2023 Southern Division of the American Fisheries Society

2023 SDAFS ANNUAL MEETING

February 1st-5th

Norfolk, Virginia

Organized in 1990

WELCOME SDAFS MEMBERS!

SDAFS President's Welcome

Welcome to the 31st annual meeting of the Southern Division of the American Fisheries Society (SDAFS)! If this is your first SDAFS meeting I want to extent to you a very special welcome. You will find the hospitality that the South is known for on full display this week in Norfolk. The Virginia Chapter has been working tirelessly to prepare to host one of the largest meetings our Division has ever had, and I am confident that it will be a fabulous conference with the robust technical committee meetings, challenging workshops, engaging symposia, and enjoyable socials that we are all accustomed to at SDAFS meetings.

The first SDAFS meeting that I attended was 20 years ago this month. I still remember that being the first time that I met some of the people who wrote or edited the textbooks we used. People like Rich Noble, Mike Van Den Avyle, and Phil Bettoli. It left an impression on me as a graduate student just how important this conference was- that if you wanted to know the latest in fisheries science from some of the greatest fisheries scientists, this was the place to be. I also met other students and young professionals at that meeting that I still count among my friends to this day. I have attended many other professional meetings over the course of my career, and there truly is no other like the SDAFS!

My encouragement to you as an attendee is to take advantage of the opportunity to meet and interact with the collection of great fisheries scientists and future colleagues who will be gathered together for 3.5 short days. The personal connections you make will last far longer than anything else you gain from this meeting, so be intentional about getting to know some new people, whether this is your first or 31st SDAFS meeting.

Finally, I want to encourage each of you to join me, the other officers, and other Division leaders at the annual Business Meeting on Friday at 4:30 PM to celebrate our Division award winners, hear messages from AFS President April Croxton and AFS Executive Director Doug Austen, and see the installation of our newly elected SDAFS officers.

I'm so glad you're here and I look forward to visiting with you over the next few days!

Sincerely,

Jason Olive
President, Southern Division of the American Fisheries Society

Virginia Chapter of the AFS President's Welcome

On behalf of the Virginia Chapter American Fishery Society, I would like to welcome you to Norfolk! We are very excited to be hosting the 2023 Southern Division meeting, after our all-virtual 2021 meeting. The planning committee has worked tirelessly to find a unique venue and develop a diverse program of workshops and symposia. I hope while you're here, you are able to explore some of the interesting attractions that Norfolk has to offer. Planning committee members are listed in the program, and I ask that if you see any of them during the meeting, please thank them for the huge effort they put into making this a success.

Most Sincerely,

Dawn Kirk
President, Virginia Chapter of the American Fisheries Society

2023 SDAFS Annual Meeting
Norfolk, Virginia — February 1st–5th

2023 SDAFS ANNUAL MEETING WEBPAGE

DOWNLOAD WHOVA MEETING APP

Local Restaurants
Things-to-do
Map of Norfolk

VISIT Norfolk

2023 SDAFS Annual Meeting
Norfolk, Virginia — February 1st–5th

2023 SDAFS ANNUAL MEETING PLANNING COMMITTEE

Meeting:	Brad Fink, Mike Isel, Hunter Hatcher
Local Arrangements:	John Odenkirk, Mike Isel, Brad Fink
Program:	John Odenkirk, Scott Smith, Brendan Runde
Program Design:	Caitlin Carey
Workshops:	Jeff Williams, Clint Morgenson
Posters:	Dan Michaelson
Student Affairs:	Chas Gowan, Shannon White, Keith Gibbs
Finance & Registration:	Hunter Hatcher, Justin Heflin, Robbie Willis
Fundraising:	Mike Isel, Bob Graham
Signage:	Brad Fink, Robbie Willis, Tim Owen
Whova Meeting App:	Margi Whitmore
AV/Technology:	Robert Humston, Brad Fink, Hunter Hatcher
Webmaster:	Karen Horodysky, Hunter Hatcher
Raffle & Auction:	Johnathan Harris, Tom Wilcox
Tradeshow:	Aaron Cushing, Mike Isel

2022-23 SDAFS OFFICERS

President:	Jason Olive
President-Elect:	Mark Rogers
Vice President:	Anthony Overton
Past-President:	Cindy Williams
Secretary-Treasurer:	Jessica Baumann
Student Representative:	Ambar Torres

2022-23 VIRGINIA CHAPTER AFS OFFICERS

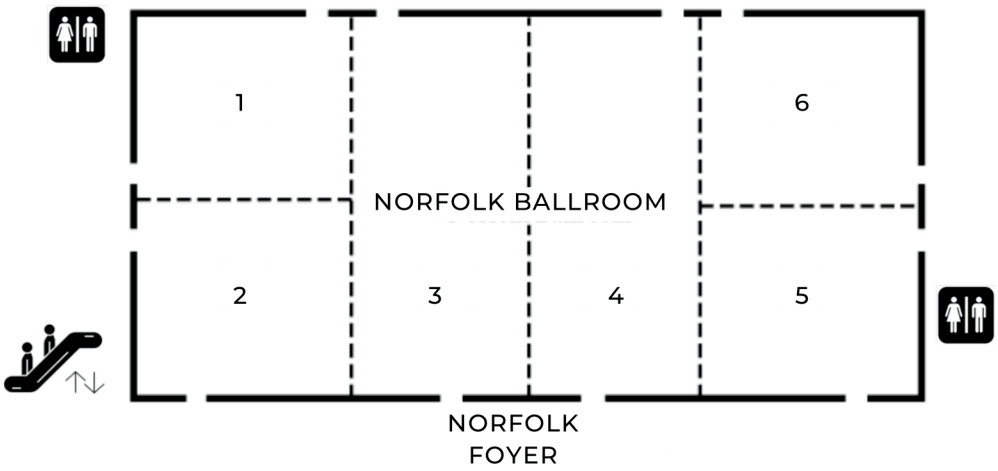
President:	Dawn Kirk
President-Elect:	Kirk Smith
Past-President:	Jeff Williams
Secretary:	Margi Whitmore
Treasurer:	Hunter Hatcher

Organized in 1990

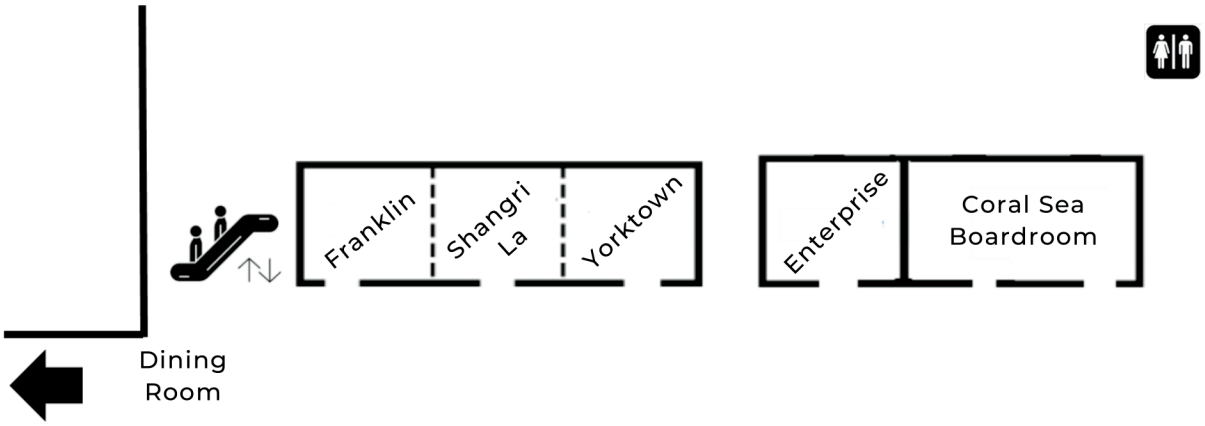
HOTEL FLOOR PLANS

Break Area / Posters / Tradeshow

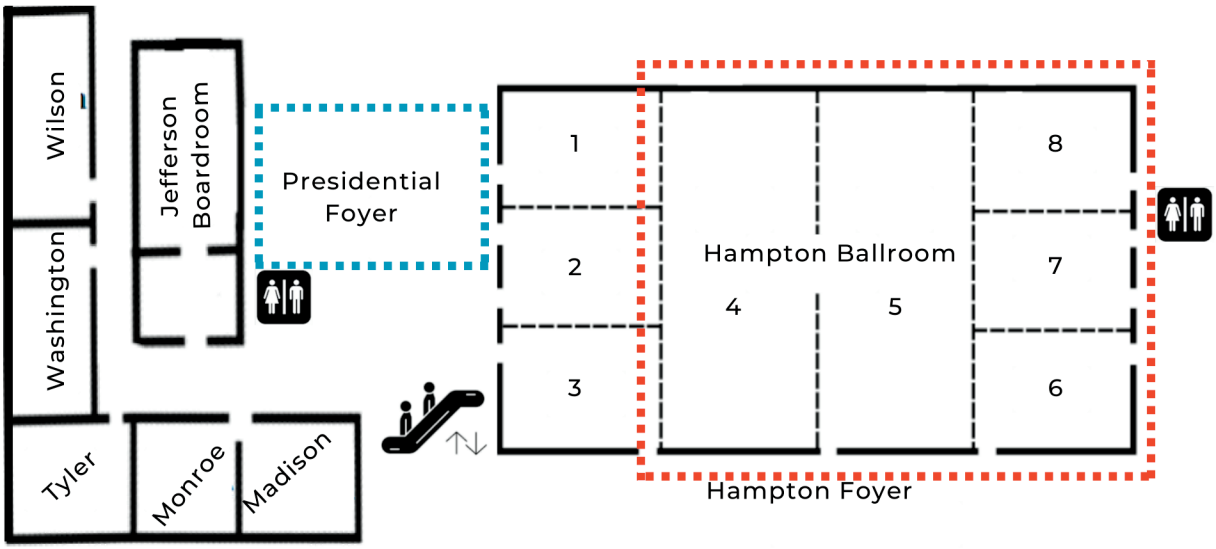
Registration



1st Floor



2nd Floor



3rd Floor

Registration located in the Presidential Foyer (3rd Floor) Wednesday (3 PM – 5 PM), Thursday – Saturday (8 AM – 5 PM), and Sunday (8 AM – 10 AM)

SCHEDULE AT A GLANCE

Thursday, February 2nd

		Location
9 AM – NOON	Technical Committee Meetings	1st – 3rd Floor*
NOON – 1 PM	Lunch	(on your own)
1 PM – 4 PM	Technical Committee Meetings	1st– 3rd Floor*
4 PM – 6 PM	EXCOM Meeting	Hampton 3 (3rd Floor)
6:30 PM – 8:30 PM	Social	Brick Anchor 241 Granby Street

Friday, February 3rd

8 AM – NOON	Trade Show & Poster Set-up	Hampton 4 – 8 (3rd Floor)
8 AM – NOON	Workshops	1st– 3rd Floor*
10 AM – 10:30 AM	Break	Hampton 4 – 8 (3rd Floor)
NOON – 1 PM	Lunch	(on your own)
NOON – 6:30 PM	Trade Show (& Posters for Viewing)	Hampton 4 – 8 (3rd Floor)
1 PM – 4:30 PM	Workshops	1st– 3rd Floor*
3 PM – 3:30 PM	Break	Hampton 4 – 8 (3rd Floor)
4:30 PM – 6 PM	SDAFS Business Meeting	Norfolk 3 & 4 (1st Floor)
6:30 PM – 8:30 PM	Poster Social	Hampton 4 – 8 (3rd Floor)

Saturday, February 4th

8:30 AM – 10 AM	Plenary Session	Norfolk 3&4 (1st Floor)
10 AM – 10:30 AM	Break	Hampton 4 – 8 (3rd Floor)
10:30 AM – 11:30 AM	Technical Sessions	1st– 3rd Floor*
11:30 AM – 1 PM	Student-Mentor Lunch	Presidential Foyer (3rd Floor)
11:30 AM – 1 PM	Lunch	(on your own)
1 PM – 3 PM	Technical Sessions	1st– 3rd Floor*
3 PM – 3:30 PM	Break	Hampton 4 – 8 (3rd Floor)
3:30 PM – 5:30 PM	Technical Sessions	1st– 3rd Floor*
6:30 PM – 10:30 PM	Grand Social	Nauticus 1 Waterside Drive

