors impacting stock status in NC and the region.

Invasive Catfish in North Carolina

T.D. VanMiddlesworth* (North Carolina Wildlife Resources Commission)

There are approximately 16 catfish species in North Carolina that includes catfish, bullhead, and madtom species. Black Bullhead Ameiurus melas and Channel Catfish Ictalurus punctatus are native to Mississippi River Basins but non-native to Atlantic River Basins. They were introduced during the early 1900's and are now naturalized. Flathead Catfish Pylodictis olivaris and Blue Catfish Ictalurus furcatus are native to Mississippi River Basins but invasive to Atlantic River Basins. They were introduced during the mid to late 1900's and now their populations are thriving and expanding. The Flathead Catfish is an apex predator that can grow up to 78 pounds in North Carolina. The Blue Catfish is the largest species of freshwater catfish in North America and can grow up to 127 pounds in North Carolina. Flathead Catfish and Blue Catfish are invasive in Atlantic River Basins because they negatively affect native species. They do this directly through predation and indirectly through competition for resources. Invasive Flathead Catfish and Blue Catfish are a complicated management issue in North Carolina. On one hand they are negatively affecting native species and on the other hand they are providing excellent opportunities for our constituents. Catfish are one of the most targeted fish species in North Carolina. Since their establishment, catfishing has become even more popular throughout North Carolina. So, how do we manage catfish in North Carolina? We have a catfish management plan and we conduct catfish surveys and research. This work allows us to document catfish populations and changes that occur overtime. So, what is our current position with invasive Flathead Catfish and Blue Catfish in North Carolina? We have conservation concerns. They are invasive so we are not protecting them and encouraging harvest. We will continue catfish surveys and research and continue building relationships with our constituents.

Bayou Behavior: Carp Intracoastal, Estuarine, and Spawning Movements in Louisiana

Christian Walker* (Louisiana State University), Rob Bourgeois (Louisiana Department of Wildlife and Fisheries), Robby Maxwell (Louisiana Department of Wildlife and Fisheries), Micheal Dance (Louisiana State University)

Identification of areas vulnerable to potential invasions are critical to containing the spread of non-native species. Here we use acoustic telemetry to examine invasive carp movement within the highly interconnected waters of Southern Louisiana. An array of 55 acoustic receivers was constructed along east-west transects of the Intracoastal Waterway, in major rivers (Mississippi River, Atchafalaya River, Mermentau River), and at connections to major estuaries of interest (Vermillion Basin, Barataria Basin, and Terrebonne Basin). Invasive carp (n = 230) were tagged with acoustic transmitters from May 2021 through January 2024, with many at large for at least 1 year. The influence of a range of predictor variables (sex, fork length, species, river stage, and time of year) on carp movement was examined using generalized additive models (GAMs), while corridors of high movement probability were identified using a network kernel density approach. The magnitude of daily movement was influenced primarily by day-of-year with movement rates peaking in late spring. Network Kernel Density Estimates showed limited movement within the Atchafalaya River basin, and dispersal and variation in movement was evident in areas east and west of the basin. Unique individual movements were also observed including cross-basin movements and extended estuarine use. Local salinity values from 3-5 ppt were observed during estuarine use, highlighting plasticity among invasive carps. Collectively, these findings advance our understanding of the movement ecology of invasive carp in the lower MS River basin, and highlight spatial and temporal patterns that facilitate the spread of these taxa.

Evaluation of Redfin Darter as a Species of Conservation Need in Oklahoma

Drew Wallace*(Oklahoma Department of Wildlife Conservation), Anthony Rodger (Oklahoma Department of Wildlife Conservation), Samuel Johnston (Oklahoma Department of Wildlife Conservation)

Redfin Darter is currently one of Oklahoma’s 52 fish species listed as Species of Greatest Conservation Need (SGCN). Past Redfin Darter habitat descriptions suggest the species has specific requirements but increasing captures in varying habitats during contemporary stream surveys suggest the species may have a broader ecological niche and occupy a larger distribution than previously thought. SGCN evaluations are ongoing in Oklahoma and will be finalized by 2025 and the Oklahoma Department of Wildlife Conservation (ODWC) is tasked with evaluating which species should be listed. To assess Redfin Darter status, a two-pronged approach of analyzing historical surveys from 1905-2023 and an 8-year occupancy modeling dataset collected by ODWC will be used to determine historical trends and factors underlying Redfin Darter distribution. Over 5,500 surveys collected across Oklahoma will be used to evaluate possible changes in Redfin Darter range. To evaluate potential associations with habitat variables, a single-species single-season occupancy model will be run based on 1195 surveys at 400 sites across Oklahoma. Occupancy and detection covariates will be used to determine which habitat variables have the strongest association with Redfin Darter distributions and how survey conditions affect detection. This study will help ODWC evaluate the conservation status of Redfin Darter and employs a framework that can be used to evaluate other species listing status.

Fishing For Science: Using hook and line sampling methods to target Trophy Bass and Stripers in the Florida Panhandle

Bradford Warland* (Florida Fish and Wildlife Conservation Commission)

Two case studies currently occurring in the Florida panhandle which show how hook and line sampling can be utilized by researchers to capture individuals that are not susceptible to other methods. The first being a trophy largemouth bass (Micropterus floridanus) assessment of a lake with extremely low conductivity making electrofishing ineffective. Live golden shiners were used to target and capture Bass weight 6 pounds or greater. The second being an acoustic telemetry study on Gulf Striped Bass (Morone saxatilis) in the Pensacola Bay watershed. When temperatures in the rivers dropped low enough to avoid high rates of mortality that were observed while electrofishing during the summer, Gulf Striped Bass in the Yellow and Blackwater rivers moved downstream into high salinity environments rendering electrofishing ineffective. Live bait and artificial lures were used while angling at night to capture and acoustically tag the Striped Bass.

Largemouth Bass Regulation Evaluation in the Escambia River Marsh

Matthew G. Wegener* (Florida Fish and Wildlife Conservation Commission), Amanda E. Mattair (Florida Fish and Wildlife Conservation Commission)

Length-based regulations remain the primary approach to black bass management. However, effectiveness can vary depending on angler attitude towards harvesting fish. Voluntary catch and release of legal-sized fish can render length limits ineffective, while abuse of liberal length limits can lead to overexploitation of sport fish populations. Therefore, knowledge of angler attitudes paired with current information on population dynamics are important for effectively measuring success of newly implemented regulations. In 2016, a 16” maximum length limit for Largemouth Bass was implemented statewide. To evaluate the effect of this regulation on the Largemouth Bass population in the Escambia River Marsh, angler attitudes and population dynamics were compared before and after implementation. Relative abundance estimates from day-time electrofishing samples were used to quantify change in population size between years. Year-class strength and total annual mortality was estimated from otolith data and exploitation was estimated with high-reward tagging. Access-point creel surveys were conducted to determine fishing effort, catch rate and angler attitudes towards Largemouth Bass harvest. This comprehensive approach indicated increased total mortality rates and high (> 30%) harvest rates during several years of the study. However, decreased angler-fishing effort, low exploitation rates, and similar relative abundance estimates from year to year suggest the current level of harvest is not negatively impacting the Largemouth Bass population in the Escambia River Marsh.

TRBN: A Tennessee River Basin Network where aquatic and human life thrive

Gillian Bee, Tennessee River Basin Network, Daniel West*, Geological Survey of Alabama

Established in 2014, the Tennessee River Basin Network (TRBN) was formed to unite a diverse network of partners committed to preserving one of North America's most diverse regions for aquatic species. The core mission of TRBN is to facilitate the exchange of information, foster networking, encourage innovative approaches, identify shared goals, and promote collaborative initiatives. Network partners encompass states, cities, counties, tribal and federal agencies, academic organizations, private industry, and non-governmental organizations. As the year 2024 approaches, TRBN anticipates celebrating a decade of meaningful partnerships and collaborative efforts and will continue its efforts to enhance its members' capacity to connect and exchange information.

The smaller, the better? First evaluation of growth and mortality in crayfish internally tagged with p-Chips

Augusto F. Huber (University of Missouri), Wesley A. Fitzsimmons (University of Missouri) and Jacob T. Westhoff* (U.S. Geological Survey, Missouri Cooperative Fish and Wildlife Research Unit)

Small-bodied aquatic animals present a challenge to researchers seeking to uniquely mark individuals for scientific study. Microtransponder tags, such as p-Chips, represent the smallest electronic animal tags available to meet this need. The use of p-Chips to tag freshwater crayfishes, however, has not been explored. The goal of this study, therefore, was to determine the effects of p-Chip tagging on growth and survival of crayfishes in a controlled laboratory environment. We also investigated potential influences from variables such as sex, reproductive form, number of molt events, and crayfish size on mortality. We internally tagged individuals of the woodland crayfish Faxonius hylas (Faxon, 1890) (12.2–26.6 mm carapace length; CL) with either one p-Chip (single-tag) or one p-Chip and one visual implant elastomer tag (double-tagged) and observed the effects over a period of 90 days. Survival probability over time was not statistically different among tagging groups, sex, and reproductive form. Survival rates were similar across all tagging groups, with 75% in the control group, 77% in the double-tagged group, and 78% in the single-tag group. A strong correlation, however, was observed between survival and the number of molt events. Additionally, there was a negative correlation between survival and crayfish size (CL), indicating a higher risk of mortality for larger individuals. There were no statistically significant differences in growth in CL or mass among the tagging groups. We conclude that p-Chips are a viable tagging option for the study of crayfishes given their size, readability, and retention through molting cycles. We recommend that future studies repeat this experiment using smaller individuals to determine the minimum crayfish size compatible with p-Chip tagging. It is also important to test p-Chips with other crayfish species and compare the growth and mortality of crayfish tagged with p-Chips in natural habitats.

Moving forward with studies of migratory sucker subsidies: insights from salmon

Kit Wheeler* (Tennessee Tech University)

The ecological influence of fish migrations in freshwater is well established, and a small number of studies have expanded the taxonomic breadth of our understanding of this phenomenon. In particular, recent work has provided empirical support for the hypothesis that migratory suckers deliver ecologically meaningful nutrient subsidies to systems used for spawning. However, we presently lack a comprehensive understanding of how sucker nutrient subsidies are incorporated across entire food webs in both freshwater and adjacent terrestrial habitats. Here, I suggest there is much to be gained by using studies of migratory salmonids to identify specific and testable hypotheses about the influence of sucker nutrient subsidies at different trophic levels within recipient food webs. For example, we can test the hypothesis that sucker nutrients subsidize freshwater food webs by increasing standing stocks of basal resources like dissolved inorganic nutrients and algal biomass. We can also test whether such fertilization effects are evident in higher trophic levels comprising intermediate consumers (e.g., macroinvertebrates) and top-level predators (e.g., resident fishes). Beyond potential effects on resource standing stocks, sucker nutrient subsidies may also influence ecosystem-level processes and rates such as nutrient cycling, stream metabolism, and emergence of adult aquatic insects. By more completely considering the range of structural and functional responses to sucker nutrient subsidies, we will be better positioned to predict consequences of changing levels of aquatic connectivity that mediate the spatial extent of sucker migrations. Furthermore, using approaches from salmonid studies in future research of migratory suckers has the potential to highlight the important ecological role played by these species and motivate the adoption of more effective conservation measures.

Secondary Benefits of an Internal R Package

Powell Wheeler* (North Carolina Wildlife Resources Commission), Kevin Dockendorf (North Carolina Wildlife Resources Commission), Kyle Rachels (North Carolina Wildlife Resources Commission)

Internal R packages help organizations make progress toward fulfilling their purpose. We developed an internal R package, {NCIFD}, for us and our coworkers in the Inland Fisheries Division of the North Carolina Wildlife Resources Commission. The objective of {NCIFD} is to help field staff work more effectively and efficiently by organizing and distributing agency data sets and sharing staff-authored functions that help with agency tasks. Because these data sets and functions are authored by field staff R users, they are flexible and can evolve for future needs. However, we discovered many unexpected secondary benefits of developing {NCIFD}. For example, {NCIFD} has made our agency databases more valuable and accessible by storing cleaned versions of the data or sharing R functions that quickly clean and analyze query results. Automated testing of package components exposed us to techniques for detecting problematic observations in large data sets which could then be evaluated and corrected. In addition, {NCIFD} development deepened our R coding skills by exposing us to a wide variety of challenging data cleaning problems. Finally, and perhaps most importantly, {NCIFD} development required collaboration with dispersed team members who were often outside of our normal work groups. These relationships will become more important in the future as our Agency confronts larger and more complicated data sets that require the unique R strengths of individual team members.

Comparing Standardized Crappie Data from Two Fyke Net Throat Designs

Alexis Whiles* (Oklahoma Department of Wildlife Conservation), Daniel E. Shoup (Oklahoma State University), Douglas L. Zentner (Oklahoma Department of Wildlife Conservation)

White and Black Crappie, Pomoxis annularis and P. nigromaculatus (hereafter collectively crappie), are a common and popular sportfish that exhibit variable recruitment. Crappie require precise and accurate standardized sampling to observe changes in population dynamics and vital rates. Modified fyke nets are the most widely used sampling gear for reservoir crappie populations, and the effectiveness of this gear is influenced by the specifications of the nets used for sampling (e.g., mesh size, throat design). The new North American Standardized modified fyke net design specifies a “finger-throat” to reduce escapement from nets and potentially increase catch per unit effort. However, it is unclear how throat design may affect other population metrics (i.e., proportional size distribution, length-frequency, age-frequency). To determine if finger-throats impact these metrics, finger-throat nets were fished simultaneously with square-throat modified fyke nets (current Oklahoma Department of Wildlife Conservation standard) during fall standardized crappie sampling on Oklahoma reservoirs. Preliminary results from two reservoirs suggest there is not a strong relationship between net type and length of fish captured, Catch per unit effort, or proportional size distribution. Additional sampling from four other Oklahoma reservoirs will be used in fall 2024 to confirm these results. Furthermore, age structure, size structure, growth trajectories, and precision will also be compared. This information will be used to guide agency decisions regarding standardized sampling for crappie and to build correction factors for comparing historical data collected with square-throat nets in the event agencies choose to transition to the new finger-throat design recommended by the American Fisheries Society.

The riverscape less traveled- revisiting non-natal straying in adult Atlantic sturgeon

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Atlantic sturgeon is a highly mobile, philopatric species that is broadly distributed throughout the east coast of the United States and Canada, with a disjunct population in the Baltic. Although adult Atlantic sturgeon form mixed-stock aggregations at the mouths of rivers and estuaries, each spawning river forms one or more genetically distinct populations. As such, it generally assumed that adult straying is minimal, and freshwater habitats are only occupied by individuals from their respective natal populations. Historically there have been few reports of adult Atlantic sturgeon in non-natal rivers, but a recent analysis reported significant use of freshwater habitats in the Delaware and Hudson rivers by non-natal individuals during spawning season. Building on this effort, we used a large, range-wide acoustic telemetry dataset to investigate the prevalence of non-natal straying across the east coast of the United States. Non-natal Atlantic sturgeon were detected upstream of the salt front in many spawning rivers, with rivers in the mid-Atlantic having the most detections of non-natal individuals. Within each river, the origin of non-natal adults was broadly distributed across populations, including fish from distant populations and distinct population segments (DPSs). Given that individual-based assignment tests performed using the present genetic baseline have low inter-DPS misassignment rates, the overall conclusion of non-natal straying is likely robust. Together, these results suggest that the mosaic of habitats used by Atlantic sturgeon may be more complex than previously thought. In addition, they highlight the extent to which local management decisions may affect populations at range-wide scales.

Advancing Blue Catfish (Ictalurus furcatus) management in the James River, Virginia using acoustic telemetry

Margaret Whitmore* (Virginia Department of Wildlife Resources), Andrew White (Virginia Department of Wildlife Resources)

Blue Catfish (Ictalurus furcatus) were intentionally introduced to the James River in the 1970's as part of an effort to create a trophy fishery in select Chesapeake Bay tributaries. Although a trophy fishery was successfully established, an unintended consequence was the rapid spread of Blue Catfish into all Chesapeake Bay tributaries. Continued expansion and population growth have prompted widespread concern and Blue Catfish are now considered an invasive species. Commercial fisheries have been established to reduce overall abundance, including a limited-access commercial low-frequency electrofishing operation; and extensive research on population dynamics, diet, and physiology is ongoing. Interannual distribution and movement patterns has been consistently identified as a knowledge gap by stakeholders. The DWR launched a Blue Catfish movement ecology project in the James River in 2021. A total of 80 Blue Catfish were tagged from fall 2021 to spring 2023 with Innovasea V13 and V16 acoustic tags, with a tag life of three and 10 years, respectively. A passive array of Innovasea acoustic receivers distributed in the mainstem James River and its major tributaries detects tagged fish moving throughout the system year-round. Tagged Blue Catfish exhibited a range of movement tactics that varied seasonally and demonstrated fidelity to aggregation areas and tributaries. The reach between Weyanoke Point (RM 55) and Windmill Point (RM 59) consistently had the highest number of detections and number of tagged fish present. Movement into higher salinity waters downstream was seasonally restricted and limited to <20% of tagged Blue Catfish. Community structure suggests seasonal movement and distribution patterns may be related to preferred prey. The results of this project will be used in the development of a Catfish Management Plan, communicated to commercial license-holders to increase operational efficiency, engage recreational anglers, and contextualize existing research to estimate impact on native and naturalized species.

An Assessment of Benthic Recovery Following Restoration of Ship Island

Dara H. Wilber* (Bowhead); Michael J. Andres (University of Southern Mississippi); Mark S. Peterson (University of Southern MIssissippi); W. Todd Slack (US Army Corps of Engineers)

Critical habitat for Gulf Sturgeon includes the shorelines of barrier islands in the Mississippi Sound. Impacts to this habitat caused by the filling of Camille Cut, which bisected Ship Island, is a concern for natural resource managers. The Mobile District Army Corps of Engineers has supported extensive research to document pre-restoration benthic macrofauna distributions and Gulf Sturgeon activity near Camille Cut and neighboring barrier islands. During pre-restoration monitoring, Gulf Sturgeon activity was highest near shallow benthic stations with high sand content and high densities of known prey taxa. Approximately one year (Fall 2021) after the restoration of Ship Island by filling Camille Cut, the benthic habitat surrounding the island had not returned to pre-restoration conditions based on sediment composition, benthic biomass, and the composition of Gulf Sturgeon potential prey assemblages. Although changes to sediment composition were most pronounced at stations north of Camille Cut, biological parameters changed between pre- and post-construction time periods in all areas sampled around Ship Island. Sediments and benthic macrofauna were sampled again in the summer of 2022, at which time sediment grain size composition was similar to Fall 2021 conditions in all areas surrounding Ship Island with the exception of northern Camille Cut where coarser grain sizes were no longer present. Summer 2022 benthic macrofaunal biomass exceeded that of Fall 2021 values for all taxa in nearly all areas, most likely reflecting temperature-related boosts to secondary production.

Tennessee-Tombigbee Waterway: A Bidirectional Pathway for Aquatic Species Invasions

James D. Williams* (Florida Museum of Natural History)

The Tennessee-Tombigbee Waterway construction project began in the early 1970s and was completed in 1985. It was advertised as a shortcut for barge traffic from the Ohio and Mississippi Rivers to the Gulf of Mexico. The waterway cut across the drainage divide (ridge) separating the Tennessee and Tombigbee River basins in northeast Mississippi, resulting in a connection between two aquatic ecosystems and their associated fauna and floras that had been isolated for millions of years. Aquatic species, foreign and native, occurring on both sides of the divide have had a pathway to invade north and south via Bay Springs Lock for almost four decades. Movement of aquatic species across the Tennessee and Tombigbee drainage divide via the waterway has the potential to negatively impact native species and/or their environments. Some of the possible outcomes include hybridization of related taxa, competitive displacement, and alteration of predator-prey relationships. While threats from mixing aquatic communities across the divide may appear subtle on the surface, they have the potential to significantly impact existing fisheries and biodiversity on both sides of the divide. The possibility of barrier systems to prevent aquatic organisms from passing through the waterway in either direction will be explored.