Sunday, February 5th

8:30 AM – 9:50 AM	Technical Sessions	1st– 3rd Floor*
9:50AM – 10:20 AM	Break	Hampton 4 – 8 (3rd Floor)
10:20 AM – NOON	Technical Sessions	1st– 3rd Floor*

*For details, see schedules for Workshops, Symposia, and Technical Sessions Below. Technical Committee Meeting details are available in the Whova App or Online in the Full Program

2023 SDAFS Annual Meeting
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TECHNICAL COMMITTEE MEETINGS

THURSDAY, FEBRUARY 2ND

All-day Technical Committee Meetings (9 AM – NOON; 1 PM – 3 PM or 4 PM)
Catfish Committee Location: Washington (3rd Floor)
Reservoir Committee Location: Hampton 3 (3rd Floor)
Warmwater Streams Committee Location: Hampton 1 (3rd Floor)
Morning Technical Committee Meetings (9 AM - NOON)
Alligator Gar Committee Location: Yorktown-Franklin-Shangri La (2nd Floor)
Aquaculture Committee Location: Madison (3rd Floor)
Pollution Committee Location: Enterprise (2nd Floor)
Striped Bass Committee Location: Norfolk 2 (1st Floor)
Afternoon Technical Committee Meeting (1 PM - 4 PM)
Small Impoundments Committee Location: Norfolk 2 (1st Floor)

WORKSHOPS

FRIDAY, FEBRUARY 3RD

All-day Workshops (8:00 AM – NOON; 1:00 PM – 4:30 PM)	Afternoon Workshops (1:00 PM – 4:30 PM)
Introductory ArcGIS/QGIS for Fisheries Biologists Location: Wilson (3rd Floor) Instructors: Hadley Boehm (University of Missouri), Kiah Wright (University of Missouri), Clint Morgeson (Virginia Department of Wildlife Resources)	**Getting Hired** Location: Hampton 2 (3rd Floor) Instructors: Patricia Mazik (USGS WV Cooperative Fish & Wildlife Research Unit)
Critical Thinking and Problem Solving in Fisheries Science Location: Madison (3rd Floor) Instructors: Vic DiCenzo (Arkansas Game and Fish Commission), Brian Murphy (Virginia Tech)	**Plain, Simple, Concise Writing** Location: Enterprise 2 (2nd Floor) Instructors: Steve McMullin (McMullin Training and Consulting, LLC)
Fish Kill Investigation Methodology Morning Location: Enterprise (2nd Floor) Afternoon Location: Norfolk 5 & 6 (1st Floor) Instructors: Travis Tidwell (Texas Parks and Wildlife Department)	**Data Visualization in ggplot** Location: Norfolk 2 (1st Floor) Instructors: Steve Midway (Louisiana State University)
Morning Workshops (8:00 AM – NOON)	***Afternoon Workshops (continued)***
Improving Science Communication with the Policymakers, the Public, and Peers Location: Hampton 2 (3rd Floor) Instructors: Aaron Bunch (Clemson University), Steve Lochmann (University of Arkansas – Pine Bluff)	**Reconnecting Aquatic Habitat at the Regional Scale: Working to Restore Aquatic Connectivity through Barrier Removal in the Southeast** Location: Hampton 1 (3rd Floor) Instructors: Victoria Ruddle and Kat Hoenke (Southeast Aquatic Resources Partnership)
Identification of the Most Common Problematic Aquatic Plants in the Southeastern States Location: Hampton 3 (3rd Floor) Instructors: Graves Lovell, Alabama DCNR and others	**Control of the Most Common Problematic Aquatic Plants in the Southeastern States** Location: Hampton 3 (3rd Floor) Instructors: Graves Lovell, Alabama DCNR and others
Continuous Stream Temperature Monitoring Location: Washington (3rd Floor) Instructors: David Young (Texas Parks & Wildlife Department), Matt Troia (University of Texas San Antonio)	**RAWA Workshop** **Location: Yorktown-Franklin-Shangri La (2nd Floor)**
Innovasea Acoustic Telemetry Location: Norfolk 2 (1st Floor) Instructors: Stephanie Smedbol (Innovasea)	
Leading at all Levels Location: Hampton 1 (3rd Floor) Instructors: Steve McMullin, Doug Austen, other AFS officers (AFS)	

SYMPOSIA

DEFCON 1: The Emerging Threat of Alabama Bass to Native Congeners in the Southeastern U.S.
Saturday, February 4th; 10:30 AM – 5:30 PM
Location: Hampton 1 (3rd Floor)
Organizers: Steven Sammons, John Odenkirk, Lawrence G. Dorsey, Michael Jolley

Crappie Management and Research: Reviving the Conversation
Saturday, February 4th; 10:30 AM – 3:50 PM
Location: Yorktown-Franklin-Shangri La (2nd Floor)
Organizers: Allen D. Martin, Ryan Hamm, Kevin J. Dockendorf, Andrew Yung

Understanding Aquatic Population Structures Using Population Genetic Techniques
Saturday, February 4th; 10:30 AM – 5:10 PM
Location: Wilson (3rd Floor)
Organizers: Zanethia C. Barnett, Tanya L. Darden

From Tidewater to the Deep Blue: Recent Advances in Marine Fishery Science and Management
Saturday, February 4th; 10:30 AM – 5:30 PM
Sunday, February 5th; 8:30 AM – Noon
Location: Norfolk 2 (1st Floor)
Organizers: Brendan Runde, Jim Morley, Kyle Shertzer, Jie Cao, Matthew Damiano

Aquatic Connectivity in the Southeast: Advancing Science Through Partnerships
Saturday, February 4th; 10:30 AM – 3:00 PM
Location: Enterprise (2nd Floor)
Organizers: Kat Hoenke, Tate Wentz, Dr. Jeffery Fore, Sara Gottlieb, Dr. Sue Colvin, Alan Weaver

Best Student Presentations
Saturday, February 4th; 10:30 AM – 5:30 PM
Location: Hampton 3 (3rd Floor)
Organizers: Chas Gowan, Shannon White, Keith Gibbs, John Odenkirk

American Eels: Emerging From the Murky Abyss and Entering a Clear Stream of Knowledge
Saturday, February 4th; 10:30 AM – 4:10 PM
Location: Madison (3rd Floor)
Organizers: Pete Sturke, Bob Graham, Robby Maxwell, Stephen Curtis, Trevor Starks, Scott Smith

Exploring Causes and Consequences of Climate Change in Streams
Saturday, February 4th; 10:30 AM – 4:50 PM
Location: Washington (3rd Floor)
Organizers: David Young, Matthew Troia

PLENARY & TECHNICAL SESSIONS

Saturday, February 4th

		Location
8:30 AM – 10:00 AM	Plenary Talks	Norfolk 3 & 4 (1st Floor)
8:40 AM	Welcome to Virginia *Ryan Brown, Executive Director, VDWR*	
8:50 AM	AFS Roots: Preachers, Pragmatists, Protectionists, and Piscicultural Purveyors *Brian Murphy, Virginia Tech*	
9:20 AM	How to be an Optimist when Reality Sucks *Don Orth*	
10:30 AM – 5:30 PM	Symposia (See Symposia Schedule)	
3:50 PM – 5:30 PM	Black Bass – Session I	Yorktown-Franklin-Shangri La (2nd Floor)
3:30 PM – 5:30 PM	Creel Surveys & Angler Attitudes	Enterprise (2nd Floor)
4:10 PM – 5:30 PM	Techniques – Session I	Madison (3rd Floor)
4:50 PM – 5:30 PM	Crayfish	Washington (3rd Floor)

Sunday, February 5th

8:30 AM – 9:30 AM	Surveys, Monitoring, & Water Quality	Hampton 1 (3rd Floor)
8:30 AM – 9:50 AM	Black Bass – Session II	Yorktown-Franklin-Shangri La (2nd Floor)
8:30 AM – NOON	Non-game Fish	Wilson (3rd Floor)
10:20 AM – 11:40 AM	Sturgeon	Hampton 1 (3rd Floor)
10:20 AM – NOON	Black Bass – Session III	Yorktown-Franklin-Shangri La (2nd Floor)
8:30 AM – 9:50 AM	Community Composition & Occupancy	Enterprise (2nd Floor)
8:30 AM – 9:50 AM	Non-native & Invasive Fish – Session I	Hampton 3 (3rd Floor)
8:30 AM – 9:30 AM	Techniques – Session II	Madison (3rd Floor)
8:30 AM – 9:50 AM	Habitat Selection	Washington (3rd Floor)
10:20 AM – 11:40 AM	Non-native & Invasive Fish – Session II	Enterprise (2nd Floor)
10:20 AM – NOON	Contributed Papers	Hampton 3 (3rd Floor)
10:20 AM – 11:20 AM	Alligator Gar	Washington (3rd Floor)

	HAMPTON 1 3RD FLOOR	YORKTOWN-FRANKLIN-SHANGRI LA 2ND FLOOR	WILSON 3RD FLOOR	NORKFOLK 2 1ST FLOOR
Start Time	**Alabama Bass Introgression Symposium** **10:30 AM – 5:30 PM** **Steve Sammons, moderator**	**Crappie Symposium** **10:30 AM - 3:50 PM** **Kevin Dockendorf, moderator**	**Population Genetics Symposium** **10:30 AM – 5:10 PM** **Zanethia Barnett, moderator**	**Marine Fisheries Symposium** **10:30 AM – 5:30 PM** **Brendan Runde, moderator**
10:30 AM	Differential effects of non-native Alabama Bass on Smallmouth and Largemouth Bass fisheries in North Georgia Reservoirs *John Damer*	Florida's Black Crappie Management Plan: guiding future management *Ryan Hamm*	Refining species boundaries in the ubiquitous freshwater mussel genus *Amblema* *Jamie Bucholz*	Too hot to fish? Effects of weather, hurricanes, and COVID-19 on angling effort *Steve Midway*
10:50 AM	Invasion and establishment of Alabama Bass in South Carolina thus far *Mark Scott*	Florida's statewide crappie regulation review *Allen Martin*	Systematic de-complexing of a widespread crayfish species complex *Bronwyn Williams*	*<Talk Canceled>*
11:10 AM	Alabama Bass invasions across North Carolina: 20 years of expansion and an uncertain future *Lawrence Dorsey*	Is crappie year class strength set at the larval phase? Is larval crappie sampling worth the effort? *Adam Martin*	Genetic diversity and population structure of the Big Sandy Crayfish *Cambarus callainus*: utilizing genetics for captive propagation planning *Nicole Garrison*	Long-term monitoring informs data-poor marine species in the northern Gulf of Mexico *Kenneth Erickson*
11:30 AM	**STUDENT-MENTOR LUNCH 11:30 AM – 1:00 PM**			
1:00 PM	Alabama Bass threaten world class black bass fisheries in Tennessee *John Hammonds*	Black Crappie regulations and management in B. Everett Jordan Reservoir, NC *Kelsey Roberts*	Population genetics of an undescribed member of the upland Burrowing Crayfish complex, *Cambarus aff. dubius* *Megan Stubbs*	*<Talk Canceled>*
1:20 PM	Effects of introduced Alabama Bass on an existing Largemouth Bass fishery in Moss Lake, North Carolina *David Goodfred*	Long-term monitoring of Black Crappie *Pomoxis nigromaculatus* fisheries at two north central Florida lakes *Steven Beck*	Genetic structure of the primary Burrowing Crayfish *Distocambarus crockeri* in the Piedmont region of South Carolina *Zanethia Barnett*	Analysis of the impacts of the Gulf Menhaden fishery on the Spotted Seatrout stock in the northern Gulf of Mexico *Robert Leaf*
1:40 PM	An analysis of monitoring data for Largemouth Bass (*Micropterus salmoides*): Comparing Georgia reservoirs with low and high catches of *Micropterus spp.* *Jacob Daley*	Using multiple sampling methods to evaluate Black Crappie *Pomoxis nigromaculatus* populations in coastal rivers of North Carolina *Christopher Smith*	Genetic diversity of crayfish species within Georgia's southeastern coastal plain *Valeria Ensenat Rivera*	Niche structure for coastal sharks in the U.S. Southeast Atlantic and Gulf of Mexico *Kaitlyn O'Brien*
2:00 PM	Chattahoochee Bass distribution, genetic integrity, and habitat associations in the Chattahoochee River basin *Chad Kaiser*	Crappie management on Harry S Truman Reservoir: lessons learned and challenges ahead *Chris Brooke*	Genetic assessment of invasive crayfish dispersal in the coastal plain of the Pee Dee River Basin, U.S.A. *Matt Walker*	Mortality and movement of Greater Amberjack in the Gulf of Mexico and Atlantic Ocean off the Southeastern US *Samantha Young*
2:20 PM	Evaluating movement and habitat selection by Alabama Bass and Largemouth Bass in Lake Hartwell, South Carolina *Deon Kerr*	Long-term evaluation of Black Crappie growth in Florida's changing climate *Tyler Steven Coleman*	Utilization of genetic data to inform native Brook Trout conservation in North Carolina *Jacob Rash*	A meta-analysis of Red Snapper *Lutjanus campechanus* discard mortality in the Gulf of Mexico *Chloe Ramsay*
2:40 PM	Invasive Hybridization and Introgression Impacts of Alabama Bass in Georgia *Bryant Bowen*	Fish removal at Lake Wauberg to evaluate changes in growth of Black Crappie *Travis Tuten*	Population genetics as a conservation tool for the Robust Redhorse *Daniel Farrae*	A novel approach to examining spatial movement patterns of Gray Snapper and Sheepshead in Tampa Bay, Florida *Zoe Golden*
3:00 PM	**BREAK 3:00 PM - 3:30 PM**			