Modeling Juvenile Gulf Sturgeon Survival in the Apalachicola River

Russell Wilson* (University of Georgia, Athens), Adam Fox (University of Georgia, Athens)

Gulf Sturgeon (Acipenser oxyrinchus desotoi; GS) are an anadromous species of sturgeon that have undergone drastic population declines throughout their range. Habitat alteration and overharvest in commercial fisheries led to the species being listed as threatened under the Endangered Species Act in 1991. To accurately monitor populations trends and recovery, accurate and repeatable methods to measure population dynamics must be assessed. During the winter, juvenile GS transition from riverine to coastal marine habitats. In the Gulf of Mexico, the fish are exposed to additional predators and harsher environmental conditions, including elevated salinity, that may contribute to increased mortality. This overwinter period is potentially a bottleneck to juvenile survival. The objective of this study is to quantify over-winter survival of age-1 GS in the Apalachicola River system from 2014–2022 using acoustic telemetry. From 2014–2022, we captured juvenile GS during summer aggregation in the Apalachicola River system using anchored gill nets. Each year of the study, a subset of 5–17 age-1 GS were implanted with acoustic transmitters. An array of acoustic receivers allowed us to detect individuals before and after their overwinter period. We used Cormack-Jolly-Seber models to estimate survival rates during the overwinter period. These estimates will give managers insight into how the survival of juvenile GS may be affecting population recovery within the river.

Evaluation and application of pectoral spine microchemistry to identify stocked channel catfish and infer fish size at stocking

Morgan Winstead* (Florida Fish and Wildlife Conservation Commission), Greg Whitledge (Southern Illinois University), Allison Asher (Arkansas Game and Fish Commission)

Understanding stocking and natural contribution to fish populations is important for fisheries management. The goals of this study were to determine the contribution of stocked fish, determine the fish size at stocking, and to assess the contribution of yearling and catchable sizes to the stocked percentage. Fish samples were obtained from four hatcheries and six lakes within different ecoregions across Arkansas to assess whether chemical signatures were different among locations. Pectoral spines from Channel Catfish were sectioned and analyzed for Strontium:Calcium (Sr:Ca) and Barium:Calcium (Ba:Ca) to determine if they were stocked and size at stocking. Spine microchemistry represents a non-lethal approach to identify stocked catfish and infer size at stocking, which will better inform allocation of hatchery-produced fish. Differences in pectoral spine Sr:Ca edge signatures among locations were detected, which were primarily driven by differences in geology among ecoregions. Among all the Channel Catfish sampled from the six lakes, 45% were identified as hatchery origin and 46% of those were stocked as catchable size fish. Contributions of stocked fish varied among study lakes from 0% to 100%. This was the first study to demonstrate that pectoral spine microchemistry can be used for assessing both stocking contribution and inferring fish size at stocking. This study will aid in the identification of hatchery-reared catfish by management biologists including how habitat enhancement may influence the contribution of natural reproduction to catfish populations.

The impact of genetics and water level fluctuations on trophy bass production in O. H. Ivie Reservoir, Texas

Lynn Wright* (Texas Parks and Wildlife Department)

O.H. Ivie Reservoir, located in West Texas, has a history of producing trophy-sized Largemouth Bass, including an unprecedented number of 13+ lb. Largemouth Bass from 2021-2023. O.H. Ivie Reservoir was impounded in 1990, and is characterized by clear water, rocky substrate with deep channels, and large fluctuations in water level. On average nearly 90,000 hours of angler effort is directed for Largemouth Bass annually, of which about 42% is tournament-directed effort. The Texas Parks and Wildlife Department has stocked over 2.6 million Florida strain Largemouth Bass fingerlings since the reservoir was constructed to enhance genetics and trophy potential. From 2013-2021 Florida LMB alleles ranged from 76-85%, while 17-27% were pure Florida strain Largemouth Bass. Water level fluctuations in O.H. Ivie Reservoir can be dramatic; in 2018, the water level rose over 35 feet and the reservoir surface area expanded from less than 4,000 acres to over 15,000 acres. The large water level increase resulted in extensive flooded terrestrial habitat and conditions that supported exceptional fish growth. From 2021-2023, a total of 56 Largemouth Bass over 13 lb. were documented. Nearly 50% of all 13+ lb. Largemouth Bass had pure (100%) Florida strain genetics and the larger size classes were associated with a greater percentage of Florida strain genetic makeup. The current trophy bass population at O.H. Ivie Reservoir can be attributed to a combination of factors, primarily the presence of high levels of Florida strain genetics and favorable environmental conditions. Given the cyclical nature of rainfall in West Texas, trophy bass production following years of significant water level rises will likely continue into the future at O.H. Ivie Reservoir.

Using high resolution spatial data to identify potential in-stream barriers at a landscape scale

Chris Brehme, Kat Hoenke (SARP), JC Woodward, Jeff Wright* (Trout Unlimited)

Stream systems are often not a single, connected unit that allow aquatic organisms free access to all areas. In-stream barriers can break these systems into smaller segments, reducing the amount of accessible habitat for aquatic species. Identifying these barriers can be critical to planning conservation activities such as selecting road-stream crossing replacements that open the most mileage or locating non-native species barriers for native salmonid reintroduction. Utilizing field crews to locate potential barriers often requires substantial effort, significant funding, and has a limited spatial scope. With its increasing availability, high resolution spatial data provides a potential first-pass alternative to traditional field crew surveys. Trout Unlimited, the Southeast Aquatic Resources Partnership, and the United States Forest Service partnered to create a model to predict the location of three types of potential barriers: low-head dams, road-stream crossings, and waterfalls. The model uses a 1-meter bare earth digital elevation model derived from LiDAR data to generate regional flowlines. Elevations are sampled every 30 feet along second order and higher streams. Sequential sample points are compared to identify significant elevation drops that may represent a barrier. This model is being trained and validated with previously collected data from a Community Science program and seasonal field crews throughout the summer of 2023. Once completed, this model can be run for any location with high resolution spatial data coverage. Managers will be able to generate locations for targeted field validation, significantly reducing the time and money spent in the early stages of project identification and prioritization.

Nuisance and Invasive Fish Controls in a Tailwater Reservoir Fishery: The Challenge of Lake Ogallala

Alexandria Keiler-Klein (University of Nebraska at Kearney), Jo Hodge (University of Nebraska at Kearney), Melissa Wuellner* (University of Nebraska at Kearney), and Keith Koupal (Nebraska Game and Parks Commission)

Lake Ogallala, separated from Lake McConaughy, by Kingsley Dam in Nebraska, is managed as a put-grow-take rainbow trout fishery. Several chemical renovations have occurred since the 1980s to support the fishery, as the available biomass becomes dominated by white sucker, alewife, gizzard shad, and common carp that are likely entrained from Lake McConaughy through the dam. Annual standard surveys may not detect increases in these nuisance and invasive species as these gears (gill net, primarily, and electrofishing, secondarily) may not be the best options for sampling these species. Early detection is key to maintaining the benefits that chemical renovations may provide in supporting the trout fishery. The objectives of this study are to: 1) determine which gear(s) - nighttime electrofishing, trap nets, and experimental gill nets - are most effective in assessing population structure of these four species; and 2) describe movements of common carp and white suckers (the two most abundant undesirable fishes) that may help to target specific locations of removals during certain times of the year. In total, addressing these objectives could inform proactive mechanical removals or localized chemical treatments to reduce the biomass of undesirable fishes and improve habitat and prey availability to support the trout.

Estimating Fishing Mortality and Large-scale Movements of Greater Amberjack off the Southeastern US

Samantha Young* (Auburn University), Matthew Catalano (Auburn University), Mark Albins (University of South Alabama), Jeff Buckel (North Carolina State University), Michael Dance (Louisiana State University), Sean Powers (University of South Alabama)

Greater Amberjack (Seriola dumerili) are an important marine species for sport and commercial fisheries across the southeastern United States. Two Greater Amberjack stocks are recognized for assessment and management off the southeastern US: the South Atlantic and Gulf of Mexico (GOM) stocks. Currently, the South Atlantic stock is neither overfished nor undergoing overfishing, but the GOM stock is experiencing both conditions. Obtaining independent estimates of exploitation and movement for these stocks would aid management by supplementing and potentially corroborating existing stock assessments. We are conducting a large-scale multi-investigator tagging study to estimate regional fishing mortality, length-based vulnerability, and large-scale movements of Greater Amberjack. From June 2022 to November 2023, we tagged 1029 Greater Amberjack with conventional reward tags; 395 fish were also implanted with an internal acoustic transmitter. The study area was divided into three regions: the Western GOM, Eastern GOM, and the South Atlantic. We assumed 100% reporting of recaptured tags from the recreational fishery by using a $250 reward incentive. Detections of fish tagged with acoustic transmitters were obtained from new and existing receiver arrays to inform mortality estimates and detect fish movements. As of November 2023, 118 externally tagged Greater Amberjack have been reported as caught by anglers: 29 in the Atlantic region, 48 in the Eastern GOM and 41 in the Western GOM. Of the recaptures, 13% came from the commercial fishery, and 87% were from recreational anglers, with 45% of fish harvested and 55% released. Comparing the release with recapture locations indicates that 96% of Amberjack were caught in the same region they were tagged. Our results will provide critical estimates that fisheries management agencies can use to make informed regulatory decisions for future fishing seasons to help maintain a sustainable fishery.

Utilizing Recreational Catch Data to Evaluate One of Arkansas Premier Striped Bass Fisheries: Where Are We Now?

Andrew Yung* (Arkansas Game and Fish Commission)

Evaluation of Striped Bass populations has routinely been problematic for management agencies across North America. Collection of adequate samples of Striped Bass has historically been challenging due to their pelagic and migratory nature. As a result, many Striped Bass fisheries are data-limited, making informed management decisions difficult. In 2018, a pilot study was initiated in an attempt to collect adequate samples sizes of Striped Bass from Lake Ouachita utilizing recreational catch data through angler journals. Since the inception of this program, over three thousand fish lengths have been recorded with the investment of relatively minimal resources. In 2021, a carcass collection effort was coupled with the journal program, allowing fishery managers to collect age data from a portion of the fish harvested by these anglers. The angler journal program has since expanded to all three Striped Bass fisheries in Arkansas, providing the ability to compare these populations. This program has not only allowed for the collection of a large volume of valuable scientific data on a previously data-limited fishery, but has shown great promise as a human relations tool for fishery managers as well.

Population genetic structure in a rare freshwater mussel, Pleurobema riddellii

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Determining the distribution of genetic variation within and among populations across geographic space is necessary for understanding the demographic and ecological processes that shape population structure and drive the evolution of lineages. As genetic sequencing and bioinformatic technologies advance, questions regarding population structure and how genetic variation is partitioned within species have become more applicable to non-model systems. These approaches can help inform the management and conservation of rare or imperiled species by providing crucial population level genetic information to resource managers. In this study we used a genotype-by-sequencing approach to assess population genetic structure in a rare imperiled freshwater mussel species, Pleurobema riddellii (family Unionidae). Tissue samples were collected from individual mussels throughout the range of the species. DNA was extracted and a reduced-complexity DNA library was generated and sequenced. The resulting sequence files were filtered to generate single-nucleotide polymorphism (SNP) data used for population genetic analyses. Principal component analysis (PCA) and the hierarchical Bayesian model Entropy (Gompert et al., 2014) were used to estimate population genetic parameters. PC axis 1 explained 5% of the variance while PC axis 2 explained 2%. P. riddellii shows within-species differentiation by drainage with PC1 separating the Big Cypress drainage from the Texas and Calcasieu drainages, with the Ouachita and Pearl drainages falling in-between. PC2 separates the Neches, Sabine, and San Jacinto drainages. Preliminary entropy results revealed similar patterns of genetic variation with k=2 resolving the Big Cypress, Ouachita, and Little River from the Texas drainages. k=3 distinguished the Ouachita from the Big Cypress and Little River drainages. k=4 breaks apart the Sabine and Neches drainages. This study will inform management of this species by providing population level genetic information across the species range that demonstrates drainage-specific differentiation in addition to insight about the ecological and geographic factors that influence differentiation in this system.

Retention of operculum Carlin dangler tags in Flathead Catfish and Blue Catfish

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Mark-recapture is commonly used to estimate fisheries metrics such as abundance, growth, survival, movement, and exploitation, but requires the assumption that tags are retained. Blue and Flathead Catfish are popular sportfish across North America. However, tag retention estimates for these species are less studied than other popular sportfishes. We estimated short- and long-term retention of Carlin Dangler tags placed between the opercle and preopercle of Blue and Flathead Catfish. Short-term retention (15-day) was estimated by laboratory observation of tagged Blue (TL 195-715 mm) and Flathead Catfish (TL 201-637 mm). Long-term retention (up to 833 days) was estimated by tagging and recapturing Blue (TL 201-949 mm) and Flathead Catfish (TL 165-1,075 mm) using multiple gears across six Oklahoma reservoirs. A subset of fish were double tagged with Carlin Dangler tags or triple tagged with Carlin Dangler, passive integrated transponder (PIT), and self-piercing tags. We used single-tagged fish to determine if species, total length, study duration, or sample gear influenced discrete tag retention. We used double and triple tagged fish to estimate discrete retention and instantaneous tag loss. Short-term tag retention and survival in the laboratory were 100% for both species. Mean discrete retention estimates from single-tagged fish in the field ranged from 97 to 100% for Blue Catfish and 89 to 100% for Flathead Catfish. Species, study duration, and total length correlated with tag loss. Mean discrete retention estimates from double and triple tagged fish were 97% for Carlin Dangler tags, 84% for PIT tags, and 65% for self-piercing tags. Instantaneous retention estimates were similar for Carlin Dangler and PIT tags but were significantly lower for self-piercing tags. Our results suggest that opercular placement of Carlin Dangler tags are suitable tags for Mark-Recapture experiments on Blue and Flathead Catfish.

Poster Presentation Abstracts

SDAFS ANNUAL MEETING 2024

CHATTANOOGA, TN

AMERICAN FISHERIES SOCIETY TENNESSEE CHAPTER

Assessing the Utility of Otolith Microchemistry on Invasive Carps in the Red River

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Otolith microchemistry has been extensively used to reconstruct fish environmental life-histories. Understanding a fishes' environmental life-history provides valuable biological, ecological, and management insights. As such, we investigated the potential utility of otolith microchemistry in reconstructing Bighead Carp and Silver Carp environmental life-histories. Carp were collected by the Oklahoma U.S. Fish and Wildlife Conservation Office in Tishmingo. Fish were collected by gillnets or obtained from angler captures. Otoliths were removed and ablated using an inductively coupled plasma mass spectrometer. Trace strontium and barium elements can provide insights into broad-scale movement patterns and natal origin. The information garnered from this study will help guide future management of invasive carps in the Red River basin.

Sampling Techniques and Habitat Types for Young of Year Black Carp (Mylopharyngodon piceus) in the Coastal Plain Province of Western Kentucky

Matthew Dollenbacher* (Kentucky Department of Fish and Wildlife (KDFWR)), Matthew R. Thomas (KDFWR), Joshua Tompkins (KDFWR)

Exotic Black Carp (Mylopharyngodon piceus) are in low numbers in the United States but are found in most of the Lower Mississippi River Basin (NAS database). After hatching, larval Black Carp seek out nursery areas to feed and grow (Nico et al 2005). Young-of-year (YOY) black carp were first documented in Kentucky waters in 2018. To further understand spawning locations and the dispersal patterns of Black Carp after hatching, a data gap in nursery habitat characteristics has been identified. A variety of habitats were surveyed to determine the optimal sampling approach for YOY Black Carp in western Kentucky.

Mitogenomes derived via genome skimming reveal a complicated history for Cambarus longulus

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DNA sequences from mitochondrial genes, notably Cytochrome Oxidase I, 12S rRNA, and 16S rRNA, have been widely and successfully used in studies of crayfish taxonomy and phylogeny. In these studies, more sequence data from each individual provides usually provides better resolution, prompting researchers to accumulate more sequence data for each individual; the logical limit to this would include complete mitogenome sequences. We used a genome skimming approach to assess mitochondrial genetic diversity across Cambarus longulus, an Atlantic slope species confined to the James, Roanoke, and Yadkin River basins. Genome skimming uses low-pass whole-genome shotgun sequencing (WGS) and bioinformatics tools to assemble all or most of the mitochondrial genome sequence. We present nearly complete mitogenomes from 12 individuals representing 6 divergent populations of C. longulus. As a bonus, we were able to reconstruct several nuclear genes, including coding regions for 28S, 5.8S, and

18S rRNA genes, allowing a concatenated data set of ca. 25Kbp per individual. We used several approaches for phylogeny reconstruction of clades within C. longulus using these data, and all trees underscored a complicated history for this species. A close analysis of our data may also imply that existing mitochondrial genome sequences currently available from GenBank may have errors in assembly, particularly in the control region.

Annual estimates of effective number of breeders in systems across the range of the Gulf Sturgeon

Kobe White* (University of Southern Mississippi), Jacob Zona (University of Southern Mississippi), Brian Kreiser (University of Southern Mississippi)

Gulf Sturgeon (Acipenser oxyrinchus desotoi) is a threatened anadromous species that spawns within seven natal rivers along the northern coast of the Gulf of Mexico from eastern Louisiana to the western Florida Peninsula. This study aims to determine the annual effective number of breeders (Nb) across their range for multiple spawning groups to track reproductive success. Effective number of breeders each year was found by calculating the effective population size (Ne) for each spawning year cohort in a population. Our agency and academic partners have sampled Gulf Sturgeon from all seven natal river systems (west to east; Pearl, Pascagoula, Escambia, Yellow/Blackwater, Choctawhatchee, Apalachicola, and Suwannee Rivers). So far, a total of 1,021 Gulf Sturgeon with fork lengths <1000mm have been genotyped with fin ray age data available for 602 of those individuals allowing them to be assigned to a spring or fall spawning cohort between 2012 to 2021. As of now, the annual Nb ranged from 36 (Suwannee fall spawning group in 2018) to 59 (Apalachicola spring spawning group in 2021). Average number of effective breeders (Nb) across years was highest in the Apalachicola spring spawning group (47.3) and lowest in the Pearl and Suwannee fall spawning groups (40.3). This study is ongoing with recent collections still being processed and analyzed. Results of this study will hopefully provide useful information for the ongoing efforts to manage and conserve populations of Gulf Sturgeon.

Range Extension of Endangered Fountain Darter Etheostoma fonticola

Lauren Chappell* (Texas State University), Elibardo Leal (Texas State University), Joshua D. Tivin (Texas State University), Timothy H. Bonner (Texas State University)

A recent survey in the eurythermal reach of the San Marcos River (Hays County, TX) revealed a dense and reproducing population of the federally-listed endangered Fountain Darter Etheostoma fonticola (N = 243). Although there are prior reports of Fountain Darter occurrences downstream from the designated critical habitat (in the stenothermal spring reach - headwaters to 4.8 river-km [rkm]), a reproducing population was found up to 11 rkm downstream from their designated critical habitat in a eurythermal reach, which was surprising given that population viability and delisting criteria of the Fountain Darter include a requirement for maintaining stenothermal conditions within their occupied range. The ecology and biology of the Fountain Darter under more eurythermal conditions could provide valuable insights into the habitat associations of this species.

Mussel community and water quality within a southcentral river basin of North America with emphasis on two federally proposed species

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In 2020, the freshwater mussels Louisiana Pigtoe Pleurobema riddellii (Lea, 1862) and Texas Heelsplitter Potamilus amphichaenus (Frierson, 1898) were categorized by the U.S. Fish and Wildlife Service as functionally extirpated/extirpated within the upper Sabine River basin of Texas and Louisiana with identified threats to population viability including changes in water quality. Purposes of this study were to update current knowledge (i.e., occurrences, relative abundances, catch per unit effort, and habitat associations) of Louisiana Pigtoe, Texas Heelsplitter, and other co-occurring mussel species within the Sabine River basin and to evaluate if water quality over a 50-year period could be a factor in the functionally extirpated/extirpated categorization of Louisiana Pigtoe and Texas Heelsplitter within the basin. Surveys resulted in the collection of 28 freshwater mussel species and 9,244 individuals among 46 mesohabitats and five reaches of the Sabine River basin. Louisiana Pigtoe (n = 57) and Texas Heelsplitter (n = 7) were only observed in the upper Sabine. Louisiana Pigtoe was associated with swift current velocities, shallow depths, and gravel substrates. Texas Heelsplitter was associated with shallow, swift, riffle mesohabitats of sand and gravel substrates. Between 1960/1970s and 2020s, several water quality variables were generally within water quality standards and improved through time, indicating that water quality likely was not a limiting factor for freshwater mussels. Future monitoring is needed to further understand relationships between freshwater mussel communities and water quality.

Evaluation of Cypress Tree Survival Rates at Kentucky Lake and Lake Barkley

Nick Simpson* (Kentucky Department of Fish and Wildlife Resources), Adam Martin (Kentucky Department of Fish and Wildlife Resources), Justin Graben (Murray State University), Scott Starr (Kentucky Department of Fish and Wildlife Resources)

Bald cypress trees (Taxodium distichum) are native to Western Kentucky and are one of only a few species hardy enough to survive within the winter drawdown zone of Kentucky Lake and Lake Barkley. These trees are known to have complex root systems that can help prevent bank erosion, and at larger sizes the “knees” and trunks can also provide shallow water cover for many fish species. The Kentucky Department of Fish and Wildlife Resources (KDFWR) has been planting cypress trees on and off in Western Kentucky for decades, but recent grant funding has provided more consistent plantings since 2017. About two thirds of the trees for these recent plantings came from tree nurseries at about 5’ tall and were planted on the shoreline shortly after purchase. The remaining trees were purchased at about 18” tall and then grown at KDFWR facilities until reaching about 4-5’ tall (1-2 years) before being planted at the lakes. Overall, 4,644 cypress trees were planted at Kentucky Lake and Lake Barkley from 2017-

2023, and the survival of these plantings was evaluated in September 2023. A total of 58.1% of cypress trees were alive when surveyed, while an additional 7.9% were still in place but appeared dead. The larger nursery trees had a survival rate of 63.8%, while trees first grown by KDFWR survived at 46.1%. It appears the larger trees from the nursery are currently the better option for higher survival, however, the cost per tree is much higher. Our goal is to continue a more consistent monitoring schedule in the future which may allow us to determine some other factors which may increase overall survival.

Assessing the accuracy of gonadosomatic index (GSI) staging for maturity and age at first maturity in summer flounder, Paralichthys dentatus

Julian Quinones* (Virginia Tech), Hailey Conrad(Virginia Tech), Holly Kindsvater(Virginia Tech)

Determination of the proportion of fish that are mature at length or age is crucial for ascertaining and estimating the maturity ogive, which is fundamental to population dynamics and stock assessment. Maturity staging in fisheries is assessed in two ways: macroscopically, which examines the external of the gonad as a whole, and microscopically, which examines the internal cellular structure of the gonad. Macroscopic staging is the external examination of the gonad with a standardized scale to determine the stage of maturity the fish is in. Macroscopic staging is relatively inexpensive and can be completed in the field; however, solely relying on macroscopic staging introduces a high amount of error. Histology, microscopic staging, is a highly accurate method of determining maturity but can be expensive and time consuming, due to its requirement of specialized equipment. This study is an assessment of accuracy for methodological approaches that uise Gonadosomatic index (GSI) to stage maturity of an indeterminate batch spawner, summer flounder (Paralichthys dentatus). Gonadosomatic index is the ratio between the weight of gonad tissue and the total weight of an individual, which can be used to estimate the reductive timing of individuals or a population. GSI-based methods will be compared to macroscopic and histological staging by comparing the results of their ogives of available summer flounder data. Flounder were classified into three stages: immature, mature, and post spawning to give a threshold to GSI values. This study will show the validity and accuracy of GSI-based staging methods, compared to traditional macroscopic and histological staging methods of flounder.

Hauling away the Blues- Evaluating the use of a commercial haul seine fishery as a management tool for tilapia in Upper St Johns River Lakes

Arthur Bernhardt* (Florida Fish and Wildlife Conservation Commission) Reid Hyle (Florida Fish and Wildlife Conservation Commission)

Non-native Tilapia Oreochromis sp. were introduced to Florida waterways over 60 years ago. When established, these fish have several potential negative impacts on water quality, native fish populations, and plant communities. In the St. Johns River of east-central Florida, the last significant cold-kill occurred in 2010 and since then, the population of Tilapia has continued to grow. Beginning in 2022, biologists from Florida Fish and Wildlife Conservation Commission (FWC) and St. John's River Water Management District (SJRWMD) permitted a seasonal commercial haul seine fishery to harvest tilapia in select lakes of the St. Johns River, primarily as a nutrient removal strategy. The fishers also removed the armored catfish: Brown Hoplo, Hoplosternum littorale and Vermiculated Sailfin Catfish Pterygoplichthyes. Using a

1,000 ft long net, 19 ft deep, and with a 3 inch stretched mesh, fishers encircled an area of 30-60 acres to capture fish. Biologists monitoring the fishery sub-sampled the catch to examine species composition. In 2022, the fishers harvested 10,443 kg of Tilapia and removed an estimated 60 kg of P from one lake. In 2023, 2 lakes were fished, removing 20,673 kg of tilapia and 2,359 kg of armored catfish (118 kg P removed). Catch composition was 60-90% exotic tilapia and armored catfish with little to no mortality of game fish. In 2024, SJRWMD is continuing to permit the removal effort on several St. Johns River Lakes. It is important to examine the use of the haul seine as a tool for management of tilapia and learn the capacity of this fishery to impact fish populations. FWC will conduct a mark-recapture study of 2 lakes to be to estimate population size, calculate exploitation rate of the fishery, and model the amount of effort that would be required to fish down the tilapia population.

Preliminary Life-History Characteristics for Bigeye Scad in Southeast Florida

Mariah France (Nova Southeastern University), Nicole Kirchhoff (Live Advantage Bait LLC), David Kerstetter (Nova Southeastern University)

In southern Florida, Bigeye Scad (Selar crumenophthamus) is a popular bait fish known locally as "goggle-eye." Fishers in Southeast Florida frequently use them live with kite fishing for big game fishes, and they are particularly well-known for their market price, which can exceed $100 per dozen. Anecdotal reports suggest a decline in local availability in recent years, and Bigeye Scad aquaculture has the potential to stabilize wild populations and generate business income, but to be successful, more information is needed regarding the life history, diet, and reproduction of Bigeye Scad in Southeast Florida and whether these local population characteristics differ from the species' Pacific Ocean counterparts. The purpose of this project is to obtain a better understanding of Bigeye Scad life history in Southeast Florida, including annual age-growth rates, reproductive trends, and diet. Working with local bait anglers and markets, the research to date has collected fresh specimens locally every month for a year to evaluate age and growth via otoliths and possible seasonality in diet and reproduction. The preliminary findings within the first ten months of sampling (n=321) were that fork length, weight, and gonadosomatic index values were high in the summer months, indicating spawning seasonality, with ongoing study of the remaining two months of samples. Stomach contents show the possibility of seasonality with the diet, with some months having polychaetes and others containing eel larvae, but Bigeye Scad favored euphausiids in all the months that have been analyzed.

Developing a standardized quantitative framework for evaluating imperilment of southeastern crayfishes

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Dozens of southeastern crayfishes are petitioned for listing under the Endangered Species Act. Thus, conservation status assessments are greatly needed for crayfishes, but these assessments are often hindered by a lack of available information, particularly for lesser-known species. To overcome this challenge, we are developing a standardized Bayesian belief network (BBN) model for conservation status assessments of southeastern crayfishes that integrates disparate information types. The model is grounded in conservation biology principles of resiliency (distribution, demographics), redundancy (metapopulation dynamics), and representation (eco-evolutionary uniqueness, long-term adaptability). To inform the model, we conducted literature reviews on crayfish imperilment, life-history strategies, and population connectivity and fragmentation. Through this review, we identified traits that may increase the probability of imperilment for crayfishes: body size, fecundity, egg size, and habitat specialization. We incorporated these traits into the BBN to inform species-level vulnerability. Additionally, we compiled information related to population connectivity, such as dispersal distances, ranging movements, and factors that influence dispersal, to inform the network structure on population redundancy. We also reviewed recent Species Status Assessments (SSAs) by the US Fish and Wildlife Service for southeastern crayfishes. From this review, we identified the key factors that have historically been used to assess current and future population condition in status assessments. To further develop and refine the model, we will convene a working group to formally review the model structure and parameterize the model. Following this review, we will use data from existing SSAs to validate the model. This approach will allow us to examine the current state of crayfish populations and predict future conditions at multiple spatial scales, permitting us to identify any areas that may need management efforts.

Monitoring river herring abundance in a Virginia tidal river using fishway electronic counts

L. Alan Weaver (Virginia Department of Wildlife Resources), Matthias Gaffney* (Virginia Department of Wildlife Resources), and Tim Owen (Virginia Department of Wildlife Resources)

River herring, Alewife (Alosa pseudoharengus) and Blueback Herring (A. aestivalis), are vital components of the Chesapeake Bay ecosystem. As populations declined, a harvest moratorium was enacted in 2012. To monitor the efficacy of this recovery strategy, extensive effort is being made to quantify the annual run strength of river herring throughout Virginia. In the Chickahominy River, a major tributary of the tidal James River, an electronic fish counter was deployed at Walker's Dam double Denil fishway (river km 36) to passively count the successful passage of migrating fish. Periodic trapping (PVC frame exit trap with 19 mm plastic mesh netting) was conducted during spring migration (2018 to 2023) to assess counter accuracy and determine species composition. Through 2023 over 1.7 million total fish were counted. Annual mean abundances through 2022 of the most abundant species: Gizzard Shad ($\bar{x}$=165,071), Blueback Herring ($\bar{x}$=102,947), and Alewife ($\bar{x}$=13,367). Ten other species passed in limited quantity, including American Shad (A. sapidissima). Two-tailed paired t-tests conducted between time-synchronized trapping events (control) and corresponding electronic counts (experimental) showed no statistically significant difference ($p<0.05$). Further regression analysis of the trap rate (fish/min) displayed a strong link between the control and experimental gears (R2 range = 0.72-0.99, $p<2.2e$ -16). The 2023 results are currently being analyzed. While high confidence exists in these passage estimates, passable submergence flow occasionally occurs for brief periods at the spillway when tidal tailwater approaches headpond level, and thus, these estimates should be considered conservative. This phenomenon is being further analyzed. The electronic count allows for reliable inference of annual river herring run strength. Additional tools are being explored, such as eDNA and boat electrofishing, to track

upstream habitat use by river herring. These results contribute to understanding the overall herring population trends and will inform river herring management strategies in Virginia.

Utilizing Fisheries Management Data to Implement On-Farm Conservation Practices in the Upper Chattahoochee Watershed

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Since 2017, UGA Extension and the Georgia Department of Natural Resources (DNR) Wildlife Resources Division (WRD) have increased efforts on the conservation of native black bass (Micropterus sp.) and their habitats in the Upper Chattahoochee watershed. Specifically, our research has sought to investigate concerns regarding introgressive hybridization from non-native invasive Alabama bass on native Chattahoochee and Shoal bass, assess effects of urbanization and poor agriculture practices on aquatic habitat, and engage and educate stakeholders of the river system about its unique, endemic fishery resources.

This research has provided critical information needed to implement management strategies to conserve native riverine black bass in the Upper Chattahoochee River basin. Collaborations with the Southeastern Aquatic Research Partnership (SARP) and new project partners have opened doors to fund even more restoration work in the watershed. To date, $748,770 have been granted to the Upper Chattahoochee watershed for assisting agronomic crop farmers and livestock producers to implement better land management practices aimed at reducing sedimentation into surface waterways.

County Extension agents in this watershed are not only administrators of the grant dollars, but are actively collaborating with the Natural Resources Conservation Service (NRCS), Master Gardeners, high schools, technical schools, and other grassroots organizations to establish education sites, host educational workshops, and grow a bank of plant material to be used for future restoration sites. This case study provides a developing template for enacting meaningful stream restoration efforts across a watershed by leveraging the skills, knowledge, and buy-in from a diverse group of resource stakeholders.

Following fishes: engaging stakeholders in fisheries research

Samantha Hagedorn*, Danielle Morley, Alejandro Acosta (Florida Fish and Wildlife Conservation Commission)

Fish spawning aggregation sites are well known to fishers and are often targeted due to the reliable immigration of fish to these locations. A seasonal closure at Western Dry Rocks, 10 miles SW of Key West, FL, was enacted to protect multiple fish species that regularly aggregate in the area. The Fish and Wildlife Research Institute (FWRI) has taken a holistic approach to monitor the changes of the closure and the efficacy of that management decision. As a dependable fishing location, FWRI wanted to inform the fishing community of the research efforts taking place in the area. To effectively reach the fishing community and general public, we distributed flyers in and around Key West, FL, created a direct line of communication to fisheries biologists through email and a phone hotline, posted on multiple social media platforms, and developed the angler participation program in the Florida Keys. Through these efforts, we have placed flyers in over 50 locations, had over 130,000 views on all social media platforms, and have had numerous dockside interactions with fishers, stakeholders, and members of the general public. Our angler participation program has increased our telemetry tag return rate from 0.8% in previous years to 4.5% since the beginning of the program two years ago. These results highlight the importance of engaging stakeholders in fisheries research and provide evidence that engagement of stakeholders in collaborative research positively influences the rate of return of tagged fish.

Temporal assessment of fish communities in the headwaters of a South-Central Plains ecoregion watershed

Tara L. Schnelting* (Arkansas Tech University), Kyler B. Hecke (Arkansas Tech University)

Among South-Central Plains ecoregion fish communities, there is a lack of knowledge on the importance of headwaters in these systems. This information is needed to understand the functionality of headwaters in respect to fish communities in this ecoregion. We wanted to address this knowledge gap by assessing seasonal changes of fish communities in headwater streams of a South-Central Plains ecoregion watershed in Arkansas (Moro Creek). A total of 16 sites within the upper reach of the Moro Creek watershed were sampled seasonally (winter, spring, and summer), with a total of three sampling events from Jan.- Aug. 2023. Multiple sampling gears were employed (backpack electrofishing, kick-nets, and seines) to increase species detection during sampling. Fish presence/absence data were analyzed using multi-season, multi-species occupancy modeling to estimate μ: community occupancy mean and Ω: probability of species belonging to a community. A total of 35 species were observed from 10 families across all sites among the seasonal sampling events. The most abundant species observed across all sampling events (n=64) were Western Mosquitofish (Gambusia affinis; n=52), Banded Pygmy Sunfish (Elassoma zonatum; n=42), Pirate Perch (Aphredoderus sayanus; n=40), Blackspotted Topminnow (Fundulus olivaceus; n=37), and Western Creek Chubsucker (Erimyzon claviformis; n=35). The sampling event with the highest species occurrence across the 16 sites was during the fall (n =31), and the lowest species occurrence was during the winter (n =25). The community occupancy mean (μ) varied from season to season, 0.22 ±0.03 in the winter, 0.26 ±0.03 in the spring, 0.30 ±0.03 in the summer, and 0.35 ±0.03 in the fall. There appears to be temporal variation in the fish community. This research will aid in

the understanding of fish patterns and species richness on a temporal scale, which will further our knowledge on the functionality of headwater streams in South-Central Plains ecoregion watersheds.

Fostering data sharing and scoping needs assessment through simple digital tools: A case study with an acoustic telemetry lookup tool

Evan C. Boone* (U.S. Fish and Wildlife Service) and Caleb A. Aldridge (U.S. Fish and Wildlife Service)

Acoustic telemetry is a popular tool among natural resource agencies for investigating broad and fine scale movements, habitat use, and life history characteristics of fishes. Acoustic telemetry presents some unique challenges and opportunities. For instance, a challenge of acoustic telemetry technology is that receivers do not discriminate tag transmissions within their listening frequency which can lead to the cumbersome task of identifying ownership of unknown tags (e.g., “daisy chain” emails) in complex datasets. An alternative perspective is that because receivers are indiscriminate, investigators can benefit from additional or ancillary information shared by colleagues, through efficiently identifying and communicating detection data. To encourage collaboration and better scope support for a tool that could assist in identifying ownership of unknown tag transmissions, we developed an interactive tool to help researchers quickly identify tag owners, locate deployed receiver arrays, and display pertinent information of acoustic telemetry projects. We used RMarkdown language to program a dynamic and interactive HyperText Markup Language (HTML) document that could be easily distributed among users and could accommodate various types of information displays. Over three updates Feb. 2022 – Sep. 2023, the Telemetry Lookup Tool (TLT) has grown from 250 receiver deployments and 2,000 tags to 600 receiver deployments and 6,000 tags. The TLT contains data from 36 acoustic telemetry projects for 18 different species in waters of 16 states. While the TLT has anecdotally assisted investigators with identifying ownership of “unknowns” and enabling collaboration among groups of researchers, development of a comprehensive telemetry observation system for the Mississippi River Basin (MRB) could further develop methodologies and best practices, host and manage large volumes of data, and expand the partnership of researchers working collaboratively on interjurisdictional fisheries issues across the MRB.

A Comparison of Freshwater Mussel Species Detection and Abundance Across Different Survey Methods

Hunter Torolski*(Oklahoma State University), James M. Long and Robert Lonsinger (U.S. Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit) and Lindsey Bruckerhoff (Ohio State University)

Freshwater mussels are vital components of healthy aquatic systems, playing a crucial role in water quality and ecosystem health. Accurate assessments of mussel populations are essential for conservation efforts, yet different survey methods can yield significantly different results, and some are conducted in tandem. In our study, we utilized three distinct survey methods (shells, qualitative, quantitative) for freshwater mussels and assessed their efficacy in detecting species and quantifying abundance at 10 reaches in the Verdigris River, Oklahoma. At each reach, we surveyed for shells of recently dead individuals along four, 100-meter transects. Then, a 60-minute timed snorkel survey was performed throughout the site to rapidly determine species occurrence and abundance (qualitative survey). Finally, we conducted a quantitative survey with 25, 1-m2 quadrats randomly distributed throughout the site. Quadrats were excavated for a total of 20 minutes to a depth of approximately 6 cm. Shell surveys poorly captured the full community of freshwater mussel species present for snorkel and quadrat surveys (mean Jaccard Similarity values of 0.44 and 0.43 respectively). Snorkel surveys and quadrat surveys performed similarly for species richness (mean Jaccard similarity = 0.80) but not community composition (mean Bray-Curtis similarity = 0.30). Quadrat data produced the most species and abundance, but with much greater effort (10 hours total for snorkeling compared to 83 hours for quadrats). Rarefaction of quadrat data to the same level of effort of snorkeling for the entire river showed that it would take 65 quadrats to achieve the same abundance levels as the snorkel surveys, and 79 quadrats to achieve the same species richness. At this level of effort, quadrats can provide robust density estimates, while saving time, which is an advantage of snorkeling surveys.

I spy with my IBI: Application of fish bioassessment across an urban-rural gradient in a watershed spanning multiple ecoregions

Olivia Reves* (University of Illinois-current, University of Texas at San Antonio-former)

Conservation of biological communities under continued urbanization requires understanding how biodiversity is affected by land use cover. We evaluated fish community composition in the San Antonio River Basin (SARB) at 12 sites that varied in land use cover to determine the factors that created differences in fish communities and to examine if a regionalized index of biotic integrity (IBI) is a useful indicator of urbanization. We used PERMANOVA and a non-metric multidimensional scaling (NMDS) analysis to explore whether sites classified as rural, suburban, and urban grouped together in terms of fish assemblages and used environmental fitting to explore relationships between natural watershed gradients, land use variables, and indicators of biotic condition. We also tested whether fish richness differed significantly between site types. We used linear regression analysis to test whether the IBI was significantly related to urban land cover. We found significant differences in SARB fish communities that were driven by a variety of natural and anthropogenic variables, and that suburban areas may support as much biodiversity as rural sites. We also found that the IBI correlates strongly with urban land cover across the SARB, after accounting for ecoregional differences, though with variability caused by sampling time and other land use gradients. These results exhibit the importance of spatiotemporal sampling, and accounting for other watershed gradients when using a regionalized fish IBI to determine areas most affected by urbanization. We advocate for continued, coordinated biological monitoring of the SARB and other Texas basins to further validate conclusions in this study.

Temporal Fish Assemblage Patterns Associated with Fluctuating Flow in a Cumberland River Watershed in Tennessee

Mark Rine* (Tennessee Tech University), Kit Wheeler (Tennessee Tech University) Temporal Fish Assemblage Patterns Associated with Fluctuating Flow in a Cumberland River Watershed in Tennessee

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Streams and rivers that naturally experience flow intermittency account for over half of all streams in the United States. Due to the dynamic attributes of intermittent fluvial systems (IFS), they harbor distinct and diverse assemblages of fishes. However, relatively few studies have investigated which environmental predictor variables influence IFS fish assemblages in temperate regions of the Southeastern United States. Using the Roaring River watershed, a Cumberland River tributary system with dynamic spatiotemporal variability in flow intermittency, our objective was to evaluate the influence of environmental variables on fish assemblages in perennial and intermittent sites and to examine variation in the extent of this influence over time. From June through September 2023, fishes were sampled at nine sites from Roaring River (some perennial and some intermittent sites), Spring Creek (all intermittent sites), and Blackburn Fork (all perennial sites), three subwatersheds with variable flow regimes within the Roaring River system. We will use canonical correspondence analysis to analyze the effect of environmental variables on assemblage structure (i.e., catch-per-unit-effort across species) and compare results between different flow regimes and across time. We predict that environmental variables will exert greater and more temporally consistent influence on fish assemblages at perennial sites than at intermittent sites, given the more stable flow regime at perennial sites. Our results can be used to better understand stream fish assemblage dynamics across variable flow regimes, thereby facilitating effective conservation and management of IFS and their unique biotic communities.