Start Time	ENTERPRISE 2ND FLOOR **Aquatic Connectivity Symposium** **10:30 AM – 3:00 PM** **Patrick Shirey, moderator**	HAMPTON 3 3RD FLOOR **Best Student Presentation Symposium** **10:30 AM – 5:30 PM** **Chas Gowan, moderator**	MADISON 3RD FLOOR **American Eel Symposium** **10:30 AM – 4:10 PM** **Stephen Curtis, moderator**	WASHINGTON 3RD FLOOR **Climate Change Symposium** **10:30 AM – 4:50 PM** **David Young, moderator**
10:30 AM	Integrating species-specific fish swimming ability Into a stream-crossing assessment framework *Ridge Sliger*	Effective and efficient or oversimplification? Experimentally testing the efficacy of a standardized barrier survey *Langston Haden*	Age, growth, and maturity of American Eel in the lower St. Johns River, Florida *Kim Bonvechio*	Fish assemblage structure along an existing aridity gradient mirrors future assemblage projections under climate change scenarios *Josh Perkin*
10:50 AM	Why did the federally listed fish cross (or not cross) the road? *Bernie Kuhajda*	Mussel community, habitat associations, and water quality in the Sabine River basin with emphasis on species that are candidates for federal listing *Caitlin Schoeck*	Evaluation of downstream migration of silver American Eel in the Susquehanna River basin *Rob Bourdon*	Examining literature trends with the Fish and Climate Change (FiCli) Database *Daria Gundermann*
11:10 AM	The impact of road crossing barriers on karst headwater endemic species in northwest Arkansas *Anthony Zenga*	Spatial segregation and shared landscape relationships of a crayfish assemblage of the Ozark Highlands *Jordan Ramey*	Population estimate and habitat associations of American eels in a hydroelectric reservoir *Carlos Lozano*	Structure and scale of spatial synchrony in southeastern US Brook Trout populations *George Valentine*
11:30 AM	**STUDENT-MENTOR LUNCH 11:30 AM – 1:00 PM**			
1:00 PM	Using a boosted regression tree model to predict road-stream crossing barrier severity scores in the Ouachita Mountain ecoregion in west-central Arkansas *Steve Lochmann*	Contributions of stocked and naturally produced Rainbow Trout *Oncorhynchus mykiss in* two Tennessee tailwater trout fisheries *Connor Ballard*	Predicting outmigration of American Eel *Anguilla rostrata* to improve eel survival at a hydroelectric facility on the Roanoke River, North Carolina *Chris Manhard*	How hatchery management of vulnerable stream fishes can predict impacts of climate change *Shannon Murphy*
1:20 PM	Assessing the unknown: understanding the degree of aquatic habitat fragmentation from road crossings in the southeastern United States *Kathleen Hoenke*	Multiple tracking methods reveal Guadalupe Bass dispersal is consistent with the restricted movement paradigm *Jacob Wolff*	Updated assessment of American Eel demographics at the Toledo Bend Hydropower Project, Sabine River, Gulf of Mexico *Robby Maxwell*	Using the electron transport system as an indicator of organismal thermal tolerance and respiration rate *Ehlana Stell*
1:40 PM	Stream fish assemblage and functional trait responses to dam removal *Luke Bower*	Estimating gear selectivity of Red Drum using 40+ years of tag-recapture data *Lukas Troha*	Age structure, growth, and movement patterns of American Eel in Texas *Nate Smith*	Addressing the need for lab experiments to fill the temperature gap in trait-based approaches in fishes *Britanny Harried*
2:00 PM	Simulating fish passage impacts on American Paddlefish metapopulation dynamics *Henry Hershey*	Diel behavior and home range of juvenile Sheepshead *Archosargus probatocephalus* associated with a commercial oyster lease determined by acoustic telemetry *Andrew McMains*	American eel recruitment, demographics, and disease in Virginia *Troy Tuckey*	Thermal tolerances and physiological responses of juvenile Tennessee Heelsplitter *Lasmigona holstonia* to environmentally relevant temperatures *Alissa Ganser*
2:20 PM	Road/stream crossing replacements in east Tennessee *Sally Petre*	Fine-scale movements and habitat use of recreationally important reef fishes *Ryan Tharp*	A database on larval Anguilliformes for biodiversity and ecological analyses *Katherine Dale*	Thermal vulnerability of spring associated fishes in an urbanizing, groundwater dependent stream *Nick Loveland*
2:40 PM	Volunteer angler data reveal social-ecological responses to habitat manipulation in a new water management area *Mariaguadalupe Vilchez*	Comparison of finfish and crustacean assemblages among established marsh terraces, new marsh terraces and open water in a restored brackish marsh *Shasta Kamara*	Developing an eel ramp network and utilizing eDNA sampling to monitor recruitment of juvenile American Eel *Anguilla rostrata* in Texas coastal drainages *Jillian Swinford*	Thermal regimes of groundwater dependent streams in south Texas: a case study of temperature monitoring in San Felipe Creek *Garrett Tucker*
3:00 PM	**BREAK 3:00 PM – 3:30 PM**			

	HAMPTON 1 3RD FLOOR	YORKTOWN-FRANKLIN-SHANGRI LA 2ND FLOOR	WILSON 3RD FLOOR	NORKFOLK 2 1ST FLOOR
Start Time	**Alabama Bass Introgression Symposium** **10:30 AM – 5:30 PM** **Steve Sammons, moderator**	**Crappie Symposium** **10:30 AM – 3:50 PM** **Kevin Dockendorf, moderator**	**Population Genetics Symposium** **10:30 AM – 5:10 PM** **Zanethia Barnett, moderator**	**Marine Fisheries Symposium** **10:30 AM – 5:30 PM** **Jim Morley/Brendan Runde, moderators**
3:30 PM	Angling effort and economic value of angling on three mid-size Alabama Rivers *Phil Carson*	Investigating potential impacts of live-imaging sonar on crappie fishing through creel surveys *Andrew Yung*	Using genetic techniques for the management and conservation of black basses in Georgia *Bryant Bowen*	Extent of suitable habitats for juvenile Striped Bass: dynamics and implications for recruitment in Chesapeake Bay *Rachel Dixon*
	Alabama Bass Introgression (cont.)	**Black Bass - Session 1** **3:50 PM - 5:30 PM** **Eric Brittle, moderator**	***Population Genetics (cont.)***	***Marine Fisheries (cont.)***
3:50 PM	Ecological correlates of native and nonnative black bass occurrence in the upper Savannah River basin *Brandon Peoples*	Impacts of Hurricane Michael on Shoal Bass within the Chipola River, Florida *Ryan Henry*	Genetic contributions of hatchery-stocked Walleye to Douglas Reservoir *Katherine Torrance*	Examining the relationship between flow and year-class strength of Striped Bass in the Roanoke River, North Carolina *Laura Lee*
4:10 PM	Survey of hybridization between sympatric Alabama Bass (*Micropterus henshalli*) and Redeye Bass (*M. coosae*) in the Mobile River Basin, Alabama *Matt Lewis*	Evaluation of population characteristic differences between Largemouth Bass and its backcross following Long-term Stocking in a large reservoir *Sean Lusk*	Genetic monitoring of Striped Bass *Morone saxatilis* stocking in South Carolina *Cameron Doll*	What a difference 45 years makes: Comparing nekton communities of the late 1970s with the 2020s for the Winyah Bay estuary *Bruce Pfirrmann*
4:30 PM	Effects of tagging on endemic Bartrams Bass and non-native Alabama Bass *Kathryn Lusk*	Environmental factors related to hatch timing of Shoal Bass *Micropterus cataractae* in the lower Flint River catchment *Jamie Rogers*	Genetic assignment of coastal Delaware Atlantic Sturgeon mixed stock assemblage *Cassia Busch*	Collapsed oyster populations in large Florida estuaries appear resistant to restoration using traditional cultching methods — insights from ongoing efforts in multiple systems *Bill Pine*
4:50 PM	What can island biogeography and shifting baseline syndrome tell us about the future of endemic black bass? *Steve Sammons*	Benefits to multi-jurisdictional monitoring of a premier catch-and-release Largemouth Bass fishery *Joe Love*	Not all who wander are lost: upstream migration of natal and non-natal Atlantic sturgeon in two mid-Atlantic rivers *Shannon White*	A novel and rapid qPCR probe assay for the detection of the roseovarius oyster disease bacterium *Aliiroseovarius crassostreae* in the Eastern Oyster *Crassostrea virginica* *Lengxob 'Lenny' Yong*
5:10 PM	Discussion *All*	Simulating Florida Bass stocking in southeastern reservoirs to inform duration and rate of stocking *Chris Middaugh*		How accurately can Sea Scallops be aged? *Sally Roman*
5:30 PM	**MEETING ADJOURN**			

	ENTERPRISE 2ND FLOOR	HAMPTON 3 3RD FLOOR	MADISON 3RD FLOOR	WASHINGTON 3RD FLOOR
Start Time	**Creel Surveys & Angler Attitudes Session** **3:30 PM – 5:30 PM** **Alan Weaver, moderator**	**Best Student Presentation Symposium** **10:30 AM – 5:30 PM** **Chas Gowan, moderator**	**American Eel Symposium** **10:30 AM – 4:10 PM** **Stephen Curtis, moderator**	**Climate Change Symposium** **10:30 AM – 4:50 PM** **David Young, moderator**
3:30 PM	Does the use of analogy change angler attitudes more than scientific evidence alone? *Steve Lochmann*	Habitat-specific abundance and mortality of juvenile blue crab *Callinectes sapidus* with Bayesian inference; influences of post-larval abundance, seasonality, and water clarity *A. Challen Hyman*	Spatial variability in growth, and prevalence of *Anguillicoloides crassus* in North American Eel populations *Aaron Bunch*	Increasing heatwave frequency in streams and rivers of the United States *Spencer Tassone*
3:50 PM	Regional and demographic patterns of early pandemic recreational fishing *Anna Kaz*	Gulf Sturgeon *Acipenser oxyrinchus desotoi* mesohabitat use in the lower Pearl River Louisiana-Mississippi *Amanda Popovich*	A cost-effective modification to an existing vertical slot fishway for improving upstream American eel passage *Michael Sears*	Vulnerability of the Virginia Department of Wildlife Resource's coastal assets to sea level rise *Clay Ferguson*
	Creel Surveys & Angler Attitudes (cont.)	***Best Student Presentation (cont.)***	**Techniques – Session 1** **4:10 PM – 5:30 PM** **Elizabeth Nyboer, moderator**	***Climate Change (cont.)***
4:10 PM	Using angler surveys & spatial analyses to inform management and R3 potential in stocked trout waters of West Virginia *Ross Andrew*	Microplastic presence in Dallas-Fort Worth lacustrine fish communities *Akshaya Mohan*	Investigating use of oxytetracycline in age estimation of fishes *Meredith Pfennig*	Change of Summer Flounder abundance in the Chesapeake Bay, and ecosystem-based evaluation *Josephine Oakley*
4:30 PM	Constraints to equitable access of marine protected areas in Florida, and tools to improve connection to these resources with implications to R3 initiatives *Christopher Schwinghamer*	Population characteristics and parasites of American Eel *Anguilla rostrata* in Puerto Rico *Ámbar Torres-Molinari*	Innovative electrofishing equipment: data, mapping, and standardization made simple *Patrick Cooney*	
	Creel Surveys & Angler Attitudes (cont.)	***Best Student Presentation (cont.)***	***Techniques – Session 1 (cont.)***	**Crayfish Session** **4:50 PM – 5:30 PM** **K. Chestnut-Faull, moderator**
4:50 PM	Validating recreational fishing effort estimates produced by a mail-based probability sample survey *Tiffanie Cross*	Context dependency of *Lepomis* nursery habitat in the lower Red River catchment *Paul Ramsey*	Gear bias of low-frequency electrofishing for sampling Blue Catfish populations in Oklahoma reservoirs *Austin Griffin*	Detection and identification of White Spot Syndrome Virus in farmed Louisiana crawfish *Mahala Gambill*
5:10 PM	Highs and lows of a tailwater: creel survey challenges and solutions for a large river trout fishery *Christy Graham*	Hot and bothered: thermal tolerance of Texas Hornshell *Popenaias popeii* in the Black River, New Mexico *Xenia L. Rangaswami*	Using environmental DNA (eDNA) to monitor river herring movement within the lower Roanoke River basin *Chase Spicer*	Captive care, rearing, and release of the imperiled Big Sandy Crayfish *Cambarus callainus* *James Hartley*
5:30 PM	**MEETING ADJOURN**			