Keywords: canonical correspondence analysis; flow regime; intermittent rivers and ephemeral streams; community ecology; fish assemblage structure

Stream Restoration on Cub Creek, tributary to Hatchie Scenic River, in Middleton, TN

Kimberly Rios Rosado* (West TN River Basin Authority), Kayla Key (West TN River Basin Authority), Amy Alford (West TN River Basin Authority), Kris Gordon (West TN River Basin Authority), and David Blackwood (West TN River Basin Authority)

The West Tennessee River Basin Authority partnered with UT Institute of Agriculture and Tennessee Wildlife Federation (TWF) to restore a large, channelized section of Cub Creek, a tributary to the Hatchie Scenic River in Hardeman County, TN. Approximately 14,500 ft of Cub Creek canal was relocated and restored to a more natural meandering stream totaling 20,500 ft, adding approximately 6,000 ft of stream length to Cub Creek. Along with adding habitat on the landscape, longitudinal connectivity of the stream was restored with the installation of 2 grade control structures that allow for organism passage. Nature-based erosion control structures were also installed to provide protection and act as initial aquatic habitat features during initial restoration phase. WTRBA has partnered with multiple university partners to study the impacts and improvements to habitat and aquatic organism communities. This project is part of a larger restoration effort to restore aquatic connectivity from Cub Creek headwaters to the mainstem Hatchie River."

Assessing aquatic organism passage (AOP) of culverts in degraded streams of West Tennessee

Caitlin Scott*, Kayla Key, Kimberly Rios Rosado, Amy Alford

All from West Tennessee River Basin Authority, Tennessee Department of Environment and Conservation, Humboldt, TN. Stream and road crossings can serve as a barrier to organism passage resulting in habitat fragmentation, particularly for small-bodied fishes in severely degraded streams. The West Tennessee River Basin Authority (WTRBA) aims to restore west Tennessee stream functionality, ecological capacity, habitat availability, and natural morphology through scientifically defensible and evidence-based engineering methods. To prioritize restoration activities, WTRBA has begun to inventory stream/road crossings in west TN watersheds. In summer 2023, WTRBA partnered with Southeast Aquatic Resources Partnership (SARP) to train employees on SARP's standardized stream crossing survey. This protocol allows for assessing organism passage and collects other information to inform prioritizing infrastructure replacement such as the estimate of cost replacement and condition. Surveys were concentrated in two HUC 12 watersheds. Among the 140 crossings surveyed, 65% were determined to be a barrier on passage and many were non-functioning due to a variety of causes such as lowered stream beds because of erosion, lack of maintenance to infrastructure, overgrown vegetation such as the dominant invasive species known as kudzu, and debris buildups. WTRBA plans to continue to add to stream crossing inventory in west TN.

Movement of bighead carp in response to a flow field produced by a half-cylinder

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Throughout its history, the Mississippi River basin has seen the construction of vast infrastructure that has reduced fish movement throughout the basin. To improve fish movement in the highly modified Mississippi River basin, new fish passage infrastructure is being put into place. However, there is uncertainty around the building of non-salmonid fish passage infrastructure within the Mississippi River especially as invasive species such as bighead carp complicate the planning and implementation of these passage facilities. To evaluate the movement of these invasive species within a riverine system, we placed a half-cylinder within an ecohydraulic research flume. Half-cylinders produce a quantifiable and reproducible flow field and are characterized by strong vorticity production, which can trigger quantifiable fish movement decisions. We introduced three bighead carp (Hypophthalmichthys nobilis) per swim trial and evaluated swimming performance under three velocity conditions: 0.00, 0.25, and 0.50 m/s. We measured fish positions at 30 hz and calculated movement statistics and spatial flume occupancy. Our results suggest that bighead carp avoid areas of high vorticity and adjust their swimming path to avoid these locations. In addition, we observed fish occupying the shear zone downstream of the half cylinder. These results have applications in the design of fish passage infrastructure such as rock ramps. Future work will focus on a wider variety of wild-caught native and non-native fish species and will utilize more complicated hydraulic environments.

A Potential Unifying Model to Assess Fish Thermal Tolerance

Jacob Daley* (Clemson University), Luke Bower (United States Geological Survey), Troy Farmer (Clemson University)

Stressful temperature regimes resulting from climate change can push fish populations towards their thermal maxima but predicting fish responses to warming can be difficult. The quantification of the thermal maxima via thermal tolerance experiments using the critical thermal maxima (CTmax) metric has been widely used but is marked by a lack of standardization in thermal assay design (dynamic, static, fluctuating), acclimation temperatures, warming (i.e., ramping) rates, and end points. The Thermal Death Time Model (TDTM) proposed by Jørgensen et al., in 2019 and reinforced in 2021, could be a potential avenue to unify thermal tolerance experiments with the concept of additive injury. The model has shown to produce similar thermal tolerance predictions for fruit flies (Drosophila spp.) using different experimental methods such as dynamic (rapid warming) and static (constant stressful temperature) assays, but still requires further testing with larger ectotherms such as fish and needs to be verified experimentally. Locally abundant fish species from four different families will have their CTmaxes estimated using dynamic and static thermal tolerance experiments. The data will be entered into the TDTM and predictions per species will be compared to see if model outputs are similar under the different methods. Furthermore, to investigate if model predictions are similar to observations, each fish species will be exposed to an additional static assay held at the species-specific temperature where the model predicts the fish can last 1 hour before reaching mortality (CTmax in 1-hour). With additional evidence, this model could unify thermal tolerance experiments and promote subsequent meta-analyses by providing a standardized method and estimate for the thermal tolerance of ectotherms.

Validating Shortnose Sturgeon (Acipenser brevirostrum) Age Estimates from Known Age Fish

Hunter Rider* (University of Georgia), Adam Fox (University of Georgia), Martin Hamel (University of Georgia)

The pectoral fin spine is the most accepted hard structure used in determining age estimates of sturgeons; however, few studies have validated fin spines for accuracy. A lack of validation in aging studies can result in inaccuracies, leading to biased findings in population dynamics studies. Shortnose Sturgeon (Acipenser brevirostrum; SNS) are a critically endangered fish where population declines are attributed to anthropogenic effects. One metric for evaluating recovery is through assessments of recruitment and population age structure, which is evaluated via age estimation with pectoral spines and modal assignments from length frequency (L-F) histograms. The accuracy of these estimation techniques, however, are unknown, and inaccuracies could lead to uninformed management decisions. Therefore, we collected pectoral fin spines from known age SNS in the Savannah, Ogeechee, and Altamaha Rivers, GA, from 2005–2023 to assess accuracy of age estimation procedures. Fin spine age estimates were obtained from known-age juvenile fish (n=122), based on modal distributions from previous L-F analyses. Ages assigned to juvenile fin spines were similar to L-F bins for age-1 SNS. Modal age assignments for older cohorts were more variable and did not conform to age estimates from fin spines. In addition, time at large for recaptured adult fish (first tagged as juveniles) did not corroborate with age estimates from fin spines; therefore, we recommend that fin spines only be used for early life age assignments (i.e., juveniles) as age assignments on older fish will likely lead to inaccuracies. Other

methods (e.g., mark-recapture analysis) are recommended for determining age estimates to avoid errors that may lead to mismanagement of this endangered fish.

Influences of environmental variation on estuarine nekton assemblages in the Guadalupe River Delta, Texas

Kyle Sullivan*, Bradley Littrell, Edmund Oborny (BIO-WEST, Inc.)

Tidal river deltas are highly productive and dynamic systems due to complex interactions between freshwater inflows, tidal regimes, and local habitat. Nekton assemblages often consist of both transient (i.e., freshwater, marine) and resident species that differ relative to their life histories and environmental requirements. Interactions between river and tidal flows establish dynamic physiochemical gradients along estuarine systems and regulate ecosystem function, driving variation in overall abundances and structure of nekton assemblages across space and time. Our goal was to examine how environmental variation influences density and structure of nekton assemblages in the Guadalupe River Delta, Texas. Sampling was conducted at three sites that increased in distance from freshwater inflow sources: 1) upper river delta (URD); 2) middle river delta (MRD); and 3) lower river delta (LRD). We fit multilevel generalized linear models to estimate the influence of flow regime indices on overall density and used multivariate analyses to identify environmental factors driving spatiotemporal patterns in nekton assemblage structure. The best supported regression model to estimate overall density included 90-day median river discharge and high flow pulse length fit with quadratic terms. For both predictors, density increased positively up to an intermediate maximum, then decreased as each predictor continued to increase. Differences in nekton assemblage structure were best explained by site location, water temperature, and salinity. URD had higher densities of estuarine resident fundulids and freshwater taxa, MRD had higher densities of estuarine residents with greater salinity tolerances and several marine migrants, and LRB contained more marine migrant taxa. In summary, our results further support that freshwater inflows can enhance productivity in estuarine systems, though may diminish at certain high flow thresholds. Our findings also show nekton assemblage structure varied spatially, with estuarine residents and marine migrants with higher salinity tolerances utilizing areas further from freshwater inflow sources.

Predictors of angler catch and effort in Texas black bass fisheries

David R. Smith (LSU), Mitch Nisbet (TPWD), Randy Myers (TPWD), J. Warren Schlechte (TPWD), Stephen R. Midway (LSU), Michael A. Dance (LSU)

State management agencies across the United States use creel and angler surveys to deliver catch and effort estimates, of which, many long-term time series are available to examine trends. For example, we applied generalized additive models to analyze black bass Micropterus spp. angler data collected at 53 Texas reservoirs between 2003 and 2021 to evaluate seasonal, spatial, and environmental predictors of angler catch rate and effort density (i.e., angler-hours/ha). Season was a significant predictor, with strong positive effects on catch rates and effort densities during the spring. Percent full (i.e., surface area relative to full pool) was also identified as a significant predictor, with increasing effort densities and catch rates at higher levels of percent full. This study provides a comparative baseline for future evaluations of black bass fisheries in Texas and a depiction of key factors influencing black bass angler

catch rates and effort densities. With the United States Inland Creel and Angler Survey Catalog (CreelCat), there now exists a national compilation of angler and creel survey data currently including data from 33 different state agencies. Looking ahead, we aim to expand on the results of this study while adding CreelCat data from multiple U.S. states while building wider regional models evaluating predictors of catch and effort.

Evaluating the efficacy of regional models in predicting flow regimes in ungaged catchments of West Tennessee

Amy B. Alford (West TN River Basin Authority), Kayla Key (West TN River Basin Authority), Kimberly Rios Rosado (West TN River Basin Authority), David Blackwood (West TN River Basin Authority)

Riverine flow regimes are defined by multiple parameters of timing, frequency, magnitude, and rate of change of flood events. Many of these parameters drive ecological processes such as availability of fish spawning and summer refuge habitats while others are useful when defining infrastructure constraints such as flood prediction maps. The challenge in defining the flood regime for a particular catchment arises when the system is ungaged. Therefore, models must be developed using available stream gauge data and interpolated to other systems. Rainfall-runoff and regional models are two widely used methods to predict flow regime parameters in ungaged catchments. Here we present the development and performance of regional models to predict flow regime parameters across streams of the 9 major HUC8 watersheds of West Tennessee. Our developed equations can then be used to interpolate conditions at locations of ecological sampling to inform flow-ecology management.

Distribution and habitat associations of Procambarus pearsei and P. braswelli and range overlap with invasive Red Swamp Crayfish (P. clarkii) in Southeastern North Carolina

Robert Adams*(Appalachian State University), Sidney Busch (Appalachian State University), Elijah Thompson (Appalachian State University), Robert Creed (Appalachian State University), Michael Gangloff (Appalachian State University)

Crayfish are important components of freshwater ecosystems and are most diverse in North America. Native crayfish populations are facing increasing pressure from multiple sources including the spread of invasive crayfish. The Red Swamp Crayfish (Procambarus clarkii) is an aggressive invader and can rapidly colonize a range of ecosystem types. The species has colonized much of the eastern Carolinas in the last 20 years including much of the Lumber and Waccamaw River systems. These watersheds are also home to two native Procambarus species of concern in North Carolina; the Sandhills Crayfish (Procambarus pearsei) and the Waccamaw Crayfish (Procambarus braswelli). These species have limited ranges and recent surveys indicated that their ranges have declined. Of the 120 independent sites we have now surveyed for P. pearsei and P. braswelli we have confirmed that 10 historically-occupied sites still have populations of P. pearsei and 10 sites still have P. braswelli. We have also documented 9 sites where one of the species of concern (P. braswelli or P. pearsei) co-occur with P. clarkii. We have detected P. clarkii at 42 of the 120 sampled sites (35%) indicating that it is extremely prevalent in the region. The majority of these P. clarkii locations lie within the Waccamaw River drainage. We are currently characterizing the biotic and abiotic habitat variables associated with the occurrence of both native species and P. clarkii.

This will allow for a better understanding of the habitat requirements for the crayfish species of interest in our study as well as the habitat characteristics for sites occupied by P. clarkii.

Assessment of Fish Movement in Relation to Barriers in the Upper Illinois Bayou Watershed

Risa McCollough* (Arkansas Tech University) and Kyler Hecke (Arkansas Tech University)

There has been increased concern about the effects stream barriers have on aquatic organism passage. Artificial barriers, such as road crossings, can hinder the movement of aquatic organisms and affect habitat connectivity. Two creeks were selected in the upper Illinois Bayou watershed (Dare and Dry Creek) to assess fish movement using mark-recapture through PIT and Visible Implant Elastomer (VIE) tags. VIE tags were limited to 20 individuals per species and PIT tags were limited to 10 individuals per species to ensure species diversity of tagged fish. Sampling occurred monthly (October 2023-present) at each site. During sampling, species abundance, length and weight of tagged individuals, number of recaptured individuals, and total number newly tagged fish were recorded. At Dare Creek, we initially (October 2023) collected 958 individuals from 22 species; 171 individuals from 21 species received VIE tags and 34 individuals from 9 species were PIT tagged. In the first recapture sample (November), we collected 560 individuals from 21 species, 120 of which received VIE tags and 26 received PIT tags. We recaptured 8 individuals from 8 species, 2 being PIT tagged and 6 tagged with VIE during November. The recapture rate was 0.04 (recaptured / tagged); this may have been affected by a substantial increase in water level between sampling periods. In the initial (October) sampling of Dry Creek, 15 species were sampled with 71 total individuals collected; 45 individuals from 12 species received VIE tags, and 13 individuals from 4 species were PIT tagged. The secondary sample was delayed due to inclement weather. Future sampling will provide data on fish movement and the temporal changes in fish communities at these sites. These data will further aid in our understanding of stream barriers, how they impact fish, and lay a foundation for further research in this watershed.

Crayfish Conservation in Kentucky

Michael C. Compton* (Office of Kentucky Nature Preserves), Zach Couch* (Kentucky Department of Fish and Wildlife Resources), David Hayes (Eastern Kentucky University)

Fish and freshwater mussels have historically received the most research and conservation attention among the aquatic groups in Kentucky, resulting in dozens of species considered imperiled at the state level and seven fish and thirty-three mussel species listed federally. A need to increase crayfish research and conservation has been recognized among state agencies and crayfish biologists. The recent State Wildlife Action Plan for Kentucky indicated that a third of the fauna were imperiled at the state level and another third were lacking the appropriate data to accurately determine a conservation status. Taylor and Schuster (2004) provided a comprehensive treatise of the crayfish fauna; however, 16 species have since been described, with one species considered federally threatened, Big Sandy Crayfish (Cambarus callainus). It is likely that more species warrant conservation protections and that several cryptic species occur within the state. Efforts to increase our knowledge of crayfish diversity, distributions, and conservation are ongoing. Initial results from statewide stream surveys have added one new species, Surgeon Crayfish (Faxonius forceps), to the state fauna. In addition, burrowing crayfish were targeted during Spring 2023 at the first annual Kentucky Burrowing Crayfish Blitz held in northwest Kentucky. Twenty crayfish biologists from five states attended the multi-day event, resulting in 58 sites surveyed and 16 taxa encountered. Lastly, DNA barcoding of specimens deposited at the Branley Branson Museum of Zoology at Eastern Kentucky University revealed intriguing patterns among Faxonius cristavarius/juvenilis/rusticus that is suggestive of cryptic lineages and undescribed species. Going forward, state agencies and their partners will systematically survey the state over the next 5 years and work with crayfish biologists to resolve species complexes and data gaps. During Spring 2024 the second annual Kentucky Burrowing Crayfish Blitz will occur. Please let us know if you would be interested in attending the event.

CPUE of Invasive Silver and Bighead Carp in Kentucky and Barkley Lakes

Joshua Tompkins (Kentucky Department of Fish and Wildlife Resources), Matthew Dollenbacher (Kentucky Department of Fish and Wildlife Resources)

Kentucky and Barkley Lakes contain a population of invasive Silver (hypophthalmichthys molitrix) and Bighead (hypophthalmichthys nobilis) carp which are commercially harvested by fishermen using gill nets. Kentucky Department of Fish and Wildlife Resources conduct ride-alongs with these commercial fishermen to collect data including search time to locate schools of invasive carp, total time on the water for each day of fishing, harvest weights, and to monitor gears being implemented. With these data, we are working to determine population trends of invasive carp in Kentucky and Barkley Lakes as well as understand the most effective means of catching and removing invasive carp in these systems.

We have found that during ride-alongs with commercial fisherman, search time each trip from 2021 to 2023 has on average decreased while harvest weights have on average increased. Additionally, we have found that day versus night fishing yields marginally different harvest rates of invasive carp. Kentucky and Barkley Lakes are year-round commercial fisheries, and it has been found that search time and harvest weights will vary widely between seasons and amongst commercial fishers. Over this three-year period, the number of commercial fishermen on the lakes has decreased but gears being used have improved to include the uses of larger boats, longer and deeper nets, more efficient electronics to locate fish, and the implementation of different fishing tactics to actively target schools of invasive carp which could explain increased catch per unit effort amidst a potentially decreasing population of invasive carp.

Offshore movements and potential spawning behaviors of southern flounder inferred from archival satellite tags

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Southern flounder Paralichthys lethostigma support valuable fisheries throughout their range and have experienced declining trends in abundance and recruitment for much of the past decade. Important knowledge gaps remain in terms of spawning areas and adult movements in ocean habitats that hinder efforts to identify the causes of low recruitment. Conservation and management efforts will benefit from a greater understanding of the location of spawning aggregations and the temporal windows when spawning takes place. Satellite archival tags were fitted to 26 adult southern flounder to obtain continuous temperature and depth records during ocean residence off North Carolina. Data retrieved from the ARGOS satellite system provided temperature and depth information during a roughly 8-month period from October 2022 to July 2023. Temperature and depth data archived in 5-minute intervals was used to identify evidence of spawning behavior, which was defined as brief and rapid ascents off the bottom that have been observed for other flatfishes during spawning episodes. In addition, estimated locations derived from the position of tags immediately after initial tag pop-off can be used to identify offshore regions of aggregation. Data for southern flounder indicated primary use of inner and mid-shelf habitats with depths between 20-40m. Several examples of potential spawning behavior were noted from rapid changes in depth, ascent followed by descent, which were often grouped into behavioral clusters. The results provide preliminary evidence of spawning in mid-shelf regions and can aid in the location of winter surveys to collect adults for future stock assessments.

Minimum Length Evaluation of Stockton Lake Crappie

Chase Forck (Missouri State University), Grant Schmitz (Missouri State University), Hae H. Kim (Missouri State University), T. Ben Parnell (Missouri Department of Conservation), and Quinton E. Phelps* (Missouri State University)

Recreational fishing is very popular in the United States and has the potential to greatly benefit local economies. White Crappie Pomoxis annularis and Black Crappie P. nigromaculatus represent commonly targeted and harvested fish species in Missouri. Currently, statewide crappie regulations allow anglers to harvest 30/person/day with no minimum length restrictions. However, certain systems are managed under varying minimum length limits and daily bag limits. Stockton Lake, located in southeastern Cedar County, northeastern Dade County, and southwestern Polk County, Missouri is formed by the Big Sac and Little Sac rivers. Crappie are currently managed under a 10" (250mm) minimum length limit of 15/person/day. However, little to no information regarding population demographics exists for the Stockton Lake crappie population. Using standardized fall trap-net sampling in conjunction with the Missouri Department of Conservation, we assessed population demographics (i.e., recruitment, growth, and mortality) using age data collected from the sagittal otoliths. Further, we used this demographic information to evaluate population level responses to harvest under current regulations. Understanding population demographics and responses to exploitation can provide managers insights into effective and proper regulations and management strategies.