	HAMPTON 1 3RD FLOOR	YORKTOWN-FRANKLIN-SHANGRI LA 2ND FLOOR	WILSON 3RD FLOOR	NORKFOLK 2 1ST FLOOR
Start Time	**Surveys, Monitoring, & Water Quality** **8:30 AM – 9:30 AM** **Jason Hallacher, moderator**	**Black Bass - Session 2** **8:30 AM – 9:50 AM** **Margaret Whitmore, moderator**	**Non-Game Fish Session** **8:30 AM – Noon** **Jeff Trollinger, moderator**	**Marine Fisheries Symposium** **8:30 AM – 11:40 AM** **Jim Morley, moderator**
8:30 AM	Survey evaluation of Florida's freshwater fisheries long-term monitoring program *Kim Bonvechio*	Assessing differences in feeding ecology among Neosho Bass, Smallmouth Bass, and their hybrids within Ozark highland streams *Anthony Rodger*	A non-lethal method for extracting diet Items from darters (Etheostomatinae) *Kyler Hecke*	Design and model-based approaches in estimating abundance of American Horseshoe Crab *Chad Wong*
8:50 AM	Leveraging a century of stream fisheries surveys to inform conservation listings in Oklahoma *Trevor Starks*	Effects of size-selective catch-and-release angling on population size structure of two black bass *Micropterus* species in an Alabama reservoir *TJ Pullen*	Short-term mortality of nongame fishes shot with bowfishing gear *Doug Zentner*	Environmental flow effects on fish passage in a fragmented coastal river: A Bayesian multistate modeling approach *Aaron Bunch*
9:10 AM	FishScales: A contemporary stream fish community database for the conterminous United States *Brandon Peoples*	Sportfish population characteristics following mechanical Largemouth Bass removal in two small public fishing impoundments in South Carolina *Preston Chrisman*	Assessing densities and habitat associations of the endangered *Etheostoma fonticola* using a long-term dataset *Melissa Wolter*	Modeling interactions among commercial shellfish fishing and wind energy *Sarah Borsetti*
9:30 AM		Estimating components of mortality for two Black Bass *Micropterus* at a large Alabama Reservoir with high catch-and-release angling *Max Rubino*	Population demographics of three Bufallofishes in the lower Red River *Daniel Bryant*	Accessibility and compatibility of fisheries-independent data in offshore wind areas *Will Shoup*
9:50 AM	**BREAK 9:50 - 10:20**			
	Sturgeon Session **10:20 AM – 11:40 AM** **Mike Bednarski, moderator**	**Black Bass – Session 3** **10:20 AM – Noon** **K. Chestnut-Faull, moderator**	***Non-Game Fish (cont.)***	***Marine Fisheries (cont.)***
10:20 AM	Population characteristics of juvenile Atlantic Sturgeon in the Winyah Bay system, SC *Derek Crane*	Movement of endemic Bartrams Bass and invasive Alabama Bass in Eastatoee Creek, SC *Tyler Zumwalt*	Morphological divergence of an undescribed catostomid, the Llano River Carpsucker *Carpiodes sp. cf. carpio* in the Colorado River basin, Texas *Hayden Roberts*	Net positive impact for offshore wind: terminology, quantification, and requirements *Brendan Runde*
10:40 AM	Climate change and water quality influence on Atlantic Sturgeon aggregation in the Altamaha River, Georgia *Maxwell Kleinhans*	Citizen science biosurveillance of Blotchy Bass Syndrome using a gamified smartphone application *Clayton Raines*	Spawning periodicity and public information use in the Bluehead Chub *Nocomis leptocephalus* *Thomas Bustamante*	Interannual variablity in morphometric condition of larval fishes as a function of environmental variables in Beaufort, NC *Reece Warfel*
11:00 AM	Oh, the places they'll go! Seasonal movements of juvenile Gulf Sturgeon in Pensacola Bay watershed *Kirsten Humphries*	Blotchy Bass Syndrome in the Lone Star State: a synergistic approach to citizen and agency science integration *Cynthia Holt*	Unwelcome visitors to Bluehead Chub *Nocomis leptocephalus* nests *Samantha Brooks*	The influence of marine protected areas, reef habitat, and human population on changes in fish diversity in the center of marine diversity *John Whalen*
11:20 AM	Flow regime and recruitment in Gulf Sturgeon in the Apalachicola River, Florida *Mark D'Ercole*	Tradeoffs between fishing quality and economic performance with increasing tournament effort in an Alabama Black Bass fishery *Natalie Coash*	Diel or no diel? Benthic fish assemblages on gravel bars vary with season, depth, and time of day *Chelsea Myles-McBurney*	Spatial differences of estuarine finfish community structure: a case study of South Carolina coastal estuaries *Elizabeth Bullard*
11:40 AM		Hybrid swarming of Neosho Bass with non-native Smallmouth Bass in the upper Illinois River basin and implications for individual growth *Kobe White*	Effects of extreme flow events on community composition and habitat complexity in groundwater dominated systems *Joshua Tivin*	
12:00 PM	**MEETING ADJOURN**			

	ENTERPRISE 2ND FLOOR	HAMPTON 3 3RD FLOOR	MADISON 3RD FLOOR	WASHINGTON 3RD FLOOR
Start Time	**Community Composition & Occupancy Session** **8:30 AM – 9:50 AM** **Dan Wilson, moderator**	**Non-native & Invasive Fish - Session 1** **8:30 AM – 9:50 AM** **Justin Heflin, moderator**	**Techniques – Session 2** **8:30 AM – 9:30 AM** **Eric Brittle, moderator**	**Habitat Session** **8:30 AM – 9:50 AM** **Steve Owens, moderator**
8:30 AM	Hydrogeological effects on spring-associated fish communities in the Edwards Plateau region of central Texas *Lauren Chappell*	Terrestrial capabilities of invasive fishes and their management implications *Noah Bressman*	Semi-anadromous Potomac River herring identified with otolith chemistry *T. Reid Nelson*	Enhancement of Beaver Lake fish habitat *Jon Stein*
8:50 AM	Creating a systematic prioritization of stream reaches for conservation of aquatic species *Alexander Kiser*	Lots of carp, but no spawning: the comings and goings of Bighead and Silver Carp *Aiden Maddux*	Evaluating consumer-grade live sonar for freshwater fisheries research *Kyle Rachels*	Summer habitat, exploitation, connectedness, and age structure of Striped Bass in the Ochlockonee River drainage, Florida *Stephen Stang*
9:10 AM	Testing responsiveness of stream fish functional traits to anthropogenic riverscape alterations *Noah Santee*	Movement behaviors of invasive Silver Carp *Hypophthalmichthys molitrix* in two rivers of central Arkansas *Andrew Althoff*	Differentiating between spawning and non-spawning habitat for Brown Trout using side-scan sonar from the Greers Ferry Tailwater, Arkansas *Derek Owens*	Role of flow and environmental variables on stream biodiversity *Joseph L. Mruzek*
9:30 AM	Freshwater conservation at scale: A 5-year review of successes, challenges and adaptive thinking *Jason Throneberry*	Environmental influences on Silver Carp population ecology across the Mississippi River basin *Jeff Stevens*	*<Talk Canceled>*	Endangered Species Act recovery criteria and expenditdures for fish management by USFWS *Patrick Shirey*
9:50 AM	**BREAK 9:50 AM – 10:20 AM**			
	Non-native & Invasive Fish – Session 2 **10:20 AM – 11:40 AM** **J. Odenkirk, moderator**	***Non-native & Invasive Fish - Session 1 (cont.)***	**Contributed Papers** **10:20 AM – Noon** **Kirk Smith, moderator**	**Alligator Gar** **10:20 AM – 11:20 AM** **Robert Humston, moderator**
10:20 AM	What's your niche? Who's eating what? *Tala Bleau*	Habitat use by Bighead Carp *Hypophthalmichthys nobilis* and Silver Carp *Hypophthalmichthys molitrix* in the lower Red River catchment *Benjamin D. Blrdsall*	Intra-annual ontogenetic growth variation in age-0 *Leiostomus xanthurus* *Annamaria Deitz*	Movement and habitat use of Alligator Gar in Pensacola Bay *Matthew Wegener*
10:40 AM	Testing the efficacy of an aquatic nuisance species removal method in an urbanized Caribbean Island stream *Wilson Xiong*	Assessing effects of Bigheaded Carp establishment on lower Mississippi River fish assemblages *Glen Jackson*	*<Talk Canceled>*	The guide-based Trinity River Alligator Gar tagging program: a win-win for management *Dan Daugherty*
11:00 AM	Assessing patterns of taxonomic homogenization of freshwater fishes across the conterminous United States *Billy Annis*	Advanced Bluegill stockings as an integrated pest management tool for biocontrol of Common Carp at Lake Mattamuskeet, North Carolina *Kevin Dockendorf*	Mercury trophodynamics in Great Smoky Mountains National Park streams: implications for Smallmouth Bass *Micropterus dolomieu* contamination *Z. Winston Clark*	A multiscale conceptual framework to predict movement and habitat associations of an imperiled megafish, the Alligator Gar *Atractosteus spatula* *Johnathan Ellard*
11:20 AM	Northern Snakehead recruitment variability and early-life history in Virginia tributaries of the Potomac River *Hae Kim*	Feeding and trophic ecology of invasive Blue Catfish *Ictalurus furcatus* in the Nanticoke River, MD/DE *Zachary Crum*	Importance of understanding and mitigating cyanobacteria in fisheries management programs *David Beasley*	
11:40 AM		Regional variation provides context for differences in non-native stream fish drivers at a local scale *Lily Thompson*	Can Threadfin Shad and juvenile Paddlefish impact noxious planktonic Cyanobacteria? *Peter Perschbacher*	
12:00 PM	**MEETING ADJOURN**			

POSTER PRESENTATIONS

ǂ Best Student Poster Candidate
***Presenter**

MARINE

ǂ 1. Feeding Habits of *Carcharhinus plumbeus*, off of the Southeast U.S Coast From 2006–2022

Emma Jackson (NOAA Hollings Scholar; University of South Carolina), John Carlson (National Marine Fisheries Service)*

2. Hatchery capacity needed to support Atlantic surfclam fishery enhancement

Caela Gilsinan (William and Mary - Virginia Institute of Marine Science), Dr's. Andrew Scheld and Sarah Borsetti (William and Mary - Virginia Institute of Marine Science), Dr. Daphne Munroe (Rutgers the State University of New Jersey, Haskin Shellfish Research Laboratory)*

3. Assessing the ecological impacts of remnant hydrological modifications on the integrity of barrier island freshwater habitats