Assessing Stream Health: What More Can Fish Assemblage Tell Us About Kansas Streams?

Aaron Walker, Caitlin Schoeck, Alexander Bornstein, Elizabeth Smith (Kansas Department of Health and Environment)

The Stream Probabilistic Monitoring Program at the Kansas Department of Health and Environment (KDHE) currently uses stream macroinvertebrate assemblage, along with chemical water quality data, to assess a stream's support for aquatic life use. These data are used to produce a statewide stream health assessment (the 305(b) report), which is required by the Clean Water Act. Two years out of every five,

however, the agency also participates in EPA's National Rivers and Streams Assessment (NRSA). Alongside the usual macroinvertebrate and water chemistry data, the team collects a great deal of additional habitat data, as well as fish assemblage data. As part of NRSA, the EPA has developed regional Multimetric Indices for the fish assemblages, and each sample can be classified as Good, Fair, or Poor. The data from the 2018-2019 NRSA effort are now available. In terms of staff field time, fish assemblage data are significantly more costly to obtain than macroinvertebrate data or water chemistry data. However, because all three data types are available for these 35 NRSA sites, it presents an opportunity to examine whether fish assemblage data reinforce, contradict, or complement the stream health conclusions that have been made based on the agency's traditional datasets. An overall analysis is presented, along with a close examination of those areas where the data types might lead to differing conclusions.

Utility of side-scan and down-scan sonar for monitoring Paddlefish

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Recreational-grade side-scan sonar (SSS) units are becoming increasingly used for monitoring large-bodied fishes. We report on evaluations of side-scan and down-scan sonar from the MEGA series of Humminbird SSS units to count and visualize Paddlefish in river and reservoir settings in Oklahoma. First, we used the side-scan channels to validate images of a fiberglass Paddlefish model, which we used to estimate maximum detection distance. Second, we surveyed several kilometers of a river and a reservoir with known populations and used distance-sampling methods to estimate abundance and account for reader variability in counts. Third, we used down-scan, in conjunction with previously recorded side-scan data, to estimate Paddlefish density and depth of water use. After accounting for detection with distance, density estimates from down-scan mirrored those obtained from side-scan. Moreover, depth of use for Paddlefish in the reservoir was unimodal at approximately 60% of total depth. These new tools open up new methods for monitoring this species in a variety of habitats.

Combining spatial gradients and sparse time series data to predict fish assemblage response to increasing aridity

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Spatial gradients (e.g., land cover land use, aridity) representing proxies for future change (e.g., landcover transformation, climate change) are useful for developing predictions of organism response to future change. However, such ‘space-for-time’ substitutions might result in erroneous predictions and validation is best achieved through long-term, temporally replicated surveys. Given that long-term surveys are challenging, cost-prohibitive, and in short supply, an alternative approach involves the use of spatial gradients and relatively sparse time series data (e.g., multiple, potentially non-consecutive snapshots). Here we apply spatial gradient analysis with sparse time series data to test the hypothesis that stream fish assemblage change along an aridity gradient provides a proxy for future fish assemblage change under climate projections. We surveyed 102 sites during 2021 under average precipitation and temperature regimes, and then revisited a subset of 16 of these locations in 2023 after two years of high intensity drought. We then used the 2021 data to project assemblage composition under climate change scenarios involving higher temperatures and reduced rainfall and used the 2023 data to assess the directionality and magnitude of short-term temporal change in fish assemblage structure. Results revealed that under climate change scenarios, fish assemblage projections moved in the direction expected along the aridity gradient (i.e., towards warmer and drier streams). When we overlaid 2023 data that were collected following two years of intense drought, fish assemblages moved in the direction indicated by the climate projections, though the magnitude of change was reduced. Our work provides a framework for integrating space-for-time substitutions and sparse time series data that can ultimately be used in other systems and circumstances.

New Vs. Old: Comparing eDNA metabarcoding with conventional electrofishing sampling to monitor fishes in headwaters of Western Tennessee

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Headwater streams are unique and vital components of fluvial ecosystems, with physical processes that supply water, sediment, and nutrients downstream; these processes and components of their fauna are unrepresented in their downstream counterparts. Further, headwaters serve as refugia or spawning habitat for fish species that depend on larger systems. However, headwaters are notoriously understudied, difficult to access, and widespread across the landscape. Until recently, conventional sampling procedures like electrofishing and seining were typically applied for surveillance of fish assemblages; but these methods can be costly to apply and may miss crucial, rare, or cryptic components of the headwater fish fauna, particularly in physically complex habitats. Technological advances have facilitated the development of new, molecular sampling approaches that may surmount these difficulties through low effort sampling, allowing for greater sampling extent, and more complete detection of rare or cryptic animals. Environmental DNA (eDNA) metabarcoding allows for rapid assemblage assessment; although its effectiveness is untested when compared conventional sampling approaches, and how such differences may be related to instream variables (e.g., flow, sediment). Here, we discuss our goal to evaluate differences in effectiveness between sampling techniques in Cub Creek, a headwater tributary to the Hatchie River in west Tennessee. Cub Creek was degraded by logging and

agriculture, resulting in channelization, incision, headcutting, and habitat complexity reduction. Results from our study can be used to inform sampling plans designed to evaluate status and trends in stream fish assemblages, a critical component of effective freshwater resource management and conservation in headwater systems.

Analyzing Gizzard Shad Dorosoma cepedianum Populations in Two Kentucky Reservoirs Affected by the Infiltration of Silver Carp Hypophthalmichthys molitrix

Justin Graben* Graduate student Timothy Spier PhD Associate Professor

Gizzard Shad Dorosoma cepedianum, a species commonly found in southeastern United States reservoirs such as Kentucky Lake and Lake Barkley, face a potential challenge due to the presence of the invasive Silver Carp Hypophthalmichthys molitrix. However, assessing the extent of this competition is complicated by the lack of baseline data on Gizzard Shad populations in these reservoirs. This study aims to conduct a detailed examination of parameters such as size distribution, condition, age structure, growth rates, mortality, and spawning potential for these populations. Data collection will involve boat electrofishing during the 2023 growing season in cove and main channel locations. Each Gizzard Shad specimen will be counted and measured. Additionally, sagittal otoliths will be utilized to determine the age of 100 Gizzard Shad per reservoir. Subsequently, the size structure, condition, age distribution, growth rates, mortality rates, and spawning potential of Gizzard Shad will be compared between the two reservoirs. The outcomes of this study are expected to serve as a reference point for continuous monitoring of Gizzard Shad populations in Kentucky Lake and Lake Barkley. Furthermore, it is anticipated that this research will ultimately provide insights into the consequences of invasive carp on Gizzard Shad, which may contribute to the conservation efforts for these reservoir ecosystems

Uncharted waters: high-resolution stream networks reveal habitats for petitioned headwater crayfish

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Burrowing crayfishes are among the most data- and knowledge-deficient crayfishes, partly because much of their life cycles occur underground. Burrowing could enable these species to inhabit temporarily wetted habitats such as roadside ditches and small streams. However, these habitats are rarely depicted

in maps or sampled within standardized monitoring programs. Thus, these systems could be sources of crayfish habitat that are often overlooked in conservation assessments. Our goal was to compare the relative occupancy of rivulet crayfishes (Hobbseus spp.) among roadside ditches, and mapped, and unmapped streams. Our emphasis was H. orconectoides, a species petitioned for listing under the Endangered Species Act and historically known from only twelve sites in eastern Mississippi. Within the five 12-digit Hydrologic Units where H. orconectoides potentially occurs, we used Geographic Information Systems and 1-m2 LiDAR elevation data to construct a high-resolution stream network depicting unmapped streams with watershed areas >300 m2. We identified mapped stream sites (1–2 orders) within the National Hydrography Dataset along with discretized 50-m roadside-ditch sites. From February–May 2023, we used two-person dip-netting within a removal occupancy design to randomly sample crayfish at 91 unmapped streams, 29 mapped streams, and 64 roadside ditches. We detected Hobbseus crayfishes at 64 sites, demonstrating members of this genus are far more prevalent than historically reported. Observed site counts of Hobbseus crayfishes ranged from 1–913 individuals, with peak counts in unmapped streams. Hobbseus crayfishes were more common in unmapped streams (40 sites, naïve occupancy = 44%) and mapped streams (14 sites, naïve occupancy = 48%) than roadside ditches (10 sites, naïve occupancy = 16%). Although Hobbseus crayfishes have restricted ranges, there is an additional 1409 km of unmapped streams than mapped streams (363 km) and 554 km of roadsides within the five HUC12s.

PING-Mapper: Efficient and Reproducible Substrate Mapping with Recreation-grade Sonar Systems

Cameron S. Bodine* (Northern Arizona University), Daniel Buscombe (Northern Arizona University)

Knowledge of the variation and distribution of substrates at large spatial extents in aquatic systems is severely lacking, impeding species conservation and habitat restoration efforts. The introduction of recreation-grade side scan sonar (SSS) instruments, or fishfinders, in the 2000's has provided researchers with an instrument that is easy-to-deploy and operate, enabling rapid surveys of these environments. However, existing methods for processing sonar mosaics and generating substrate maps requires a high degree of human-intervention and expertise, which limits the accessibility, efficiency, and reproducibility of these approaches. An open-source and automated tool for generating geospatial datasets from recreation-grade sonar instruments is needed to help increase our understanding of aquatic habitats at the site and landscape-level. We introduce PING-Mapper, an open-source and freely available Python-based software for generating geospatial benthic datasets from recreation-grade SSS systems. PING-Mapper is an end-to-end framework for surveying and mapping aquatic systems at large spatial extents reproducibly, with minimal intervention from the user. Version 1.0 of the software (Summer 2022) decodes sonar recordings from any Humminbird® side imaging system, export plots of sonar intensities and sensor-derived bedpicks and generates georeferenced mosaics of geometrically corrected sonar imagery. Version 2.0 of the software, released Fall 2023, extends PING-Mapper functionality by incorporating deep neural network models that automatically locate and mask sonar shadows, calculate independent bedpicks from both side scan channels, and classify substrates at the pixel level. An additional workflow enables normalization of sonar intensity values, or backscatter, effectively correcting attenuation effects and improving overall contrast of the sonar mosaics. This software provides the aquatic research community with an efficient means of surveying aquatic systems and generating

substrate maps which will inform fish sampling efforts, habitat suitability models, and planning and monitoring habitat restoration.

The Middle Collins River is not as barren as we thought: Assessment of a newly discovered population of the Barrens Topminnow (Fundulus julisia)

Kirsten Humphries* (Tennessee Tech University), Kit Wheeler (Tennessee Tech University)

The Barrens Topminnow (BTM; Fundulus julisia) is a federally endangered species in critical decline. In the fall of 2022, a new BTM population was discovered in the Middle Collins River that appears to be relatively isolated from Western Mosquitofish (Gambusia affinis), a species known to have a negative impact on BTM populations. Understanding the dynamics of any new naturally occurring population is a necessary step towards conservation and recovery for a species of concern. The primary objective of this project is to assess the status of the newly discovered BTM population by collecting data to estimate population abundance and growth rates, and to evaluate variation in population size structure across space and time. Additionally, we will collect habitat data to examine relationships between population parameters and habitat features. The secondary objective is to assess the susceptibility of the new population to Western Mosquitofish invasion. We will locate and characterize the nearest population of mosquitofish in relation to the new BTM population. We will also identify fish movement barriers, such as culverts, and evaluate their permeability to mosquitofish passage. By doing this, we aim to identify barriers that are most critical for providing protection of the new BTM population from Western Mosquitofish invasion. By understanding key population characteristics of and key threats facing imperiled species, we are better positioned to develop successful conservation efforts for species recovery.

Can eDNA be used to locate Shawnee Cavefish?

Megan Brandt* (Murray State University), Dr.Timothy Spier (Murray State University)

Traditional stream fish sampling methods, such as seining and electrofishing, are time consuming, expensive, and limited to short stretches of stream. However, the analysis of environmental DNA (eDNA) from water samples promises to be a quick, inexpensive method for detecting fish. The streams of the Land Between the Lakes Recreational Area (LBL, Murray KY) are unique, mostly undisturbed streams which contain many interesting fish species for which little information exists. One such rare and interesting species is the Shawnee Cavefish Forbesichthys papilliferus, which is known to exist in a few LBL streams. However, the complete distribution of the Shawnee Cavefish in LBL is not known, and very little information is available to assist with the management and conservation of this rare species. We used backpack electrofishing to locate cavefish within various stream sites and tagged them with visible implant elastomer (VIE) tags. A mark/recapture estimate using the VIE tagged fish will be compared to eDNA samples from each stream to determine if eDNA accurately quantifies the size of the cavefish populations, and unsampled streams will also be tested for cavefish eDNA to determine if those streams also contain this fish. The relative Shawnee cavefish population size within LBL streams will be determined which in turn will benefit the rare Shawnee cavefish and provide valuable information for further studies and management actions.

Land Use Impacts on Fish Communities in the Arkansas Valley Ecoregion: A Preliminary Analysis

Jarrett Tallent* (University of Central Arkansas), Ryne Lehman (University of Central Arkansas), Ginny Adams (University of Central Arkansas), Reid Adams (University of Central Arkansas)

Stream fish communities are shaped by anthropogenic land use and natural land cover within their upstream catchments. Upstream catchments with high proportions of anthropogenic disturbance tend to have communities composed of more tolerant species, while upstream catchments dominated by natural land cover may be able to support more sensitive species. We have gathered land use and land cover data for 25 sites in the Arkansas Valley Ecoregion to assess how stream fish communities of the ecoregion may be influenced by the surrounding landscape. We used ArcGIS Pro and the National Land Cover Database layer (2019) to analyze the percentage of anthropogenic land use and natural land cover present in the upstream catchment of each site. Our upstream catchments had a range of anthropogenic land use from 4.88% to 83.95% and a range of natural land cover from 15.84% to 94.94%. Fish communities at each site were sampled using a combination of backpack electrofishing and seining. Preliminary data from these sites will be analyzed for correlations between fish community composition and land use.

Conditional Occupancy and Habitat Selection of the Rocky Shiner, Notropis suttkusi, in Arkansas

Savannah Wise* (Arkansas Tech University), John Jackson (Arkansas Tech University)

The Rocky Shiner, Notropis suttkusi, is a species endemic to the Little River and its tributaries within southwestern Arkansas and southeastern Oklahoma. This species is petitioned to be listed under the Endangered Species Act (ESA), but recent publications have shown differing levels of abundance by region. In order to clarify distribution of N. suttkusi in Arkansas, we randomly sampled fifteen sites in three tributaries to the Little River (Rolling Fork, Cossatot, and Saline) in the summer of 2023 using a conditional occupancy approach. This method entails resampling of occupied sites and is used when studying rare species. Physical habitat and water quality data were collected at each site, and microhabitat was recorded for each seine haul. All fish caught were identified, and body measurements of N. suttkusi were recorded. Analyses for habitat preference and length frequency distribution models were performed, along with single-season, single-species occupancy modeling to estimate Ψ: informed occupancy rate and p: probability of detection. Five out of the fifteen sites sampled were found to be occupied by our target species. Three of these sites were on the Cossatot River, with one each on the Rolling Fork and Saline Rivers. A total of 57 N. suttkusi were observed across 25 sampling events. After resampling, the site with the highest abundance of N. suttkusi (n=16, 14) was located on the Cossatot River approximately 30 km upstream of its confluence with the Little River. The results of this study will provide additional information concerning the future ESA listing of the species in the Little River Watershed.

Temporal and spatial patterns of larval fish assemblages across a river-reservoir continuum

Madison Niles* (Clemson University), Luke Bower (USGS South Carolina Cooperative Fish & Wildlife Research Unit, Clemson University)

In the southeastern United States, a majority of rivers are impounded by at least one dam along their reach, negatively impacting fish biodiversity and assemblage patterns. When evaluating the effect of impoundments on fishes, most studies focus only on the adult life stage, this has led to major gaps in our knowledge on how dams impact the most vulnerable life stage of fishes, their larval stage. Reservoirs created by dams expose the larvae of rheophilic species to a lentic environment with potentially unsuitable conditions that could be detrimental to larvae survival. In this study, we investigate changes in assemblage structure and temporal patterns of larval fish at the family level across a river-reservoir continuum and determine the environmental variables that influence assemblage structure. We will sample larval fish bi-weekly in the highly regulated Broad River, South Carolina using ichthyoplankton nets and light traps. Our aim is to identify the drivers of the observed larval fish patterns in order to determine which environmental variables are the most influential and have the largest management implications. We expect to see a decline in the diversity of larval fish as well as disruption in assemblage structure within the reservoir in response to unfavorable environmental conditions, such as changes in the flow regime and temperature. The findings from this study could give valuable insights to when fishes are most vulnerable to environmental disturbances, such as dam releases, and could be used in the future implementation of management strategies as well as aid in the conservation of specific populations and species of concern.

The development of triploidy induction methods for hybrid Striped bass production

Samuel Garcia-Vazquez* (University of Arkansas at Pine Bluff), David Straus (United States Department of Agriculture), Dayan A. Perera (University of Arkansas at Pine Bluff)

Sunshine bass are hybrids produced by crossing White bass females and Striped bass males. These bass hybrids are highly desirable sport fish and have been stocked in southern states of United States. Bass hybrids have a wider tolerance to environmental variables, better survival, better growth rate, and disease resistance than their counterparts. Triploidization is an effective method for production of sterile fishes. Triploidy increases the possibility to obtain trophy sport fish. Because striped bass hybrids are fertile and can backcross with striped, it is understood that backcrossing could affect the gene pools of parental species because of introgression. We can avoid this backcrossing if the hybrid is sterile. This project aims to evaluate three triploidy induction methods that have been used successfully with other commercial aquaculture species. Our goal is determining an optimum methodology for triploid production with special attention being placed on maximizing embryo survival and obtaining high triploidy induction in sunshine bass. The three methodologies include thermal shock, hydrostatic pressure shock, and electrical shock. In year one of this study hydrostatic pressure shocks were evaluated for the production of triploid sunshine bass embryos. Three pressures (6000, 7000, and 8000 PSI) and shock durations of 1.5, 2, 3, 4, and 5 minutes were evaluated. All shocks were administered 4 minutes post-fertilization. The produced fry were evaluated for triploidy using a flow cytometer. The initial results yielded very low survival and triploidy percentages. We believe the pressure may have been too intense and the duration too short. We will adjust the pressure shocks by lowering the pressure to 5000 PSI and lengthening the shock duration beyond five minutes. In year two, we will start the evaluation of thermal shocks and electrical shocks.

Assessment of barriers to connectivity in Alabama's Uphapee Creek watershed

Susan Fuller (Troy University), Josiah Gullatte (Auburn University), Colin Nunn (Troy University), Daniel West (Geological Survey of Alabama), James Stoeckel (Auburn University), and Kaelyn Fogelman (Troy University)

Alabama has 132,000 miles of rivers and streams and 210,000 miles of roadways. Culverts, bridges, and fords are created of waterways and roads to allow for passage of both people and aquatic organisms. Alabama is a hotspot for aquatic organism biodiversity and these organisms are threatened by stressors such as climate change, pollution, sedimentation, and habitat modification. Crossing structure conditions are extremely important to aquatic organism's success as perched culverts can limit or eliminate organism's immigration, emigration, reproduction, and spatial distribution. The Alabama Rivers and Streams including Connectivity (ARSNiC) program was established to assess and prioritize issues occurring at the stream crossings. Uphapee Creek, located in central East Alabama, is a critical habitat to many mussel species; Finelined Pocketbook, Southern Clubshell, and Ovate Clubshell. Our objective in Uphapee Creek watershed is to conduct the Sediment Risk Index survey at each road crossing structure. The survey assesses stream crossings and determines possible threats to the species that occur or need passage at these crossings. Critical survey data includes perched culvert outfall drop heights and overall sediment risk. Within Uphapee, where surveys were completed, 21% of crossings had perched culverts (outfall drop >0 ft). Perched culverts had an average drop of 1.6 ft (max 6 ft). The SRI scores of crossings surveyed were 97.4% low, 1.9% moderate, and 0.7% high risk. With completion of these surveys – data collected can be used to prioritize barrier remediation and restoration, management, public knowledge and involvement, and conservation of imperiled species within these critical habitats

Genetic Analysis of Cambarus aff. dubius in Kentucky using RADseq Methodologies

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Cambarus dubius (Upland Burrowing Crayfish) occurs throughout the central and southern Appalachians and represents a well-known species complex. Several distinct colorful phenotypes exist within the complex with monochromatic and polychromatic forms. Astacologists have investigated the possible taxonomic utility of color within this complex and have had difficulty delimiting species morphologically. While color forms do appear to have geographic boundaries, most taxa within this group morphologically are homoplastic, making determining diagnostic characters to differentiate species difficult. We sampled C. aff. dubius from across its range and used RADseq methods to differentiate populations and determine what constitutes a significant barrier to gene flow within this complex. Our efforts focused on populations in West Virginia and Kentucky, with specific emphasis on Kentucky populations where two phenotypes meet geographically.