Raymond P. Kidder II (Georgia Southern University), Dr. J. Checo Colon-Gaud (Georgia Southern Biology Department), Dr. Rachel Guy (Sapelo Island National Estuarine Research Reserve)*

4. Artificial illumination of trawl gear components to reduce Pacific halibut bycatch in the US West Coast bottom trawl fishery

Derek Jackson (Virginia Institute of Marine Science)*

5. Using DNA Metabarcoding to Characterize the Rufa Red Knot's (*Calidris canutus rufa*) diet at Grand Isle and the Chandeleur Islands

Wyatt Voelker (Nicholls State University), Dr. Justine Whitaker (Nicholls State University)*

6. Examining home range trends of reef fish on North Carolina artificial reefs

Reese Dorroh (North Carolina State University), Jeffrey Buckel, Ryan Tharp (North Carolina State University)*

7. Juvenile Gulf Sturgeon Dynamics in the Pensacola Bay Watershed

Bradford Warland (Florida Fish and Wildlife Conservation Commission), Kirsten Humphries, John Knight*

ǂ 8. Whole genome sequencing of century-old Philippine reef fishes

Roy Roberts (Texas A&M University - Coprus Christi), Sharon Magnuson (Texas A&M University - Coprus Christi), Christopher E. Bird (Texas A&M University - Coprus Christi)*

9. Benthic tray sampling and electrofishing capture different changes in nekton assemblages as restored reef complexity changes

Sean Kinney (Louisiana Department of Wildlife and Fisheries), Melanie Bates (School of Renewable Natural Resources, Louisiana State University Agricultural Center), Steve Midway (Department of Oceanography and Coastal Sciences, Louisiana State University), Megan La Peyre (U.S. Geological Survey, Louisiana Fish and Wildlife Cooperative Research Unit, School of Renewable Natural Resources, Louisiana State University Agricultural Center)*

10. Investigating centennial genetic changes at an epicenter of marine biodiversity through short-read genome assemblies

Jemelyn Grace Baldisimo (Old Dominion University), Eric Garcia (Old Dominion University), Abner Bucol (Silliman University), Rene Clark (Rutgers University), Brendan Reid (Rutgers University), Roy Roberts (Texas A&M University-Corpus Christi), John Whalen (Old Dominion University), Chris Bird (Texas A&M University-Corpus Christi)*

HUMAN DIMENSIONS

ǂ 11. Fishing Preferences of Urban Anglers in the Metro-area of Richmond, Virginia

Sophie Bels (Christopher Newport University), Rene X. Valdez (Virginia Department of Wildlife Resources), Mallory G. White (Virginia Department of Wildlife Resources), Clint Morgeson (Virginia Department of Wildlife Resources)*

12. U.S. inland creel programs: a review and management recommendations

Anna L. Kaz (Louisiana State University), Stephen R. Midway (Louisiana State University)*

13. Development of the Blue Ridge Snorkel Trail in North Carolina

Luke Etchison (NC Wildlife Resources Commission), Andrea Leslie (NC Wildlife Resources Commission)*

14. A New Open Textbook for Nonmajors: Fish, Fishing, and Conservation

Donald J. Orth (Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University), Anita R. Walz and Kindred Grey (Virginia Polytechnic Institute and State University, University Libraries)*

CRAYFISH

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

Anna Raney (School of Natural Resources, University of Missouri), Jacob Westhoff (U.S. Geological Survey, Missouri Cooperative Fish and Wildlife Research Unit, School of Natural Resources)*

ǂ 16. Taxonomic Standing and Genetic Surveillance of *Cambarus jezerinaci* in Kentucky

Cassidy Gebhardt (West Liberty University), Nicole Garrison and Zachary Loughman (West Liberty University)*

ǂ 17. Conservation and taxonomic assessment of an undescribed crayfish species complex in coastal Virginia.

Alyssa Oppedisano (West Liberty University), Dr. Zachary Loughman (West Liberty University, Department of Organismal Biology, Ecology, & Zoo Sciences), Dr. Sujan Henkanaththegedara (Longwood University, Department of Biological & Environmental Sciences), Dr. Paul Cabe (Washington and Lee University, Department of Biology)*

18. Distribution of *Procambarus pearsei* and *Procambarus braswelli* in North Carolina and the effects of P. clarkii invasion

Robert Adams (Appalachian State University), S.J. Busch, E.J.Thompson, R.P Creed, and M.M Gangloff (Appalachian State University)*

19. Conservation Assessment and Genetic Haplotype Mapping of the Greenbrier Cave Crayfish (*Cambarus nerterius*)

Addie Shanor (West Liberty University), Dr. Zachary Loughman (West Liberty University), Dr. Nicole Garrison (West Liberty University)*

20. "Home is where you make it" Exploring genetic variation in populations of the red claw crayfish (*Cherax quadricarinatus*) introduced to the island of Puerto Rico

Nicholas A. Macias (Georgia Southern University), Dr. Checo Colon-Gaud (Georgia Southern University), Dr. J. Scott Harrison (Georgia Southern University)*

MUSSELS

21. Identification of host fish species parasitized by freshwater mussels of Florida

Kallie Thornhill (Florida Fish & Wildlife Conservation Commission- FWRI), Susan Geda (FWC), and Lauren Patterson (FWC)*

22. Application of the Microrefugia Concept to explain disjunct and peripheral mussel and fish populations near endemic-rich Edwards Plateau (central Texas)

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

23. Molecular identification of freshwater mussel glochidia from naturally parasitized fish in a small stream community

Olivia Poelmann (Clemson University),*

24. Spatial distribution and habitat associations of mussel and fish communities in the upper Guadalupe River basin (TX) during extreme drought

Zachary Hutchens (Department of Biology, Texas State University), Timothy Bonner (Department of Biology, Texas State University)*

ǂ 25. Reproductive Periodicity in a Threatened Freshwater Mussel: *Pleurobema ridellii*

Alexander Zalmat (Texas State University), Timmothy Bonner PhD (Texas State University)*

RIVERS/STREAMS

ǂ 26. Comparison of Redfin Darter (*Etheostoma whipplei*) Diets from Two Spatially-Distinct Streams in the Arkansas River Valley.

Ben Johnson (Arkansas Tech University, Department of Biological Sciences), Ethan Dodson (Arkansas Tech University, Department of Biological Sciences), Kyler Hecke (Arkansas Tech University, Department of Biological Sciences)*

27. Spatial and temporal variation in food affects habitat choice in competing brook trout

Eliza Brooks (Randolph-Macon College), Charles Gowan (Randolph-Macon College)*

ǂ 28. Longitudinal Assessment of Fish Communities of Moro Creek, Arkansas.

Andrew Julian (Arkansas Tech University), Dr. Kyler Hecke (ATU)*

ǂ 29. Assessing Biota and Environmental Characteristics Above and Below a Low-head Dam
Trevor Alexander (Western Carolina University), Keith Gibbs (WCU) & Tom Martin (WCU)*

ǂ 30. Reproduction and diet of the Harlequin Darter in the Neches River basin of Texas
Daisy Blake (Texas State University), Dr. Timothy Bonner (Texas State University)*

ǂ 31. Rare and Endangered Species Habitat Modeling in the Upper Little Tennessee River Basin
James Miles (Western Carolina University), Keith Gibbs (WCU), and Tom Martin (WCU)*

ǂ 32. Spatiotemporal variability in abundance and biomass of Mississippi River floodplain associated fish species
Adam H. Quade (Coastal Behavioral Ecology Lab, Louisiana Universities Marine Consortium; Fish Morphology and Behavior Lab, Department of Biological Sciences, University of New Orleans), Kelly S. Boyle (Fish Morphology and Behavior Lab, Department of Biological Sciences, University of New Orleans) Guillaume Rieucau (Coastal Behavioral Ecology Lab, Louisiana Universities Marine Consortium)*

SNAKEHEAD

33. Removal of Northern Snakehead from Conowingo Dam Fish Lifts in Upper Chesapeake Bay
Joseph Love (Maryland Department of Natural Resources)*

34. The Distribution of Per- and Polyfluoroalkyl Substances in Northern Snakehead of the Potomac River: Implications for Potential Consumption Limits
Tabitha King (George Mason University), T. Reid Nelson (George Mason University), Tom Huff (George Mason University)*

35. Seasonal movements of a native species, Bowfin (*Amia calva*), and an invasive species, the Northern Snakehead (*Channa argus*) in the Piankatank River, Virginia.
Patrick McGrath (Virginia Institute of Marine Science), Eric Hilton*

GENETICS

36. Making sausage with countless cooks; combining genetic and acoustic telemetry data from many collaborators to understand coastwide migration patterns of Atlantic Sturgeon
Dewayne Fox (Delaware State University), Matthew Breece (University of Delaware), David Kazyak (USGS), Matthew Balazik (USACE), Hal Brundage (Environmental Research and Consulting Inc.), Keith Dunton (Monmouth University), Adam Fox (University of Georgia), Mike Frisk (Stony Brook University), Christian Hager (Chesapeake Scientific), Danielle Haulsee (Hubbs Seaworld Research Institute), Amanda Higgs (Cornell University), Eric Hilton (Virginia Institute of Marine Sciences), Joe Iafrates (US Navy), Robin Johnson (USGS), Jason Kahn (NMFS), Micah Kieffer (USGS), Michael Loeffler (North Carolina Division of Marine Fisheries), Barbara Lubinski (USGS), Pat McGrath (Virginia Institute of Marine Sciences), Mike O'Brien (University of Maryland), Ian Park (Delaware Division of Fish and Wildlife), Bill Post (South Carolina Department of Natural Resources), Eric Reyier (NASA), Tom Savoy (Department of Energy and Environmental Protection), Dave Secor (University of Maryland), James Sulikowski (Arizona State University), Carter Watterson (US Navy), Shannon White (USGS), Gayle Zydlewski (University of Maine)*

37. Effectiveness of Reduced Representation Sequencing on Century-Old Ethanol-Preserved Museum Fishes
Eric Garcia (Old Dominion University), Martin French (Texas A&M University-Corpus Christi), Chris Bird (Texas A&M University-Corpus Christi)*

MISCELLANEOUS

38. Alligator Gar Research in Pensacola Bay
Calvin Beech (Florida Fish and Wildlife Conservation Commission), Amanda Mattair (Florida Fish and Wildlife Conservation Commission), Mathew Wegener (Florida Fish and Wildlife Conservation Commission)*

ǂ 39. Developing a joint species, spatially dependent physiologically guided abundance model to improve predictions under future climate change scenarios
Christopher A Custer (Pennsylvania Cooperative Fish and Wildlife Research Unit, Intercollege Graduate Degree Program in Ecology, Pennsylvania State University), Erin M. Schliep (Department of Statistics, North Carolina State University), Joshua S. North (Earth and Environmental Sciences, Lawrence Berkeley National Laboratory), Gretchen J.A. Hansen (Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota), Holly Kundel (Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota), Jenna K.R. Nelson (Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota), Tyler Wagner (U.S. Geological Survey, Pennsylvania Cooperative Fish and Wildlife Research Unit, The Pennsylvania State University)*

ǂ 40. Do electrofishing catch rates of Alabama Bass and Largemouth Bass differ between day and night?
Isabel Tiller (Clemson University), Adam Smallridge (Clemson University), Madison Byars (Clemson University), Brittany Darrington (Clemson University), Andrew Peel (Clemson University), Preston Chrisman (SCDNR), William Wood (SCDNR), Deon Kerr (Clemson University), Troy Farmer (Clemson University)*

NOTES

NOTES

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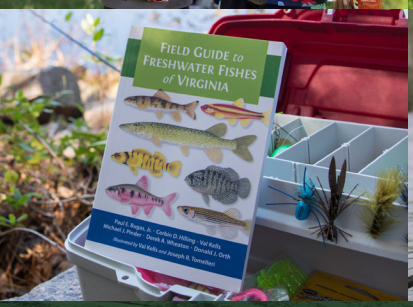



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Saturday, February 4th
Grand Social
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Dinner Menu

STATION ONE

CAESAR SALAD

Crisp hearts of Romaine Lettuce, Grated Parmesan Cheese, Zesty Croutons, Freshly Shaved Parmesan; Caesar Dressing