Geomorphic and Ecological Responses of a Small Dam Removal

Emily Chalfin* (University of Georgia), Seth Wenger (University of Georgia, Odum School of Ecology), Rhett Jackson (University of Georgia, Warnell School of Forestry and Natural Resources)

Many small dams have outlived their design lifespan and are both potential hazards and barriers to passage for aquatic organisms. However, removal of small dams may have negative short-term impacts due to the release of stored sediments, which can degrade downstream habitat. This study will evaluate the effects of removing a small dam and impoundment on the geomorphology and biota of a small mountain tributary to the Upper Etowah River in Georgia, USA. We will sample biota in the tributary containing the dam and the mainstem of the Etowah River prior to the removal of the dam in order to determine the presence of any imperiled species. We will also measure geomorphologic characteristics in the impoundment, the tributary, and the Etowah River. After the dam is removed in the summer of 2024, we will repeat biotic and geomorphic sampling to assess differences in community composition and abundance of organisms before and after dam removal, as well as geomorphic changes. This study will be a comprehensive review of hydrology, geomorphology, sedimentation, and biota pre- and post-dam removal, including some biota that are understudied such as crayfish. The results will be useful for informing decisions and methods for future small dam removals in the Etowah River and nearby watersheds.

Impact of land management on Distocambarus crockeri (Piedmont prairie burrowing crayfish) burrow density in Sumter National Forest

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Distocambarus species are narrowly endemic burrowing crayfish with a high affinity for southeastern prairie habitats. Anthropogenic pressures throughout South Carolina, where most of these taxa occur, have destroyed the unique piedmont prairie ecological communities. Specifically, pine plantations appear to eliminate key ecological parameters needed for Distocambarus species to thrive. While silviculture methods threaten the habitat utilized by Distocambarus species, other agricultural processes do not appear to be as deleterious for the Distocambarus taxa. Feedlots and agricultural practices that create habitats analogous to Piedmont prairies could allow and possibly create ecological situations where Distocambarus taxa could occur. To test this hypothesis, we plan on determining the density of Distocambarus crockeri in various managed fields in the Long Cane Ranger District of Sumter National Forest. Burrow densities will be determined along an ecotonal edge between forests and fields, as well as within both forests and fields to determine where D. crockeri densities are highest. Our results will aid land managers in designing conservation plans for these unique endemic species.

First dedicated survey of the Upper Guyandotte River for Cambarus veteranus (Guyandotte River Crayfish)

Montana Fonner* (West Liberty University), Zachary Loughman (West Liberty University)

Cambarus veteranus (Guyandotte River Crayfish) was federally listed as endangered in April of 2016. The major contributing factor for listing was the noted decline of C. veteranus across its range. At the time of listing, C. veteranus had historical occurrences in several Upper Guyandotte watershed tributaries and zero records from the Guyandotte River mainstem. In 2021 a single C. veteranus was collected from the Upper Guyandotte River Immediately downstream of the Pinnacle Creek/ Guyandotte River confluence. Pinnacle Creek is one of two stream systems in the Upper Guyandotte that harbors C. veteranus populations. Given this record, a dedicated survey of the Upper Guyandotte River is warranted. Possible methods for this survey are discussed, as well as crayfish survey methods for rivers where cambarid crayfish collection can be difficult and inefficient. The ultimate goal of this project is to determine the extent of C. veteranus in the Upper Guyandotte River mainstem and determine if C. veteranus utilizes different habitat in larger waters compared to tributaries where the species is known to occur.

Scale-dependent tradeoffs between habitat and time in explaining Alligator Gar (Atractosteus spatula) movement

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Ecological theory predicts that movement by riverine fishes at the population level is characterized by both stationary and mobile individuals together creating a leptokurtic distribution of movement distances. However, studies testing this theory typically ignore spatial heterogeneity in riverscapes and the theory has not been tested using Alligator Gar (Atractosteus spatula), a species of growing interest among anglers and fisheries managers alike. We characterized movements and habitat associations of Alligator Gar in the Brazos River, Texas, at fine (every two hours for 24 hours) and coarse (every month for 16 months) spatiotemporal scales. We tested for the presence of leptokurtosis and relationships between movement distance, habitat dissimilarity, and time-at-large using multivariate and univariate statistical approaches. Dispersal by Alligator Gar revealed leptokurtosis at the coarse scale but not the fine scale. At the fine scale, mixed effects quantile regression revealed there was no relationship between habitat dissimilarity and dispersal distance, but dispersal was positively correlated with time. At the coarse scale, dispersal was positively correlated with increased habitat dissimilarity and time, but only for the most mobile individuals. Our work suggests that short-term movements by riverine Alligator Gar during warm seasons and at base flows increased with time but were unrelated to habitat, while long-term movements over an annual cycle during warm season flow pulses revealed highly mobile members of the population accessed distant and novel floodplain environments.

Hydrodynamics and Fish Assemblage Fluxes in a Forested Riverscape

Blake Elzi* (Texas A&M University), Hannah Evans (Texas A&M University), Lucas Stevens (Texas A&M University), Joshuah Perkin (Texas A&M University)

Abiotic factors such as hydrologic variability in rivers, streams, and floodplains affect fish abundance and distribution. Fish assemblage variability is strongly tied to hydrologic fluctuations in channel- floodplain ecosystems where hydrologic connectivity (i.e., water-mediated connections during floods) between a channel and a floodplain allows for fish immigration and emigration. Understanding how flow variability affects hydrologic connectivity and thus fish movement is therefore important for understanding how channel-floodplain ecosystems might be managed and preserved. We tracked water mediated connectivity between creek channels and floodplains and associated changes in fish assemblage composition in Lick Creek Park near College Station, TX. We surveyed fish assemblages and measured environmental variables across two paired channel-floodplain sets of sites during fall of 2023. Floodplain habitats were relatively shallow compared to creek channel sites and largely devoid of fishes following extreme drought during summer 2023. Wetland fish assemblages were dominated by phytophilic species (spawning over vegetation) while creek fish assemblages represented a mixture of spawning strategies, including vegetation spawners, nest spawners, substrate spawners, and broadcast spawners. These results provide baseline data for tracking fish assemblage development in wetlands following the return of high water and highlight the importance of hydrologic connectivity between channel and floodplain habitats.

A Statistical Model to Assess Juvenile Atlantic Sturgeon Age Based on Length and Julian Day

Alan Bond* (University of Georgia), Adam Fox (University of Georgia), Martin Hamel (University of Georgia)

Atlantic Sturgeon, once plentiful in most large rivers along the eastern coast of the United States and Canada, suffered major declines by more than a century of overfishing and habitat degradation and fragmentation. This decline in Atlantic Sturgeon numbers led to this species being listed as endangered in 1998. To assess recovery, long-term trends in annual recruitment have become a valuable method to gauge the recovery status of an individual population; this is accomplished using mark recapture of age1 fish. To ensure marked fish are of the correct age group for yearly recruitment analysis, several methods have been employed, including assigning age via length frequency histograms or from reading calcified structures. Both of these methods present problems inherent in their application. To surmount some of the issues caused by other aging techniques, this study uses a finite mixture modeling approach to delimit Atlantic Sturgeon based on length and Julian day. We applied this model to a 20-year data set that has been continuously collected since 2003. Our model was able to delimit three age classes of sturgeon: age 0, 1, and >1 based on their length and Julian day. Due to variable growth of Atlantic Sturgeon across their range, individual finite mixture models may need to be developed within particular river systems to enhance the accuracy of age classification. The basis for this study is broadly applicable not only to other populations of Atlantic Sturgeon, but other species that show linear growth in their early life stages. This type of modeling will allow researchers and managers to make more informed estimates of the age of a fish given the fish's length and the date it was captured.

Does Rio Grande Cichlid (Herichthys cyanoguttatus) induce trophic niche shifts in native centrarchids?

Jacob Wolff* (Texas A&M University), Joshuah Perkin (Texas A&M University), Chris Johnson (Living Waters Fly Fishing)

Non-native species invasions affect aquatic ecosystems globally. This can be caused by, but not limited to, anthropogenic alterations to aquatic habitats that open niche space for invaders and human introductions of species outside their native range. In the case of fishes, species that are successful in these scenarios exhibit characteristics such as plasticity in feeding strategies, a strong tolerance of poor water quality conditions, or an aggressive nature that allow them to outcompete native fishes. The Rio Grande Cichlid (Herricthys cyanoguttatus) exhibits all of these characteristics. Native to the Rio Grande Basin of Texas and south into Mexico, the Rio Grande Cichlid has spread rapidly throughout the southern United States. The Rio Grande Cichlid has potential to induce trophic niche shifts, extirpate or displace native fishes, and alter natural food webs and trophic hierarchies. Alternatively, anecdotal evidence suggests Rio Grande Cichlid may exhibit trophic plasticity and adjust their own feeding ecology in the presence of Centrarchidae fish competitors. The goal of this study was to determine trophic overlap and niche shift in Rio Grande Cichlid and an imperiled species, the Guadalupe Bass (Micropterus treculii). To answer this question, Rio Grande Cichlid and Guadalupe Bass were collected in Brushy Creek, Texas, a stream where both species are common. Fin clips were collected and preserved from both species, as well as basal carbon resources, in order to conduct stable isotope analyses. Trophic overlap and niche shift of the two species in the presence of one another were then assessed. We hope to use the results of this study to inform management strategies of Rio Grande Cichlid outside their native range where they could be negatively affecting endemic fish communities.

Identifying Drivers of Arapaima Population Dynamics in a Floodplain Ecosystem

Emma A. Hultin* (Virginia Tech), George Brooks (Virginia Tech), Holly K. Kindsvater (Virginia Tech), Leandro Castello (Virginia Tech)

Freshwater fisheries are an invaluable natural resource, supporting millions of people worldwide as a source of food, financial stability, and cultural value. However, freshwater ecosystems are increasingly threatened by habitat loss and degradation, the effect of invasive species, and overharvest. These problems are particularly severe in tropical regions which are predicted to experience dramatic changes in precipitation and seasonal flows due to climate change. In order to set fisheries management rules that will result in sustainable future harvests, we need to first understand the life history and environmental controls regulating fish populations; therefore, we need to understand the fundamental ecological drivers of population productivity. Typical Western fisheries models assume top-down population control in a relatively uniform habitat like the ocean, but a floodplain ecosystem is temporally dynamic, and fish experience a wide range of habitat conditions each year. Stock dynamics in this system may instead be driven more by the environment than fishing pressure, in which case fish populations will not respond as predicted by traditional biomass production models. We use Arapaima spp. as a case study to explore the role of bottom-up drivers of population dynamics in a floodplain ecosystem. Using a Bayesian approach, we will build an N-mixture model of Arapaima population dynamics given lake characteristics and annual flood pulse dynamics. We hope to explain the variation in productivity of Arapaima populations at the lake level in this temporally and spatially dynamic floodplain ecosystem.

Silver Carp Hypophthalmichthys molitrix movements in the Lower Cumberland River and Lower Tennessee River

Miranda Belanger* (Murray State University), Tim Spier (Murray State University)

The introduction of exotic fishes in freshwater environments has caused significant ecological and economic changes. Silver Carp Hypophthalmichthys molitrix are an invasive species in the United States but are native to large rivers in eastern Asia. This species is expanding its range throughout the Mississippi River basin, beginning with the Cumberland River and Tennessee River drainages. Although Silver Carp movement patterns have been studied in other portions of the Cumberland River and Tennessee River, the lowermost portion of both rivers below Lake Barkley Dam and Kentucky Lake Dam is a unique environment in which the movement of Silver Carp has not yet been closely studied. Understanding the movement patterns of Silver Carp along with native planktivores in the lower part of these rivers is important for understanding the factors that influence fish dam crossing and migrations. I used acoustic tags to track multiple fish species in the lower Cumberland River and lower Tennessee River. Contrary to my expectations, Silver Carp were found more often near the mouth of each river instead of near the dam. The movement of fish was influenced mostly by discharge and water temperature, but fish response to these parameters was complex. These results can be used to assist barrier operation and management to prevent Silver Carp from passing into Lake Barkley and Kentucky Lake.

Assessment of Barriers to Connectivity in Alabama's Uchee Creek Watershed

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In addition to an immense amount of freshwater biodiversity, Alabama contains 132,000 river and stream miles and 210,000 miles of roadways. The interface of these roads and waterways create a need for culverts and bridge crossings and create fords. These intersections of aquatic and human life are critical points in stream connectivity as well as ecological factors such as climate change, pollution, and sedimentation; and also impact population factors such as immigration, emigration, spatial distributions and reproduction. The Alabama Rivers and Streams including Connectivity (ARSNiC) program has been established to assess and report on barriers to connectivity, aquatic organism passage, and sediment risk at these "critical points." The establishment of Strategic Habitat Units (SHUs) within the state allowed for the focused efforts and funding on the watersheds in the state with stable morphology, normal and healthy stream flow, water quality acceptable for normal growth, stability, and viability to the animals in the stream. Uchee Creek has been designated a SHU and is one of many systems within the in the Apalachicola River drainage. Uchee Creek is home to many aquatic species including mussels, snails, fish, and turtles. The objective of this project was to conduct risk surveys of this watershed's crossing structures, including Sediment Risk Index (SRI) and the Southeastern Aquatic Resource Partnership (SARP) aquatic organism passage assessments to provide a baseline for restoration efforts of the habitat where these critical species live. From May '22 – August '23 SRI and SARP surveys have been conducted on 57% and 52% of Uchee Creek's 586 crossing structures, respectively. Efforts are in progress to complete SRI and SARP surveys all of Uchee's stream crossings structures, evaluate biotic composition at

locations that have been deemed “high” and “low” risk for connectivity and sedimentation, and provide recommendations for areas in need of restoration and prioritization.

Effects of prolonged holding in recirculating aquaculture systems on spawning efficiency of wild White Crappie (Pomoxis annularis)

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Crappie spawn in early spring in response to increasing photoperiod and water temperature, meaning hatchery operators have limited time to capture and spawn broodstock. The ability to hold crappie for an extended time at pre-spawn conditions would allow for additional flexibility over scheduling spawning activities. However, the effects on spawning efficiency and egg quality of extended holding are not known. Therefore, pre-spawn White Crappie (Pomoxis annularis) were collected and held for 6-, 8-, or 10-weeks in 3,500-L recirculating aquaculture systems at extended spring conditions (15°C). After holding, fish were moved to smaller individual spawning tanks. They were subjected to a similar regime of warming water (1°C/day) until 22°C, where they were maintained for 7 days. Spawning was induced by intramuscular injections of gonadotropin-releasing hormone analog (GnRHa; 10% priming dose and 90% resolving dose, 24h later), with fish strip-spawned upon ovulation. In the 6-week treatment group, 49% percent of females ovulated with an average fertilization rate of 54%. In the 8-week treatment group, 47% of females ovulated with an average fertilization rate of 12%. In the 10-week treatment group, 75% of females ovulated with an average fertilization rate of 32%. We also calculated the pre- and post-spawn gonadosomatic index along with egg counts to determine egg quality, reproductive output, and fertilization effectiveness. Effects of the different holding times will be discussed in the context of crappie aquaculture.

U.S. INLAND CREEL PROGRAMS: A REGIONAL COMPARISON AND BEST PRACTICES

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In United States (U.S.) inland waters, recreational fishers (anglers), rather than commercial fishers, account for the primary source of fishing pressure. As such, the recreational sector can be a substantial driver of fishing mortality, requiring well-informed management for the sustained viability of inland recreational fisheries. Creel surveys are common data collection techniques administered by resource managers which ultimately inform fishery management decisions with necessary ecological and human dimensions data. The U.S. Creel and Angler Survey Catalog (‘CreelCat’) is a publicly accessible database of inland creel surveys compiled from states across the U.S. in support of broad scale research and management. Here, we review creel data from 35 states and territories and 1) provide a regional comparison of U.S. inland creel programs, 2) discuss important limitations and biases of the dataset, and 3) identify best practices for future creel data collection to increase broad-scale comparability, validity,

and utility of data. This review marks an initial step towards characterizing available inland fishery data, making it possible to identify national or regional data needs. Ultimately, more cohesive, accessible data enables the capacity to monitor trends within U.S. inland recreational fisheries on larger scales and extrapolate to broader ecological and social shifts.

Effects of Extreme Flow Events on Community Composition and Habitat Complexity in Groundwater Dominated Systems

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Extreme flow events in the form of major floods and droughts are primary drivers in structuring aquatic habitats and communities. While floods and droughts can directly alter aquatic biota by displacement or by increased mortalities, these extreme flow events can have an indirect and prolonged effect on biota by altering habitat complexity, which in turn delays the recovery of the aquatic biota. Interrelationships among stream flow extremes, habitat complexity, and stream fish communities are established in streams and rivers with waters dominated by run-off. Less known are the interrelationships among stream flow extremes, habitat complexity, and fish communities in hydrologically stable aquatic systems, such as spring systems with surface flows provided primarily by groundwater discharges. The San Marcos and Comal rivers are the two largest groundwater dominated systems located on the Edwards Plateau within Central Texas. These groundwater dominated systems function as evolutionary and hydrologic refugia for many endemic species. The purpose of this study is to assess how extreme flow events effect habitat complexity and the fish community within the San Marcos and Comal rivers using an 8-year dataset. Habitats were quantified as deep or shallow based on sampling effort (SCUBA or seine) and the habitat complexity was quantified using a Canonical Correspondence Analysis (CCA). Fishes were placed into water-column usage guilds and their resistance and recovery were assessed using univariate and multivariate analyses. Changes in habitat composition were also quantified. Results indicated that deep water habitats had higher levels of habitat complexity and a fish community less affected by flow extremes than shallow water habitats. Complex habitats were defined as having greater vegetation cover, heterogeneity within the substrate, and slower current velocities. Overall, all fish guilds were relatively unaffected by extreme flow events with few exceptions.

Responses of Fishes to Multiple Barrier Removals on War Eagle Creek

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Channel fragmentation from dams and other stream barriers has impacted more than 90% of the total discharge from U.S. rivers. Dams impact fish passage by isolating tributaries upstream, altering seasonal flow patterns, and causing modification of in-stream habitats due to loss of longitudinal connectivity. In addition to dams, road crossings can also limit fish passage due to outlet drops, low or no water in crossings, high water velocity, and passage blockages from sediment buildup. Changes in hydrology and reduced stream connectivity may influence the varied and complex life cycles of fishes that require different, sometimes widely separated, habitats throughout their life. Fish responses to removal of barriers are not well documented, and current restoration efforts spearheaded by Arkansas Game and

Fish Commission offer a unique opportunity to assess the response of fish communities in War Eagle Creek to removal of a dam and two low-water road crossings. A Before-After-Control-Impact design (BACI) is being used with seven replicate sites established on War Eagle Creek spanning the river segment where the target barriers are located, and five sites in nearby Kings River serving as controls. Sites will be sampled at least once prior to the barrier removal and twice a year, in late spring/early summer and late summer/early fall during low water after removals. At each site, all available habitat in the reach will be opportunistically sampled for fishes and sampling effort will be stratified across pools, riffles, and runs using seines. We will test for differences among sites over time using typical multivariate ordination approaches (e.g., NMDS) and associated tests of dissimilarity and dispersion. Habitat data will also be assessed temporally, and any associations with fish assemblage structure will be determine using vector overlays. We will present fish data collected prior to barrier removals in War Eagle Creek.

Examining spatial heterogeneity in the summer flounder sex ratio using fishery-independent data

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Summer flounder have exhibited temperature-induced sex-reversal in experimental aquaculture settings, but nothing is known about how temperature may impact the sex ratio of the wild population. Additionally, male and female summer flounder (Paralichthys dentatus) exhibit different water temperature and depth preferences at local scales, resulting in spatial sex-segregation. The summer flounder stock assessment has also noted changes in the sex ratio of the overall population over time, and other studies have identified latitudinal differences in the sex ratio of fishery landings. We used regression analyses to identify whether patterns of spatial sex-segregation could be found in fishery-independent data across the entire range of summer flounder, using data collected by the NEFSC trawl surveys. In accordance with previous studies, we found relationships between sex ratio and temperature and depth. We also identified latitudinal differences in the sex ratio of the adult population.

Determining Minimum Habitat Availability for Muskellunge in North Carolina

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The Muskellunge (Esox masquinongy) is a species native to the western portion of North Carolina, including the French Broad and Little Tennessee rivers. As southern Muskellunge fisheries become more popular, anglers and management agencies are working to maximize habitat and establish self-sustaining populations throughout their native range. The purpose of this project is to identify and compare habitat in areas where Muskellunge population augmentation is occurring to an area with no current restocking effort to better understand minimum habitat requirements for the species. Two sections of the French Broad and Little Tennessee River in Western North Carolina were analyzed for factors that could determine Muskellunge occupancy. Data collected includes gradient, depth, substrate, and presence of large woody debris. Sites were chosen using fish data previously collected by the North Carolina Wildlife Resources Commission. This work is ongoing, and we hope to identify any limiting factors that make the river uninhabitable for Muskellunge to focus future restoration efforts on those limiting factors.

Investigating Batrachochytrium dendrobatidis presence in Mississippi crayfish and exploring bounds of critical temperature possibly affected by Batrachochytrium dendrobatidis load

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The fungal pathogen Batrachochytrium dendrobatidis(Bd) has been associated with significant population declines in amphibians. Previous studies have reported Bd infection in nonamphibian hosts, such as crayfish, which could serve as a reservoir of the pathogen, and even negatively impact crayfish physiology and conservation. However, only a few species of crayfish have been surveyed for Bd so far. Thus, we aimed to test for chytrid presence and load in two previously unsampled crayfish species in Northern Mississippi: Faxonius etnieri sp. complex and Lacunicambarus erythrodactylus. Additionally, we measured critical thermal maximum temperature(CTmax) to test for impacts of Bd infection on crayfish thermal physiology. We collected 15 F. sp. complex and 9 L. erythrodactylus from the University of Mississippi Field Station in Lafayette County, Mississippi in fall 2023. We tested CTmax in a water bath at a ramping rate of 1ºC/minute. After euthanasia, we tested for Bd by swabbing the gastrointestinal tract of each crayfish. DNA was extracted from the swabs and used in quantitative PCR to quantify any Bd load. None of the crayfish were infected with Bd. However, we did find that L. erythrodactylus had a CTmax that was marginally significantly higher than F. sp. complex, which may reflect the different ecologies of these species (primary burrowing versus stream-dwelling) and/or their evolutionary history. In the future, we hope to increase the number of individuals and species sampled for Bd, as well as perform histology to confirm infection. Given the diversity and conservation status of crayfishes in the southeastern USA, surveying for this amphibian disease in crayfish is a first step in understanding potential physiological and ecological impacts on these crustaceans.

Non-invasive Survey of Walleye in the Tennessee-Tombigbee Waterway

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The Walleye (Sander vitreus) is a widespread freshwater sportfish species with commercial importance. There are three genetic stocks of Walleye in Mississippi: 1) the northern stock which has been introduced to the state from the upper Mississippi River, 2) the southern stock of the lower Mississippi River, and 3) the Gulf Strain Walleye. Essential habitat for Gulf Strain Walleye has been lost due to anthropogenic activities. Construction of the Tennessee-Tombigbee Waterway has been identified as a source of habitat modification and changes in gene flow in aquatic species. Because of its limited distribution and recent population decline, Gulf Strain Walleye is considered a species of conservation concern. Environmental DNA (eDNA) will be collected from water to survey Walleye presence in the Tennessee-Tombigbee Waterway and determine which genetic stocks are present. Polymerase chain reaction (PCR) will be used as a detection tool by amplifying Walleye DNA in eDNA. Assignment of Walleye to genetic stocks will be achieved by sequencing PCR products and comparing nucleotides to a database. Information about which genetic stocks are present will be disseminated to hatcheries which can use these data in Walleye breeding programs.

Assessment of stream fish assemblage responses to hydrologic variability and disturbances in the Ichawaynochaway Creek Watershed, GA

Jake R. Duhé* (School of Renewable Natural Resources, Louisiana State University), Garrett W. Hopper (School of Renewable Natural Resources, Louisiana State University and Agricultural Center), Carla L. Atkinson (Department of Biological Sciences, University of Alabama)

Stream fish assemblages are highly dynamic units influenced by environmental disturbances associated with hydrologic variability. Although stream fishes exhibit adaptations allowing for resilience to disturbances like drought and flooding events, prolonged disturbances or disturbances of increased severity can alter assemblage structure. Anticipated increases in the frequency, magnitude, and duration of disturbance events due to anthropogenic activities warrant rigorous tests of how stream fish assemblages are influenced. We assessed spatial and temporal variation in assemblage responses to hydrologic variability using a fish assemblage dataset collected in the Ichawaynochaway Creek Watershed, Georgia during 2011-2017, a disturbance-prone region that is expected to experience increased hydrologic extremes in the future. Two severe droughts impacted the region from 2010-2012 and 2016, causing three of our ten study sites to completely dry during 2011. Species richness varied significantly among sites and across time. Sites in smaller headwater streams dried during drought and tended to have lower species richness than sites located in larger streams. Future work will investigate assemblage responses in the context of life history theory. We expect opportunistic species to increase in abundance, while periodic and equilibrium species decrease in abundance following low-flow disturbances. Our research informs future stream fish management strategies aimed at preserving diversity through the lens of species life history strategies.

Trophic dynamics of an expanding population of invasive blue catfish in Albemarle Sound, North Carolina

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The blue catfish (Ictalurus punctatus) is a large, generalist omnivore native to the Mississippi River basin. They were first introduced to the Atlantic drainages of North Carolina in 1966 in an effort to increase angler opportunities, and their range has since expanded to most river basins in the state. They have experienced explosive population growth in other areas where they have been introduced and can have considerable impacts on local fauna and community structure. A relatively high salinity tolerance has enabled blue catfish to expand into brackish water ecosystems, such as the Albemarle sound, which has experienced rapid increases in blue catfish abundance in the past 10-15 years. The potential for predatory impacts by blue catfish on commercially valuable species, such as blue crab, American shad, river herring, and striped bass are unknown. The primary focus of this project is to characterize the diet of blue catfish in the Albemarle Sound ecosystem, including variation in food habitats among seasons, spatial locations (primarily a hypothesized east to west gradient), and predator body size. Field collections of blue catfish will occur through low frequency electrofishing in the Roanoke/Chowan rivers and western Albemarle Sound, and both active and passive gill netting in the central and eastern Albemarle Sound. Sampling was initiated in summer 2023 and will continue approximately bi-monthly for two years. Diets will be informed through both traditional stomach content analysis, with enhanced

prey taxonomic resolution from DNA barcoding, and also the analysis of bulk stable isotopes (δN, δC, and δS) in muscle and liver tissue samples. Daily ration of blue catfish will be estimated in different seasons during diel surveys of gut fullness to assess predatory demand at the individual level. The work will provide the first comprehensive study of the trophic ecology of blue catfish in this ecosystem and is the first step toward understanding potential predatory impact

Use of secondary pectoral fin rays to age Atlantic sturgeon: examining section thickness to improve the clarity of annuli distinction

Marc Chelala* (UNCW), Joseph Mathews (UNCW), Frederick Scharf (UNCW)

Non-lethal methods for estimating age and growth are critical for evaluating the population dynamics of threatened and endangered species. The Atlantic sturgeon Acipenser oxyrinchus oxyrinchus is distributed along the east coast of North America and is listed as endangered throughout much of its range. Aging sturgeon using the secondary pectoral fin ray is a relatively new approach and can present challenges to distinguish annuli, especially in young fish. Here, we report on the evaluation of fin ray section thickness to improve clarity in annuli distinction for a range of body sizes of Atlantic sturgeon captured in the Cape Fear River, NC. Secondary pectoral fin ray samples (n = 25) were obtained from fish captured in large-mesh gill net sampling during 2023. Each fin ray section was cleaned, embedded in epoxy, and then sectioned in multiple locations to produce a range of section thicknesses, including 0.30, 0.38, 0.50, and 0.60 mm, which were mounted on glass microscope slides for inspection. Sections will be read independently by at least two readers to estimate age based on annuli counts. Both quantitative estimates of aging precision and qualitative evaluation of annuli distinctiveness will be used to recommend best practices (section thickness) for specific body sizes/ages. The use of the secondary pectoral fin ray for aging Atlantic sturgeon has only recently begun and its performance as a reliable aging structure remains uncertain. However, the non-invasive method of removal was shown to be less injurious for sturgeon, therefore, improving the use of this aging structure could prove beneficial for conservation and management of threatened and endangered species. Our findings related to annuli clarity as a function of section thickness should contribute to a broader coastwide effort to standardize aging methods that provide key information to support conservation of Atlantic sturgeon.

Optimizing environmental DNA assays for Atlantic Sturgeon: a pilot study in the Ocmulgee River, Georgia

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The Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) is an endangered anadromous fish that lives in coastal waters but spawns in natal rivers. In the Altamaha River watershed in Georgia, spawning occurs in the fall, with residence at spawning sites lasting days to weeks. Detecting spawning sturgeon can be challenging in shallow, swift shoals, but the timing of spawning at such sites is important to resolve. We initiated an environmental DNA (eDNA) pilot study to assess the feasibility of detecting Atlantic Sturgeon in the Ocmulgee River below the Juliette Dam. Beginning in mid-September 2023, we collected two-liter water samples from the bank each week using a backpack eDNA sampler and 5-micron filters. Each sampling period began with collection of a field negative control upstream of the Juliette Dam. Triplicate samples were collected at three sites below the dam: approximately 750 meters downstream of the dam, 15 km downstream, and 30 km downstream. Column-based DNA extractions and inhibitor removal were conducted including an extraction negative control in each batch. We screened these samples via conventional PCR using fluorescent dye labeled amplification primers developed for eDNA assays (ATS-CytB, Plough et al. 2021). These primers amplified products of the expected size (144 base pairs) in a subset of eDNA samples in the absence of amplification of field, extraction, and PCR negative controls. However, they also produced strong products outside the expected size range (106 to 125 base pairs) in a subset of samples that were negative for the expected product. The next steps will include sequencing of the amplicons to determine identity of the non-target products as well as quantitative PCR using the ATS-CytB primers and probe. Despite these initial mixed results, we detected Atlantic Sturgeon in the shoals immediately downstream of the dam, confirming their presence at the first barrier along the Ocmulgee River.

Detection and Modeling of Darters and Madtoms: eDNA Surveillance of Imperiled Southeastern US Fishes

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The Southeastern United States is the hotspot for aquatic diversity in the temperate world, with many small and endemic species – including those that are threatened and endangered. Information is limited but needed for many species, particularly those that are cryptic with small distributions. Rapid and sensitive biomonitoring approaches such as molecular surveillance can demarcate the distribution of critically imperiled and cryptic species. Additionally, remotely-sensed data provides researchers with a means to further develop non-intrusive and rapid approaches for habitat assessment. Two rare fishes on the brink provide opportunities for the application of environmental DNA (eDNA) surveillance combined with habitat modelling to ascertain the current distribution of two rapidly declining, potentially extirpated species. We propose the development of an extirpation index framework using a combined approach of sensitive sampling with distributional modeling to incorporate uncertainty, allowing managers to identify, with measurable confidence, range decreases or extinction such that conservation resources can be allocated appropriately using two rare species as a case study. Our objectives are to assess use of eDNA for detection of rare species; understand limitations of the current distribution of the Duskytail Darter in Copper Creek, VA and the Chucky Madtom in Little Chucky Creek, TN and create framework for an extirpation index.

Effects of anthropogenic stream barriers on Sandhills Chub (Semotilus lumbee) population genetics

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The Sandhills Chub, (Semotilus lumbee), is a small, headwater stream fish endemic to the Sandhills ecoregion of North Carolina and South Carolina. Habitat loss, fragmentation, and land use changes in the Sandhills are common, leading to possible extirpations. Additionally, fragmentation of streams can lead to a reduction in gene flow. The objective of this study is to quantify the role of anthropogenic stream barriers on genetic population structure, genetic diversity, effective population size, gene flow, and inbreeding rates of Sandhills Chub. Headwater streams in North Carolina and South Carolina were backpack electrofished beginning in May 2022. Samples were taken from streams with a range of anthropogenic fragmentation, as well as in streams that are unfragmented. Bayesian generalized linear mixed models will be used to test if population differentiation (pairwise FST) is related to the number of anthropogenic impoundments and riverine distance between sites. Additionally, Bayesian linear mixed models will be used to test if indices of genetic diversity and health (He, HO, AR, Ne, and FIs) are related to upstream drainage area, number of anthropogenic barriers downstream and upstream of a site, and distance of free-flowing stream reach a site is within. As of October 2023, 926 fin clips have been collected across the geographic distribution of Sandhills Chub and sample collection will continue through May 2024. This study will provide insight into the role anthropogenic barriers have in structuring Sandhills Chub population genetics and guide conservation efforts.

Angler attitudes toward longnose gar in Virginia’s recreational fisheries: Ecological outcomes and management implications

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This project establishes a baseline understanding of an emerging recreational fishery that targets longnose gar (LNG) on Virginia’s James River. We are analyzing 22 years of data collected by Virginia's Department of Wildlife Resources (DWR) on LNG abundance (catch per unit effort, CPUE), and length-weight relationships (condition, K) to document changes in populations over time on the non-tidal upper and middle portions of the James River above the fall line. Our analysis compares patterns of CPUE and K for LNG both spatially (in the upper vs middle portions of the river) and temporally (from 1991 - 2023). We are conducting interviews with anglers fishing at sites across this drainage to document attitudes and perceptions of LNG in these systems, and to understand current and previous prevalence of and propensity for the emerging practice of bowfishing for LNG along this drainage. The specific objectives of this research are to 1) evaluate LNG abundance and condition at different sites on the James River watershed, 2) assess angler attitudes toward and treatment of LNG and perceptions of value and 3) assess potential threats to the LNG in Virginia posed by the largely unregulated and high-mortality bow fishery.

Looking for Lazarus: Environmental DNA (eDNA) surveillance of the federally threatened Slender Chub (Erimystax cahni) in the Clinch River and Powell Rivers

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The Slender Chub (Erimystax cahni) is a federally threatened fish native to the river and valley physiographic provinces of the Tennessee River drainage and is one of the most geographically restricted eastern North American minnows. Historical collection areas include the Powell, Clinch and Lower Holston rivers in Tennessee. Habitat degradation from multiple sources including surface mining, agriculture, dams, and urbanization are associated with the decline of this species that is obligate inhabitant of gravel shoals in large rivers. As of 1964, only 15 voucher specimens were known and there has not been any observed for decades. A federal recovery plan and Species Status Assessment were developed to determine if slender chub still exist and could be restored. Given the lack of recent observations using conventional sampling to search for presence of a rare species, we used environmental DNA sampling to determine their potential presence. Our specific objectives were to 1) develop a quantitative PCR (qPCR) assay aimed at species-specific detection and 2) sample historically known areas of collection. We sampled 43 sites in the Clinch and Powell rivers. For the first time in almost two decades, we provide evidence for the continued existence of a putatively extinct species. We detected slender chub eDNA in both the Powell and Clinch rivers, albeit at only three sites. We cannot confirm the presence of living E. cahni, and positive eDNA matches could be attributed to amplification from a hybrid. Our results do indicate the presence of slender chub DNA perseveres in the systems and can inform resource agencies of localities to pursue more intensive survey efforts with conventional methods (e.g., snorkeling, seining) and potential restoration and recovery sites.

Microhabitat Use of the Highland Darter (Etheostoma teddyroosevelt) in the Illinois Bayou Watershed of Arkansas

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Highland Darters (Etheostoma teddyroosevelt) are an Ozark regional endemic species, occurring in the Arkansas River and upper White River systems of Arkansas, Kansas, Oklahoma, and Missouri and is listed as a species of greatest conservation need in each of these states. There have been very few studies on this species, specifically those that have quantified the habitat use of this species across its range. A new study was needed to fill in the knowledge gap of microhabitat use by the Highland Darter. We wanted to address this knowledge gap by assessing the microhabitat use of this species in the Illinois Bayou watershed in Arkansas. Highland Darters were observed during snorkel surveys at known and unknow localities for this species. For each unique observation, microhabitat use (1 m2 area) was determined for this species. Various environmental and habitat variables were measured within the area of observation, canopy cover (%), discharge (m/sec3), substrate frequency (%), depth (m), etc. Microhabitat data were assessed across multiple spatial scales (watershed and site). A total of 12 individuals were observed from 3 sites during August-September 2023. At the watershed level, mean (±SE) frequency of substrate in Highland Darter microhabitats were 65.4 (±7.3) % cobble, 15.4 (±7.0) % gravel, 0.7 (±0.7) % bedrock, and

10.2 (±3.6) % sand/silt. Further, at the watershed level, mean estimates of other environmental/habitat variables at Highland Darter microhabitats were 25.4 (±7.3) % for canopy cover, 0.01 (±0.01) m3/sec for discharge, and 0.4 (±0.7) m for depth. There appears to be some spatial variation in the environmental variables within the microhabitat of the Highland Darter. This research will aid in the understanding of Highland Darter biology and ecology. Future research will assess the seasonality of microhabitat use by Highland Darters.

Quantifying Movement of Seven Imperiled Pelagic-Broadcast Spawning Fishes in Three Great Plains Rivers

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Dam-building, barrier construction, water diversion, groundwater pumping, and drought events cause habitat loss and fragmentation in large rivers, particularly in the Southern Great Plains ecoregion. These river alterations negatively affect cyprinids belonging to the Pelagic-Broadcast Spawning (PBS) reproductive guild characterized by production of nearly neutrally buoyant ova that are swept downstream potentially long distances during development. In this study, we used mark-recapture to quantify movement behaviors of seven imperiled Great Plains PBS fishes distributed among the Canadian, Brazos, and Red river basins including Plains Minnow (Hybognathus placitus; 3,580 tagged, 76 recaptured), Prairie Chub (Macrhybopsis australis; 5,771, 213), Shoal Chub (Macrhybopsis hyostoma; 1,535, 47), Peppered Chub (Macrhybopsis tetranema; 2,944, 378), Smalleye Shiner (Notropis buccula; 3,306, 63), Sharpnose Shiner (Notropis oxyrhynchus; 3,778, 306), and Arkansas River Shiner (Notropis girardi; 2,231, 95). Fishes were captured by seine, tagged using visible implant elastomer to code the location and date of capture, and then movement was tracked over 5-7 months during spring and summer (between 2019-2022). Results revealed movement patterns were leptokurtic for all species except Shoal Chub, suggesting populations represented heterogenous mixes of stationary and mobile individuals. The movement distances by mobile components of each species were 1-2 orders of magnitude greater than expected for fishes of similar size in rivers of similar size, highlighting long distance movements by mobile members of populations (300-1,200 m/d). Biased upstream movement was evident for Sharpnose Shiner, Peppered Chub, and Arkansas River Shiner, but not the remaining four species. Estimated movement distances by the mobile component of all seven species was predictive of the minimum estimated stream fragment length species require or persistence (derived from literature), revealing a link between dispersal and habitat fragmentation. Our results provide insight into the appropriate spatial scales for management actions aimed at conserving multiple species of highly imperiled PBS fishes.

Movement and Habitat Use of Lemon Sharks (Negaprion brevirostris) in Mississippi Coastal Waters

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The Mississippi Sound and its barrier islands serve as nursery habitat for a variety of coastal shark species. The Lemon Shark (Negaprion brevirostris), a member of the large coastal shark complex, is known to use the waters surrounding the adjacent Chandeleur Islands as their northernmost nursery habitat; however, seasonal movement and the extent of their home range beyond the Chandeleur Island chain is unknown. The goal of this study is to determine how Lemon sharks use Mississippi coastal waters and if the Mississippi barrier islands serve as additional nursery habitat. To examine Lemon Shark use of Mississippi coastal waters, we used long-term gillnet monitoring (LTM) data from Cat Island (North) in conjunction with a focused gillnet study in shallow water habitat, Cat Island (South). Captured elasmobranch species were identified, sexed, measured, and weighed. Lemon sharks were then surgically implanted with acoustic transmitters. In total, 14 Lemon sharks were implanted with acoustic transmitters around Cat Island between July and September of 2023. Fork length of tagged individuals ranged from 568–955 mm (average 683.3 mm). Of those tagged, eight individuals have been detected within our array, with six individuals remaining around Cat Island into the fall. Detected individuals have primarily been detected along the south side of Cat Island within a shallow inlet. Comparison of the focused capture data to the LTM data showed a difference in elasmobranch comparison, with Lemon sharks being predominant in the focused study compared with Atlantic Sharpnose Shark in the LTM. Similarly, we found differences associated with top teleost species captured, demonstrating nursery habitat differences between coastal pelagic species in the Mississippi Sound as well. Data from this study will help contribute to the Mississippi State Wildlife Action Plan as the Lemon Shark is being considered for inclusion in the 2025 plan.