SMOKED BEEF BRISKET

BBQ Sauce

STATION TWO

PULLED PORK BBQ

BBQ Sauce

GRILLED VEGETABLE DISPLAY

An elaborate display of grilled vegetables featuring:
Roasted Eggplant, Zucchini, Yellow Squash, Carrots, Roasted Garlic, Asparagus, Portabella Mushrooms, Red Onions and Red Pepper, Drizzled with Olive Oil & Balsamic Vinegar
Served with Garlic Hummus & Pita

STATION THREE

PARMESAN ENCRUSTED BONELESS CHICKEN BREAST

Lemon Buerre Blanc

PENNE PASTA WITH FRESH BASIL CREAM, SHIITAKE MUSHROOMS, SUN-DRIED TOMATO, PARMESAN & HERBS

Beverages

BAR

STANDARD FULL BAR

This bar package includes the following:

Bud Light, Corona, Devils Backbone Vienna Lager
Standard House Wine

Mixers:
Coke, Diet Coke, Sprite, Ginger Ale, Cranberry Juice, Orange Juice, Grapefruit Juice, Pineapple Juice, Sour Mix, Soda & Tonic Water, Bottled Water, Limes, Lemons, Maraschino Cherries, Olives, Beverage Napkins & Straws

CASH BAR - MIXED DRINKS ONLY

Guests to pay cash for any liquor and mixed drinks - at one bar only

This bar package includes the following:
Tito's Vodka, Tanqueray, Jack Daniels, & Bacardi

$ 8 per drink

Movement behaviors of invasive Silver Carp Hypop*hthalmichthys molitrix* in two rivers of central Arkansas

Andrew Althoff* (University of Arkansas at Pine Bluff), Jeffery Stevens UAPB, Steve Lochmann UAPB, Jamie Kindschuh AGFC, Jonathan Spurgeon University of Nebraska - Lincoln

Silver Carp *Hypophthalmichthys molitrix* is an invasive species found throughout the Mississippi River basin. Silver Carp are notorious for "jumping" when disturbed, posing a health risk to boaters and a risk to boats and equipment. Many studies have looked at movement behaviors of this species to help develop strategies for controlling their spread. These studies have predominately taken place in the upper Mississippi River and its tributaries. Movement studies are much less common in the lower Mississippi River. Between June 2021 and May 2022, we quantified movement distances, rates, home ranges, and main-channel residency periods of 105 Silver Carp in the free-flowing lower White River and regulated lower Arkansas using passive acoustic telemetry arrays and internal implant acoustic transmitters. Silver Carp in the White River were picked up more times by acoustic receivers, moved greater distances, and covered larger home ranges than Silver Carp in the Arkansas River. Movement rates were similar between rivers. Main-channel residency periods varied based on river and season. Overall, movement patterns suggest movement of Silver Carp in the Arkansas River is limited by the numerous locks and dams of the McClellan Kerr Arkansas River Navigation System.

Primary Contact: Andrew Althoff (althofa9260@uapb.edu)

Using angler surveys & spatial analyses to inform management and R3 potential in stocked trout waters of West Virginia

Ross Andrew* (West Virginia University), Chris Schwinghamer (WVU), Robert Burns (WVU), Kyle Hartman (WVU)

The West Virginia Division of Natural Resources (WVDNR) annually stocks trout into lakes and streams to provide recreational fishing opportunities. This study examined human dimensions of trout anglers related to the WVDNR stocking program throughout West Virginia. An online survey was developed and distributed to over 9,000 anglers who purchased a trout stamp in 2020, resulting in nearly 1,800 completed responses. Anglers were asked about fishing effort, travel patterns, and perceptions of crowding and satisfaction with their fishing experience (rated on a 10-point scale). Demographic and location data were also collected and analyzed in the context of trout stocking perception scores. On average, respondents rated the overall quality of the trout stocking program in WV as "fair to good" (6.7/10) with 58% of respondents rating the program as "good" or "excellent". Anglers felt "slightly to moderately" crowded during their time at stocked fishing locations. Significant positive trends were identified between quality rating and angler age and distance traveled to fishing location. Spatially, significant clusters were identified for low quality ratings in several areas of the state. These areas also represented significant spatial clusters for respondents with lower age and relatively fewer years of trout stamp purchase. Location data combined with angler perception scores and survey metrics were used to develop interpolation surfaces for general perception trends across the state. Understanding the location of anglers with high and low perception ratings of trout stocking activities can help inform managers and administrators of locations with higher or lower R3 potential.

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Assessing patterns of taxonomic homogenization of freshwater fishes across the conterminous United States

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Biotic homogenization is the reshuffling of communities due to nonnative introductions and the extirpation of unique species, leading to decreased beta diversity. Freshwater fish communities are becoming homogenized across the globe and are the subject of numerous regional analyses. While homogenization of freshwater fish communities is relatively well-studied, most studies are focused at regional scales, which might miss large scale patterns. This study seeks to fill this gap by examining homogenization at the continental scale using a freshwater fish community dataset covering the conterminous United States. Fish occurrence data from this dataset will be aggregated to the HUC8 watershed scale representing discrete contemporary communities. Historic fish communities will be created using the NatureServe's Digital Distribution Maps of the Freshwater Fishes of the Conterminous United States. Beta diversity will be calculated at each time step as the pairwise dissimilarity between each unique pair of communities using the Sorensen Dissimilarity Index and partitioned into nestedness and turnover components, resulting in three measures of beta diversity. Partitioning beta diversity allows a greater mechanistic understanding of homogenization and can improve the detection of homogenization. A Bayesian correlation analysis will be used to calculate the correlations between each beta diversity measure at each time step and test if mean beta diversity values and correlation coefficients differ over time. A decrease in mean beta diversity values would indicate that freshwater fish communities have homogenized and a change in the correlation coefficients would indicate that fundamental diversity relationships have changed over time.

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Contributions of stocked and naturally reproduced Rainbow Trout *Oncorhynchus mykiss* to two Tennessee tailwater trout fisheries

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Natural reproduction of Rainbow Trout *Oncorhynchus mykiss* is uncommon in southeastern hydropeaking tailwater trout fisheries. As a result, tailwater fisheries typically rely on periodic stocking of hatchery fish. Norris and Fort Patrick Henry tailwaters are both popular stocked Rainbow Trout fisheries in Tennessee. In recent years, wild young-of-the-year Rainbow Trout have been observed in both tailwaters. The objective of this research is to better understand how stocked fingerling (TL <150 mm), stocked catchable-size (TL > 200 mm), and naturally reproduced Rainbow Trout contribute to these two fisheries. From 2019-2022 we marked hatchery Rainbow Trout with coded wire tags and/or fin clips prior to stocking in Fort Patrick Henry and Norris tailwater. While following a robust mark-recapture sampling design, we used a combination of backpack and boat electrofishing to sample the tailwaters. Naturally reproduced Rainbow Trout were present in both tailwaters and were particularly abundant in Norris tailwater, where they may represent a large portion of the Rainbow Trout population. Hatchery fingerlings recruited poorly in both fisheries and may not be viable in systems where survival of hatchery trout is poor. By understanding how these different Rainbow Trout cohorts contribute to the fisheries, Tennessee Wildlife Resources Agency can adapt stocking to maximize return to creel and angler satisfaction. Other southeastern U.S. tailwater trout fisheries should be evaluated periodically in order to use stocking resources efficiently and to detect natural reproduction of tailwater trout.

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Genetic structure of the primary Burrowing Crayfish *Distocambarus crockeri* in the Piedmont Region of South Carolina

Zanethia Barnett* (USDA Forest Service, Southern Research Station)

The southeastern United States is a global hotspot for crayfish diversity, with more than 300 described species in the region. Crayfish that are found far from surface water spend most of their life in and around burrows and are considered primary burrowers. Primary burrowers constitute a small subset of the United States crayfish fauna (15%), but they represent a disproportionate number (32%) of the imperiled species. *Distocambarus crokeri* is a primary burrowing crayfish that is limited to Piedmont region of South Carolina and strongly associated with open-canopy prairie like habitats. Because of its limited distribution and loss of essential habitat, conserving this species is necessary to prevent its loss. In this study we will assess the genetic diversity and structure of *D. crockeri* throughout Sumter National Forest using mtDNA. We will also use this data to assess land use that facilitates or resist gene flow. Findings from this study can be used to plan for the impacts of recent and future land use changes, providing guidance for conservation management. These findings may also be transferrable to other *Distocambarus* species and other primary burrowing crayfishes.

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Importance of understanding and mitigating cyanobacteria in fisheries management programs

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Algae function as a large source of food for aquatic organisms and are a critical component of bottom-up ecosystem management especially for a healthy fishery. In many fisheries programs, fertilizer is amended to promote overall algal productivity. However, Cyanobacteria (aka blue-green algae) often arise and dominate a system if not managed appropriately. Cyanobacteria are not easily consumed nor support trophic transfer of nutrients. Additionally, they cause direct stress to the aquatic community from toxin production and indirect stress from swings in pH, dissolved oxygen, etc. Understanding specific nutrients to amend or remove is critical to selecting for a beneficial algal assemblage. Independent or in concert with this, strategic use of algaecides can selectively control the cyanobacteria while allowing beneficial algae to persist. In addition to other management techniques, data will be presented in incorporation of algaecides to selectively control nuisance cyanobacteria and maintain a better assemblage without cyanobacterial dominance. Multiple management approaches are needed to offset cyanobacterial growth and dominance in freshwater systems. This research will assist managers in ecologically sound directions to select for more beneficial algal assemblages to support a fisheries management program.

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Long-term monitoring of Black Crappie *Pomoxis nigromaculatus* fisheries at two north central Florida lakes

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Lochloosa and Newnans lakes contain some of the most popular Black Crappie *Pomoxis nigromaculatus* fisheries in Florida and have been extensively monitored for decades. This long-term dataset has spanned multiple drought and flood events and improved with method standardization. Trawl surveys have been conducted in both lakes annually since 1998 to monitor relative abundance and age distribution. In Lochloosa Lake, roving creel surveys have been conducted annually since 2006 to monitor fishery performance (angler effort, catch, and harvest). Fish carcasses have been collected from Lochloosa Lake during each creel survey to document size and age distribution of harvested fish. In 2015, an annual roving creel survey was started in Newnans Lake. Black Crappie have been tagged in both lakes annually since 2015 to monitor exploitation. Black Crappie productivity in these lakes is characteristically highly variable and relationships between water level, relative abundance, fishery performance, and exploitation have been observed. Patterns of fishery performance on these two lakes in relation to neighboring Orange Lake have also emerged. These data have enabled fishery performance forecasting, population modeling to inform statewide regulation review, and are being considered for adaptive management applications.

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Habitat use by Bighead Carp *Hypophthalmichthys nobilis* and Silver Carp *H. molitrix* in the lower Red River catchment

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The importance of understanding multi-scale habitat use is well established as related to developing meaningful conservation and management actions for both native and non-native species. Bighead Carp Hypophthalmichthys nobilis and Silver Carp Hypophthalmichthys molitrix are two invasive fishes, and their habitat use has been documented in portions of the central United States; however, new invasion fronts have occurred in novel river catchments that possess different physicochemical conditions. Bighead Carp and Silver Carp were first detected in the lower Red River catchment of Oklahoma, Texas, and Arkansas in 2012, and very little is known about this population. We assessed Bighead Carp and Silver Carp summer habitat use within an occupancy framework across reaches nested within river segments and catchments. We surveyed each of 45 sites 2-3 times using electrofishing and gill netting during the summers of 2021 and 2022. Preliminary modeling results indicate that Silver Carp detection was positively associated with electrofishing effort (sec), whereas, Bighead Carp detection was positively associated with water temperature (°C). Occupancy of both species was negatively associated with river segment sinuosity and reach-scale with-to-depth ratios. If the goal is to increase the effectiveness of removal efforts, then we recommend that efforts should target locations characterized by low sinuosity and relatively narrow and deep channels.

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What’s your niche? Who's eating what?

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Cichlids have been invading Florida since the 1940’s and the extent of their impacts on the feeding ecology of native species has not been fully described. The feeding ecology of Mayan Cichlids, Oscars, and Tilapia in the Everglades was examined, and percent stomach content was determined for each species. The diet of Mayan Cichlids was comprised of 38% gastropods, 24% fish, 14% insects, 6% shrimp, and 3% nematodes. The Oscar's diet consisted of 59% insects and 41% crayfish. Tilapia were found to have 100% algae in their stomachs. The feeding ecology of all three cichlid species overlaps with native Rock Bass, Warmouth, and Bluegill. Gastropods made up 90% of items in Rock Bass stomachs and 7% of items in Bluegill stomachs, which were being used as part of the Mayan Cichlid’s diet. Insects made up 39% of items in Warmouth stomachs and 80% of items in Bluegill stomachs, of which both Mayan Cichlids and Oscars fed upon. Algae made up 61% of the Warmouth’s diet, which was also being consumed by Tilapia. Nematodes made up 3% of items in Rock Bass stomachs and 4% of items in Bluegill stomachs, which were also consumed by Mayan Cichlids. This information was used to inform impacts of invasive cichlids 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.

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Age, growth, and maturity of American Eel in the lower St. Johns River, Florida

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Jessica Carroll, Florida Fish and Wildlife Conservation Commission

The American Eel *Anguilla rostrata* stock is in a state of decline with the species facing a myriad of threats from across its large geographic range. There is a paucity of information about American Eel populations in much of its range, including Florida. This study aims to collect important life history and population dynamics data for the lower St. Johns River eel population, the first study of its kind in Florida. During a twelve-week period from August to November 2021 and September to December 2022, eels were collected from ~90 rkm via boat electrofishing. Catch rates were low with only 250 eels collected to date despite more than 57 hrs of sampling effort. Overall, fish ranged in size from 150 to 652 TL and were primarily collected in the lowest reach of the river in shallow (< 1-m) habitats containing riprap, woody snag, and emergent vegetation. Adult *Anguillicoloides crassus* parasites were observed in 37% of individuals, and 58% exhibited some level of damaged swim bladder as indicated by non-zero swim bladder degenerative index (SDI) scores. No differences in length-weight relationships were observed between fish with impacted or unimpacted swim bladders or those with or without active infections. Fish samples are currently still being processed, but histological examination of gonads from 87 eels collected in 2021 revealed most were immature females or undifferentiated. Additional sex, gonad staging, and age data will provide critical inputs for describing the sex-specific growth rate and maturity of eels in the St. Johns River.

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Survey evaluation of Florida's freshwater fisheries long-term monitoring program

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Natural resource monitoring programs benefit from routine evaluation to assess if objectives and goals are being met and to identify areas for improvement. We used Florida's statewide Freshwater Fisheries Long-Term Monitoring (LTM) program to show how user-group surveys can be integral to the evaluation process of a monitoring program. In 2022, an email survey was sent to state agency personnel who collect, enter, or use freshwater fisheries data for fisheries and habitat management purposes. Focusing specifically on the LTM program, the survey was able to address four main objectives: to 1) evaluate the LTM program at its 15-year mark; 2) compare results with a similar survey conducted at the 5-year mark; 3) compare results among groups based on experience and functional role; and 4) develop recommendations for strategic initiatives to further improve the program in the future. The survey consisted of 43 questions split into six main sections: demographics; field sampling; data entry, summary and reporting; management decision support; programmatic views; and additional input. Of the 144 individuals sent the survey, information was received from 73 individuals with roles in fisheries management, fisheries research, and habitat management. Respondents generally had a positive view of the LTM program and its components, but the survey revealed important differences among groups of respondents and identified initiatives and evaluations that can be prioritized in the future. Surveys like this one are an important step in the evaluation process, providing valuable stakeholder input for gauging progress and planning for future management needs.

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Modeling interactions among commercial shellfish fishing and wind energy

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The lucrative shellfish fisheries operating on the Northeast U.S. continental shelf are highly vulnerable to impacts from offshore wind energy development because of the overlap of large areas proposed for wind energy and fishing grounds, limitations to access for bottom-tending gear towed by large vessels, and the high value of the landed product. The economic impacts of future offshore wind farms on these fisheries are evaluated using a modeling framework that integrates spatial dynamics in stock biology, fishery captain and fleet behavior, federal management decisions, and fishery economics. The simulations implemented with the model consider the impacts of proposed wind array configurations on the fisheries that result from anticipated vessel responses to array and turbine locations and responses of stock population dynamics to changing environmental conditions. The simulations are constrained by stock assessment data and detailed input from industry advisory teams about fleet and captain behavior. The model will also be implemented to project responses and consequent impacts on the fishery resulting from stock range shifts, as may occur with climate warming, rotational closures, and management changes. The simulation results provide understanding and identification of the costs to these shellfish fisheries and their surveys produced by displacement or changes in fishing activity due to wind energy and a warming climate. This information is critical for industry and fishery managers to assess approaches for mitigating interactions between commercial fisheries, the growing offshore wind industry, and changing environmental conditions.

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Evaluation of downstream migration of silver American Eel in the Susquehanna River basin

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Following a consistent trap and transport effort (2008-present) translocating American eels *Anguilla rostrata* upstream of four hydroelectric dams in the lower Susquehanna River, the US Fish and Wildlife Service, in partnership with hydroelectric dam operators, initiated a three-year study of downstream silver eel migration in August 2021. This project will 1) describe the timing and duration of downstream eel migration, 2) determine the environmental variables that are associated with migration events, 3) calculate cumulative survival of eels during passage through the lower Susquehanna River, and 4) describe the impacts of hydroelectric operation on downstream passage. As of September 2022, 117 mature American eels have been surgically tagged with InnovaSea model V13-1x acoustic tags. All eels were captured and released upriver of York Haven Dam, the most upstream of the four lower Susquehanna main stem dams. A series of nine acoustic receiver arrays will monitor the outmigration of these eels from Harrisburg, PA downstream to Havre de Grace, MD as they attempt to navigate past these hydroelectric facilities. An additional 100 mature eels will be tagged in summer 2023 and tracked through the conclusion of the study in spring 2024. Results of this project will be used to inform potential mitigation strategies to increase eel survival and decrease delays during outmigration.

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Using genetic techniques for management and conservation of black basses in Georgia

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Black bass are the most sought-after sport fishes in the country and many state fisheries agencies, including Georgia, consider black bass management a high priority. Georgia's world-renowned black bass fisheries are made up of at least twelve species of black bass and produced the world record Largemouth bass, making Georgia the black bass capitol of the world. There has never been a more exciting time to study and promote black bass fisheries, but with this excitement brings the need to understand, conserve and manage these diverse and sometimes fragile natural resources. Georgia DNR has been actively increasing black bass management across the state over the past decade and has incorporated molecular tools to gather data on our black bass populations. Since 2013, GADNR has been working with Auburn's Aquatic Genetics and Genomics laboratory, using SNP's, to analyze genetic material from all our black bass populations to better understand the distribution of our endemic black bass genes. Our main objectives are to resolve the current levels of introgression among populations of Largemouth bass, Florida bass, and their interspecific hybrids from reservoirs, lakes and rivers across the state and to describe the hybridization impacts on our native black bass species. Our goal is to define and understand the genetic diversity partitioned across the state to not only preserve this abundant genetic diversity statewide across our diverse black bass fisheries but to also provide supportive conservation materials if populations are diminished. Determining these genetic population characteristics using the latest and most sensitive technology will inform future management efforts for black bass to protect the genetic heritage of our diverse populations and ensure the highest quality black bass fisheries for our anglers.

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Invasive hybridization and introgression impacts of Alabama Bass in Georgia

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Alabama Bass were introduced into Georgia reservoirs in the 80's or maybe even earlier to increase catches at fishing tournaments. Once introduced, Alabama Bass started competing with native black bass populations across the state. Soon after, Alabama Bass started radiating up into the headwaters of these reservoirs and began to hybridize with native and in some instances endemic black bass populations. Georgia DNR had no data of the extent of this hybridization or if any introgression issues existed or would arise. Georgia DNR has been actively increasing black bass management across the state over the past decade and has incorporated molecular tools to gather data on our black bass populations. Since 2013, GADNR has been working with Auburn's Aquatic Genetics and Genomics laboratory, using SNP's, to analyze genetic material from all our black bass populations to better understand the distribution of our endemic black bass genes. One of our main objectives was to describe the hybridization impacts on native black bass species and to resolve the current levels of introgression. Our goal is to define and understand the genetic diversity partitioned across the state to not only preserve this abundant genetic diversity statewide across our diverse black bass fisheries but to also provide supportive conservation materials if populations are diminished.

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Stream fish assemblage and functional trait responses to dam removal

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Dam removal is an effective way of restoring riverine systems, yet few studies have explored the response of fish assemblages to small dam removals in streams. The objective of this project is to quantify the changes in functional diversity and assemblage structure of stream fishes in response to the removal of two dams 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 calculated functional diversity based on life history traits and community weighted means of life history the strategies for each sample. We examined the changes in functional and assemblage structure before and after dam removal. A decrease in equilibrium life history strategists was observed after dam removal as well as a change in functional diversity. We found a shift in community structure with increases in flow specialists after dam removal.

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Terrestrial capabilities of invasive fishes and their management implications

Noah R. Bressman* (Salisbury University)

Amphibious fishes have many adaptations that make them successful in a wide variety of conditions, including air-breathing, terrestrial locomotor capabilities, and extreme tolerance of poor water quality. However, the traits that make them highly adaptable may allow these fishes to successfully establish themselves outside of their native regions. In particular, the terrestrial capabilities of invasive amphibious fishes allow them to disperse overland, unlike fully aquatic invasive fishes, making their management more complicated. Despite numerous amphibious fish introductions around the world, ecological risk assessments and management plans often fail to adequately account for their terrestrial behaviors. In this review, I discuss the diversity of invasive amphibious fishes and what we currently know about why they emerge onto land, how they move around terrestrial environments, and how they orient while on land. In doing so, I use case studies of the performance and motivations of nonnative amphibious fishes in terrestrial environments to propose management solutions that factor in their complete natural history. Because of their terrestrial capabilities, we may need to manage amphibious fishes more like amphibians than fully aquatic fishes, but to do so, we need to learn more about how these species perform in a wide range of terrestrial environments and conditions.

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Crappie management on Harry S Truman Reservoir: lessons learned and challenges ahead

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Harry S Truman Reservoir (Truman Lake; 55,000 acres) is an excellent crappie fishery, regularly appearing in national crappie tournament trails and known for high catch rates of legal (>9") fish. Truman Lake has been managed with a 9" minimum length limit and 15 fish creel limit since 1989. Crappie have been sampled with trap nets nearly every fall since 1980, with detailed data available from most years on individual net locations and catch data. Since 2018, intensive sampling efforts (nearly 200 net nights/year) have been put in to attempt to tease out differences in the population dynamics across the reservoir as well as factors that may affect variation in catch rates. Over 4,000 crappie, collected from trap nets and through angler harvested fish, have been aged using otoliths. Many of the populations dynamics have drastic spatial and temporal variation, including the proportion of each species (i.e., White Crappies *Pomoxis annularis* versus Black Crappies *Pomoxis nigromaculatus*) and growth rates. The spatial and temporal variability within the fishery make it challenging to understand how management decisions (i.e., regulation changes) could affect the fishery.

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Unwelcome visitors to Bluehead Chub *Nocomis leptocephalus* nests

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The Bluehead Chub *Nocomis leptocephalus* is a common, freshwater minnow found in streams across the southeastern United States. Each summer, using their mouths, male chubs construct mound nests out of pebbles. These nests attract other fish species, of which there can be as many as a few hundred fishes of different species on a nest at a time. Whereas these nests are beneficial for the reproduction of many Leuciscid species, an often-untold story is that these fish aggregations are prime locations for predators. We observed and profiled predators who visit Bluehead Chub nests, either to prey on eggs or individuals in the spawning aggregation. We used visual observations, as well as daytime and nighttime videography and photography involving over and underwater high-definition cameras and motion-activated trail cameras. Preliminary data from nearly ten years of repeated visual observations in Toms Creek situated in Blacksburg, Virginia suggests that mounds are foraging grounds for a long list of predators, including those who prey on adult fish: northern water snakes, birds, piscivorous fishes, and snapping turtles, and those who prey on eggs: crayfishes, darters, sculpins, and other chub associates. Knowing that the minnows spawn both day and night, this novel study aims to reveal predator activity on Bluehead Chub mounds likely to involve mammals. A comprehensive documentation of nest predation is helping to unravel river food web structure and the intricate connections between aquatic and terrestrial food webs, to fully characterize the role of *Nocomis* as keystone species in eastern North American streams.