Evidence of an extant spring-spawning population of Atlantic sturgeon in a southeastern North Carolina river

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Informing data deficiencies across the historical range of Atlantic sturgeon is crucial for species recovery. Many rivers that previously supported or still support spawning populations require further characterization to define population structure and demography which have been impacted over time from overfishing, habitat alteration, and pollution. Several riverine systems within the Carolina distinct population segment (DPS) are currently lacking sufficient data to confirm the existence of active spawning populations. Here, we present several lines of evidence to support the existence of an extant spawning population in the Cape Fear River, NC. Between 2021-2023, twenty (20) Atlantic sturgeon adults (>1300 mm FL) were captured in upriver, freshwater habitats, acoustically tagged, and monitored at both fine and broad spatial scales. Both males (actively releasing milt) and a female (possessing developed eggs) displayed characteristics indicative of spawning. Tagged fish demonstrated annual upriver migrations each spring to the same upriver, freshwater habitats where they were originally captured. Egg mat sampling in these habitats produced Atlantic sturgeon eggs, confirmed by the application of species-specific genetic primers. In addition, river-resident juveniles (<500 mm FL) were captured near the salt/freshwater interface during all sampling years. Atlantic sturgeon are widely

believed to remain in their natal river system through this life stage. The combination of field capture of adult and early juvenile life stages, the confirmed presence of eggs, and acoustic telemetry that revealed repeated return tendencies by migrating adults provide strong evidence for an extant spring-spawning population in the Cape Fear River. Improved genetic and demographic characterization of the Cape Fear River population will inform Atlantic sturgeon recovery and management within the Carolina DPS and coastwide.

Evaluation of passage efficiency and migration of striped bass in relation to a modified nature-like fish swimway and elevated flows in the Cape Fear River

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The construction of nature-like fish swimways is an increasingly common method to improve connectivity and mitigate physical barriers that restrict the movements of migratory fishes. In 2012, the USACE created a nature-like swimway to improve passage of anadromous fishes at the lowermost of three lock and dam structures (LD1) in the Cape Fear River, North Carolina. Acoustic telemetry studies conducted in 2013-2015 found passage rates of striped bass (Morone saxatilis) to be considerably lower than those achieved with previous locking procedures. In response, additional modification of the fishway was completed in 2021 to improve passage success. Starting in spring 2022, we re-evaluated the passage success of striped bass over the modified fishway, and we also quantified fish movements above all three LD structures during high environmental flow events (supplemental water releases from an upriver reservoir following heavy precipitation). A large array (n > 60) of acoustic receivers, as well as receiver gates above and below each LD, informed the movements of tagged striped bass. The average raw upstream passage efficiencies of striped bass at the LD1 fishway in 2022 and 2023 were found to be slightly higher (35%) than passage rates of the original structure (2013-2015: 20-25%). Passage efficiencies at the upriver LD structures, LD2 and LD3, where no nature-like swimways exist and no locking was conducted, were 48% and 15% respectively. All fish passage of the upriver LD structures occurred during two environmental flow events in mid and late April, when all LD structures were completely submerged. The environmental flow events also facilitated the passage of LD1 by striped bass, with 80% of fish passing during these high flows. The 2021 modifications to the nature-like fish swimway led to modest increases in passage success, but have yet to meet original passage efficiency goals. The use of environmental flow events to supplement fish passage appears promising.

Stomach Content Analysis of the Non-Native Mayan Cichlid (Mayaheros urophthalmus) in Wolf Branch Creek Nature Preserve, Tampa, Florida

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The Mayan Cichlid (Mayaheros uropthalmus) is a tropical fish native to Central America and southern Mexico. This aggressive cichlid, first recorded in 1983 in the Everglades, also has established and expanding populations in the Tampa Bay watershed. To better understand this fish’s potential impact on native flora and fauna, a stomach content analysis was conducted. As in their native and introduced ranges, Mayan Cichlids in Wolf Branch Creek Nature Preserve near Tampa Bay were documented to be generalist omnivores – dipterans (adults, larvae, and pupae), gastropods, micro and macro crustaceans, actinopterygians, fish scales, macroalgae, and cyanobacteria were found in varying number, mass, and occurrence in 72 individuals. Due to the variety of prey types consumed, Mayan Cichlids may be competing with native fishes, especially considering their populations are expanding. Indeed, their omnivorous trophic ecology is likely facilitating their expansion in Tampa's freshwater and estuarine habitats. Additionally, some previous studies documented an increased presence of fishes in the stomachs of larger Mayan Cichlids both in their native and introduced ranges. In Wolf Branch, however, no such relationship was observed. There was no correlation between fish length and the proportion of vertebrate prey (e.g., fish) to invertebrate prey (e.g., insects) found in the stomachs of Mayan Cichlids collected at this site. The abundance of invertebrates in the stomachs of juvenile and adult Mayan Cichlids suggests potential competitive impacts on native species that also prey on invertebrate food sources. Future work, therefore, will explore possible dietary overlap between Mayan Cichlids and native Centrarchids in habitats where their populations coincide.

Spatial Assessment of Slender Madtom (Noturus exilis) Diets within the Illinois Bayou Watershed

Kade B. Mitchell* (Arkansas Tech University), Kyler B. Hecke (Arkansas Tech University)

The Slender Madtom (Noturus exilis) is a common species with a widespread distribution across the Mississippi River basin. In Arkansas, they can be found in upland rivers/streams in the Arkansas River and White River watershed. Very little data has been collected on the diet of this species and how it varies. We wanted to spatially assess the diet of Slender Madtoms. Slender Madtoms were sampled from 8 sites in the Illinois Bayou watershed using seines and kick nets. Small-scale gastric lavage was used to extract diet data from all individuals. All prey items were preserved and identified to the genus level (if possible). Bray-Curtis dissimilarity was used to assess the composition of prey items between sites. A total of 157 different prey items from 41 fish (43-88 mm), covering 6 orders were extracted from Slender Madtoms during September (2023). Prey items consisted mostly of Chironomids (True Flies, n= 74), Heptageniid (Mayflies, n= 27), and Philopotamid (Caddisflies, n=18). There were varying levels of diversity among Slender Madtom diets from site to site; Shannon-Weiner Species Diversity Index (H=0.10-1.97), Evenness (E=0.65-1.00), and Simpson's Dominance Index (1-D= 0.00-0.80). Slender Madtom diets from the lowest sampling site were more similar to diets from other sites (mean [±SE] Bray-Curtis Distance=0.51 [±0.13]), than the upper most site (mean Bray-Curtis Distance= 0.93 [±0.17]). The most diverse diets observed in this species were from the lowest site on Illinois Bayou (n= 38 prey items, 5 orders), suggesting a spatial relationship in diet diversity. Further sampling will incorporate diets from Slender Madtoms at more sites, and also assess temporal changes in diets from fish at these sites. This research will aid in the understanding of Slender Madtom diets and how they vary spatially.

Mate Choice as a Driver of Reproductive Isolation in Fundulus notatus and Fundulus olivaceous

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Understanding the origins of reproductive isolation between closely related species is foundational to evolutionary and ecological research. Recent reviews have documented contemporary hybridization between a large portion of species. A greater knowledge of reproductive isolation and its components are vital to expanding conservation efforts for threats such as those to species persistence and community processes. Although, we lack a clear understanding of how isolating mechanisms evolve throughout many systems where hybridization is prominent. Species in the Fundulus notatus species complex (F. notatus, F. olivaceus, and F. euryzonus) readily hybridize at many contact zones replicated throughout their broadly overlapping ranges in the southeastern United States. However, recent work has highlighted high variability in hybridization rates across replicated zones (zones range from <1% to >30% individuals of hybrid ancestry). To better understand the mechanisms controlling hybridization rates across species contact zones, we conducted mate-choice trials between individuals from populations within the Fundulus notatus species complex that freely hybridize and those that do not. The experimental set up allowed individuals free choice of a conspecific or heterospecific over the course of 6-hour trials. During that time, movement was monitored and tracked for each individual through an artificial intelligence software integrated into video cameras. From there, we used temporal proximity of individuals as a metric of mate preference and to quantify the mode of sexual selection. The distance and duration of association among fish allow us to consider sexual selection as the driver of reproductive isolation among the Fundulus notatus species complex.

Assessment of Aquatic Macroinvertebrate Assemblages in the Upper Illinois Bayou Watershed of Arkansas

Coley Turner* (Arkansas Tech University), Risa McCollough (Arkansas Tech University), and Kyler Hecke (Arkansas Tech University)

With the continual expansion of urban areas, there has been increased concern about the effects stream barriers have on aquatic organism passage with much of the focus on fish. However, not much focus has been placed on the smaller effects these barriers can have, i.e., macroinvertebrate assemblages. To address this knowledge gap, we collected macroinvertebrate samples from two tributaries (Dare and Dry Creek) with a barrier (one artificial and one natural) in the upper Illinois Bayou watershed in Arkansas. Macroinvertebrate samples were collected using a Hess sampler and D-frame kick-nets. Twelve invertebrate samples were collected from each site – six upstream (3 D-frame kick-nets and 3 Hess samples) and six downstream. Collected samples were taken back to the lab for identification, and macroinvertebrate individuals were identified down to family using a dissecting scope and macroinvertebrates.org. A total of 211 individuals from thirteen families across six orders were identified from Dry Creek. The Shannon-Wiener index (H’) was 0.71 (H’ max 1.11), Evenness (J’) was 0.63, and Simpson’s Dominance index (1-D) was 0.71. A total of 422 individuals from sixteen families across six orders were identified from Dare Creek. The Shannon-Wiener index (H’) was 0.56 (H’ max 1.20), Evenness (J’) was 0.46, and Simpson’s Dominance index (1-D) was 0.58. Heptageniids (Flat-headed Mayflies) and Chironomids (Non-biting Midges) were the most abundant families at both sites. Further analyses will compare the assemblages between upstream and downstream and dissimilarities between the two creeks. These data further aid in our understanding of the effects of stream barriers on aquatic ecosystems and provide direction for further research.

Assessing vulnerability to overfishing of the top imported marine ornamental species into the US using productivity susceptibility analysis

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Every year, millions of coral reef fishes are harvested in the wild for the marine aquarium trade (MAT). Reef fishes are crucial for maintaining coral reef health and balanced marine cycles within their native habitats but harvesting fishes for the MAT also supports fishers' livelihoods, coastal economies in low-income countries, and marine education. Thus, understanding the impact of the MAT on fish populations and ensuring the long-term sustainability of harvesting in the wild is critical. In this study, Productivity-susceptibility analysis (PSA) was used to semi-quantitatively analyze the vulnerability to overfishing of species collected for the MAT. A vulnerability score was calculated based on various productivity and susceptibility factors that were individually scored. An updated PSA model was developed in this study and applied to the top 258 species imported into the US. Vulnerability scores were applied to a Gaussian clustering algorithm to visualize the comparative sustainability of species. Results showed that for many species, available data was limited or lacking for one or more factors examined. This revised PSA for the MAT provides useful information to stakeholders and support for sustainable decision-making throughout the trade, including a list of species that require management attention through stock assessments, catch limits, and aquaculture production.

Estimation of Sportfish Populations in an Unmanaged Farm Pond in Arkansas

Karson Hamilton* (Arkansas Tech University) and Kyler Hecke (Arkansas Tech University)

Population estimation has been a valuable tool for fishery managers regarding the management of sportfish populations. This tool can be used to establish baselines for sportfish species so that proper management objectives can be applied to a fishery. We wanted to use population estimation techniques to estimate the sportfish populations of an unmanaged farm pond (2.5 hectares) surrounded by agriculture fields and deciduous forest and at the edge of the Arkansas Tech University campus. Hook-and-line sampling was used to collect data on sportfish species in this pond. Various lures were used to increase chances of catching a fish. Hook-and-line sampling took place multiple times a week. At least two anglers participated in hook-and-line sampling during each sampling event. Every individual fish caught (>100 mm in length) was tagged with a numbered T-bar anchor tag. Tagged fish were allowed a 10-min. recovery period after tagging, then placed back into the pond. Sportfish populations were estimated with the modified Lincoln-Peterson Index. A total of 5 sampling events took place from October-November (2023). A total of 35 fish (Largemouth Bass Micropterus nigricans and Black Crappie Lepomis nigromaculatus) were sampled across all sampling events. Median (range) fish caught per sampling event was 7 (1-14); there have been no recaptures during sampling so far. Median catch-per-unit effort (CPUE) across all sampling events was 0.6 (0.3-1.3) fish/hr. The population estimate (confidence intervals) for Largemouth Bass was 42. 4 (18.6-66.2). This low population estimate might have been due to varying CPUE and lack of recaptures. Increased CPUE and recaptures would likely increase the population estimation of sportfish species in this farm pond. This data will provide knowledge to inform management decisions regarding the fishery in this farm pond.

Machine Learning, Longlining Fishing Tactics, and Seabird Bycatch Risk

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Western North Atlantic U.S. seabird bycatch in the pelagic longline fishery is a serious concern. The Pelagic Observer Program (POP) started in 1992 to monitor the Atlantic longline fishery bycatch including seabirds and other species of interest in the United States. Existing studies based on the POP data and a Bayesian spatial-temporal generalized linear model found that vessel ID is a significant factor in estimating seabird bycatch probability. Additionally, preliminary analyses revealed that there were significant differences in fishing tactics between vessels that are known to have sea bird bycatch and those that do not. In order to further understand the connection between longlining fishing tactics and seabird bycatch probability, this study aims to use machine learning algorithms to estimate the probability of seabird bycatch based on fishing gear use. The objective of this study is to develop a machine learning model to predict sea bird bycatch events, and to identify vessel related fishing tactics that might affect seabird bycatch probabilities to help reduce seabird bycatch. In total 31 different tactics across four categories: effort, depth, lures, and miscellaneous, as well as several environmental variables were used to create decision tree type models for four different management regions and one single combined model. The data show that gear usage varies significantly between regions; for example, the GOM region has a higher mean set depth than other regions. While the models for each management region vary greatly, target species consistently had a strong influence on the probability of seabird bycatch. While the current accuracy of these models remains low, due to the low bycatch sample size, the accuracy should improve as the models are refined in the next phase of the study.

RAPID ASSESSMENT OF MUSSEL COMMUNITIES OF TWO TRIBUTARIES IN THE ARKANSAS SOUTH CENTRAL PLAINS ECOREGION

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Anthropogenic influences such as mining and water quality degradation from wastewater effluents and agricultural runoff negatively impact freshwater mussel communities. The South-Central Plains (SCP) Ecoregion in Arkansas contains the Smackover Formation, an area that has been exploited for its oil with high frequency of drilling. In 1922 the Smackover pool in Union County was found and quickly became one of the world's most productive oil sites. Hurricane Creek and Smackover Creek, two tributaries within the Ouachita River basin, have experienced negative impacts from oil exploration and mining. However, to our knowledge, mussel communities in these creeks have not been assessed in the past twenty years. We surveyed mussel communities at seven sites on Hurricane Creek and five on Smackover Creek using a rapid assessment protocol. Initially a one-hour broad search was conducted using snorkeling, grubbing, and raking techniques. This search was followed by a 30-minute focused search in the area where the highest abundance of mussels was initially found. Each mussel was identified, measured (mm), and returned to the location where it was initially found. Additionally, we collected basic water quality and habitat parameters such as temperature (°C), total dissolved solids (ppm), salinity (ppt), conductivity (mS/cm), pH, depth (m), and substrate composition (%). We found six species of

native mussels: Eastern Pondmussel (Sagittunio nasutus), Louisiana Fatmucket (Lampsilis hydiana), Mucket (Actinonaias ligamentina), Texas Lilliput (Toxolasma texasiense), Tapered Pondhorn (Uniomerus declivis), Yellow Sandshell (Lampsilis teres) (n = 143) across eight sites and no mussels at five sites. Furthermore, we found evidence of active recruitment through the presence of smaller individuals. Our study provides insight into the importance of heavily degraded small streams for mussel populations in the SCP Ecoregion. We also suggest that future survey efforts should incorporate small tributaries in determining mussel distribution.

Native crayfish morphological variation in relation to dams and introduced species

Rachel Simpson (Troy University), Riley Egan (Troy University), Zanethia Barnett (US Forest Service), Brian Helms (Troy University)

Many species of crayfish show subtle population-level variation in morphology, often in response to environmental conditions. Whether local adaptation or phenotypic plasticity, this morphological variation presumably affords some sort of advantage in response to local selective pressures. These fine-scale selective pressures can range from hydrological to physicochemical to biological in nature. Introduced species and dams, two prevalent stressors that can alter selective pressures, often occur in tandem and potentially can have additive effects in aquatic systems. In the Cahaba River drainage in central Alabama, Faxonius virilis has been introduced and is the predominant crayfish species in many reaches, but shares habitat with multiple native species. The Cahaba River drainage is also home to over 117, mostly small, dams. Thus our objective was to quantify morphological variation of native crayfish populations in impounded and unimpounded streams, with and without F. virilis, using geometric morphometric techniques. Six impounded streams and 4 unimpounded streams were sampled in 2 reaches each with a backpack electroshocker to quantify and characterize crayfish assemblages in the drainage. Adult specimens from each site were photographed dorsoventrally and digitized with 29 homologous landmarks, including the acumen and marginal spines of the rostrum, postorbital spines, suborbital angle spines, cervical spines, anterior and posterior midpoints of the rostrum, the narrowest width of the areola, insertion points of somites, and telson spines. Landmarks from each specimen were subsequently analyzed with a canonical variance analysis (CVA) to determine any shape differences across sites that vary in dam and F. virilis presence. Preliminary CVAs suggest that there is significant spatial variation in body morphology of native crayfish species in this drainage. These data suggest that local morphological variation exists in native crayfish populations and further analysis will help determine the role of dams and F. virilis in explaining this variation.

Reproductive Life History of Pleurobema riddellii

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Basic life history information is necessary for formulating management and conservation plans for imperiled species. Life history information on freshwater mussels (Unionidae) is rather limited for several of the imperiled mussel species in Texas. This study focuses on the reproductive cycle of Louisiana Pigtoe (Pleurobema riddellii), a candidate species for listing by US Fish and Wildlife Service. Study objectives included an assessment of the annual reproductive cycle and associated environmental correlates,

obtained from a dense population located in an irrigation canal fed by the Neches River in southeast Texas. Preliminary results indicate that female gametogenesis begins in the spring and summer months and declines into the fall and winter. Brooding lags slightly behind female gametogenesis. Gametogenesis and brooding correspond with water temperature but not with flow. The study is ongoing but ultimately should provide basic information to assess if their imperilment is related to limits on their reproductive cycle.

Mitogenome Surveillance of Invasive and Endangered Fishes in the Southeastern United States

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Invasive species represent a growing threat to the ecosystems and economies of the United States. The southeastern United States represents an aquatic biodiversity hotspot, and a rapidly growing number of nonindigenous freshwater fishes are attributed to the decline of multiple native species already facing extinction. Presidential order 13751 describes the need for rapid and cost-effective tools to detect invasive species during the earliest stages of introduction, when mitigation and control efforts are most effective. This study includes development of noninvasive environmental DNA (eDNA) protocols designed for early detection of invasive freshwater fishes in the southeastern United States. The mitochondrial genome is targeted by traditional eDNA assays, but public DNA sequence repositories are inadequate resources for species-specific eDNA primer development. In this study, we describe a novel single PCR assay that successfully amplifies the nearly complete mitochondrial genome of a broad diversity of actinopterygian fishes, including those identified with high invasive potential by the Department of Interior Horizon Scan project. We present a pipeline for rapid noninvasive detection of species with high potential for invasion of North America's freshwater biodiversity hotspot. Results of controlled trial experiments provide proof of concept for effective deployment of this pipeline in real-world situations where traditional sampling methods are inadequate for development of "rapid, cost-effective, noninvasive tools to monitor the geographic range of invasive species" (Presidential order 13751). Thus, the deliverables of this study represent a rapid and cost-effective alternative to traditional sampling methods, and a cost-effective contribution to preserving the world's most biodiverse temperate freshwater ecosystem.