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Population demographics of three buffalo fishes in the lower Red River

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Smallmouth Buffalo *Ictiobus bubalus*, Bigmouth Buffalo *I. cyprinellus*, and Black Buffalo *I. niger* are long-lived fishes that are harvested by commercial and bow fishers throughout their distribution in North America. Age and growth data are commonly used to monitor growth and mortality in managed fisheries. Using a subset of lapilli otoliths from Bigmouth and Smallmouth Buffalo, we investigated the age structure of populations in the lower Red River catchment in Oklahoma, Texas, and Arkansas. Total lengths ranged 289-1661mm (average 665mm, n=393) for Black Buffalo; 289-1661mm (average 665mm, n=641) for Bigmouth Buffalo; 234-960mm (average 532mm, n=1077) for Smallmouth Buffalo. Sampling for 2021 occurred from May to October. Preliminary age estimates for Smallmouth Buffalo range 4 to 24 years and Bigmouth Buffalo range 8 to 25 years. The population demographics of these fishes remain largely unknown and additional information is valuable for future management actions.

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Refining species boundaries in the ubiquitous freshwater mussel Genus *Amblema*

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Freshwater mussels are ubiquitous in freshwater systems where they filter water, provide substrate for other aquatic species, and are important for nutrient cycling. Many of these species face rapid declines. Accurate identification and classification of species or other evolutionarily significant units are critical for the population monitoring and conservation of at-risk and imperiled taxa. We seek to refine the taxonomy of a widespread and common freshwater mussel genus, Amblema, to aid in their conservation recovery and management planning. Using a genome-wide reduced representation method and mitochondrial DNA sequencing, we examined the phylogenetic relationships among 180 individuals from 26 rivers, including populations of *Amblema plicata* (federal status least concern), *A. elliottii* (vulnerable status in Alabama), and *A. nieslerii* (federal status critically endangered). Genomic data suggest the presence of four distinct genetic clusters, with populations from the Tennessee and Ohio, Mobile, Texas and Escambia, and Appalachicola River Basins forming distinct genetic groups. FST between these 4 major genetic clusters ranged from 0.4-0.7, indicating strong genetic differentiation between major river basins. Interestingly, *Amblema* in the Tombigbee and Upper Coosa show little distinct differentiation, suggesting the need for further consideration of *elliottii* as distinct from *plicata*. Mitonuclear discordance was present, with the Appalachicola River (*A. nieslerii*) and some Upper Coosa River (*A. elliottii*) samples sister in the mtDNA neighbor joining phylogeny, while no Coosa samples clustered with Apalachicola in the genomic phylogeny. Our work refines our understanding of the existing genetic diversity and differentiation within *Amblema* spp., so we can endeavor to preserve it.

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Spatial differences of estuarine finfish community structure: a case study of South Carolina coastal estuaries

Elizabeth Bullard* (SCDNR & College of Charleston), Dr. Joseph Ballenger, SCDNR

Finfish community structure within estuaries is one indicator for the health and productivity of a given coastal or estuarine region, and changes in said structure can reflect arising issues for our coastal habitats. In 1991, researchers began sampling marine organisms throughout salt marsh estuaries in South Carolina, USA with consistent quarterly sampling in five estuaries beginning in 2010. Herein, we used long-term data from three surveys (estuarine trawl, trammel net, and longline surveys) to investigate differences in finfish community structure across South Carolina's estuaries. We detected spatial differences in community structure by converting the abundance of species to distance matrices, and using these matrices to test for variability amongst estuaries. By studying distinctions between diversity metrics and utilizing multivariate statistical analysis (e.g., PERMANOVA), spatial differences in community structure have been seen amongst the five estuaries. Alpha diversity showed strong seasonal trends while beta diversity gave support for spatial differences. PERMANOVA was able to show that these differences are considered significant ($p < 0.001$), but they cannot be fully explained solely based on geographic region. Therefore, we must look into identifying potential covariates to develop a better mechanistic understanding of similarities and differences when comparing regions. Methods will involve fitting significant environmental factors (e.g., impervious cover, salinity, temperature) to an ordination. Spatial differences detected in community structure emphasize the uniqueness of seemingly parallel estuaries. A better understanding of the disparate drivers of community structure across estuaries will allow for the implementation of proper fisheries management techniques for the future.

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Environmental flow effects on fish passage in a fragmented coastal river: a Bayesian multistate modeling approach

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Flow regimes and connectedness to natal spawning grounds have shaped life-history traits of anadromous fishes over evolutionary time scales. Habitat fragmentation from damming alters anadromous fish movements to natal spawning grounds. Our goal was to manipulate spring flows on a highly modified and fragmented Atlantic slope river (Cape Fear River, North Carolina) to mimic natural flood events that were high enough to submerge lock and dam structures that were not operable for "conservation locking". Acoustic tags were implanted into American Shad *Alosa sapidissima*, Striped Bass *Morone saxitilus*, and Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus* during spring migrations in 2021 and 2022. An acoustic array of VR2W receivers was in place within the full extent of the study area. To evaluate year- and species-specific movements, we utilized a multistate Cormack–Jolly–Seber (CJS) model within a Bayesian framework to estimate probabilities of apparent survival, detection, and transition (passage over dams, movement to upper spawning grounds, or fallback). Five model states were defined based on locations upstream, downstream, and between four lowhead dams. Flow was incorporated as an environmental covariate. We found the highest passage probabilities for American Shad, followed by Striped Bass, and no passage by Atlantic Sturgeon. Environmental flow pulses triggered fish to pass over lowhead dams. Environmental flow pulses which effectively submerged lowhead dams improved passage during periods when lock chambers were not operable for conservation locking.

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Spatial variability in growth, and prevalence of *Anguillicoloides crassus* in North American Eel populations

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American Eels *Anguilla rostrata* are a widely distributed fish species in Atlantic and Gulf of Mexico drainages of North America and the northern portion of South America with a complex panmictic and catadromous life cycle. The parasitic non-native nematode *Anguillicoloides crassus* infects eel swim bladders, which has been implicated as potential driver of declines since introduction in mid-1990s. Eels were collected, aged, and evaluated for *A. crassus* from surveys across numerous coastal and inland water bodies in a large portion of their range. Sampling locations in the USA included Maryland, Virginia, South Carolina, Florida, and Louisiana, while those from Canada included Newfoundland and Labrador, Nova Scotia, and Ontario. We used a Bayesian hierarchical modeling framework to test for spatial differences in von Bertalanffy (VB) growth parameters across states/provinces and ocean basin. In order to test whether nematode presence affects individual growth, VB parameters were estimated using presence data of adult *A. crassus* incorporated as a covariate. A total of 10,944 individual ages were analyzed with 8,650 of those paired with *A. crassus* presence data. Overall, 32% of all samples evaluated for *A. crassus* showed presence of this non-native nematode. This provides a multi-regional spatial analysis of American Eel growth and prevalence of *A. crassus* and should aid management of the species in North America.

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Genetic assignment of coastal Delaware Atlantic Sturgeon mixed stock assemblage

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Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus,* are an anadromous species ranging along the eastern coast of the United States. This, long lived species spends most of its life migrating within marine waters, returning to natal rivers to spawn. The spawning populations of Atlantic sturgeon were divided into 5 distinct population segments (DPS) when they were added to the US Endangered Species Act (ESA) in 2012. While migrating along the coast, Atlantic sturgeon can travel great distances and move in aggregates composed of individuals from separate rivers, or even DPS's. A better understanding of population structure of Atlantic sturgeon is crucial to gain knowledge on their ecology, along with predicting future success of subpopulations. With such a highly motile species, genetic assignment can be crucial to determine river origin while these fish are in the marine phase of their life. Whole genomic DNA from 12 microsatellite loci was analyzed for 470 individuals collected from estuarine and coastal waters of Delaware and compared against a baseline to determine highest probable river of origin. Results show a high proportion of individuals originating from the Hudson River population, followed by the fall-spawning population of the James River, and the Delaware River population. However, sturgeon captured off the coast of Delaware included representation of populations from each DPS along the Atlantic coast. These assignments of telemetered individuals will be used to help characterize migration patterns both within the Hudson and Delaware Rivers and along the coast.

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Spawning periodicity and public information use in Bluehead Chub *Nocomis leptocephalus*

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The use of public information (using the performance of other individuals to gauge environmental quality) to locate optimal nesting habitat has been explored in birds but not fish. Many fish construct nests to protect their offspring, and the utilization of public information could be a suitable strategy for determining which nesting locations would optimize fitness. We studied public information use in Bluehead Chub, a species of nesting Leuciscid in the Southeastern United States. Previous evidence suggests that Bluehead Chub nest periodically during breeding season (late April to late July). Additionally, nests are more successful when utilized by an abundance of nest associates, which could be a key indicator for other chubs to nest nearby. We hypothesized that areas where nests accumulated more associates during one spawning period would have more nests in nearby locations in the next period. We assessed nest location, date of construction, and daily activity of nests in 2021 and 2022 along a 0.65km reach of Toms Creek, a third order tributary of the New River in Blacksburg, VA. Temporally constrained hierarchical cluster analysis showed distinct active and inactive nesting periods in a season. Additionally, fourth-corner analysis showed an overall spatiotemporal correlation in nest placement, meaning new nests are built close to preexisting nests shortly after they are constructed. These preliminary results suggest that chubs use the locations of other nests as an indicator of optimal nest habitat. Further analysis using nesting activity will determine if highly active nests are used more.

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Angling effort and economic value of angling on three mid-size Alabama rivers

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Multiple survey methods were used to gather angler effort and economic use data on the Cahaba, Locust Fork, and Coosa Rivers, Alabama. These data were needed to revise fish kill loss valuation metrics for riverine systems in the state. Trail cameras were installed at all public access points to monitor angler use and effort, while economic and demographic data were gathered using a combination of bus-route, roving, and telephone surveys. Annual direct expenditures related to angling ranged from $200,000 - $725,000. Total consumer surplus values, estimated using the Travel Cost Method, ranged from $390,000 - $1.1 million for the three rivers. Therefore, estimated annual economic value of angling on these rivers ranged from $660,000 - $1.8 million. When effort estimates from the bus-route survey and trail camera methods were compared, each method produced similar results. The trail camera method, however, required 72% fewer employee hours and offered an average $27,000 in cost reduction. Also, bootstrap analyses of known angler effort data suggested that sampling 30% of available camera sample days provided estimates with acceptable levels of precision.

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Hydrogeological effects on spring-associated fish communities in the Edwards Plateau region of central Texas

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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 and correlated the patterns with surface geology. Preliminary results indicated strong concordance between fish communities and surface geology. Greater numbers of spring associated fishes were associated with streams within Cretaceous geology than streams within Pleistocene fluviatile terrace deposits. The next step is to explore the mechanisms associated with the concordance (e.g., water permanency), which likely also explains why fish communities within Cretaceous geology are not identical (e.g., water permanency associated with losing and gaining reaches of streams). Understanding of natural factors influencing fish community structure facilitates the identification of anthropogenic factors affecting fish community structure.

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Sportfish population characteristics following mechanical Largemouth Bass removal in two small public fishing impoundments in South Carolina

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Abstract: Declining angler harvest rates of Largemouth Bass *Micropterus salmoides* have increasingly led to small impoundments containing overcrowded Largemouth Bass populations. Various methods to correct or prevent crowded populations have been used by fisheries managers, with mixed results. Largemouth Bass were removed from two small impoundments in South Carolina using boat electrofishing over two consecutive years. Relative weight (Wr) was used as the removal criterion: all bass displaying condition Wr ≥ 95 were released and all others were removed. We set targets of removing 40-50% of the population each year at both impoundments. Population sizes were estimated in each impoundment using mark-recapture with a Chapman's modified Lincoln-Petersen framework for both large (≥200 mm TL) and small (<200 mm TL) length groups. A total of 1641 bass (162.5 fish ha-1) were removed from Jonesville Reservoir (10.1 ha), and 1022 (63.1 fish ha-1) were removed from Lake Oliphant (16.2 ha) in 2020 and 2021. Proportions removed approached removal goals of 40-50% of the estimated population size for both length groups at both impoundments in 2020 but fell short of removal targets in 2021 at Jonesville Reservoir. Improved Bluegill *Lepomis macrochirus* catch rates and reduced bass catch rates at Lake Oliphant following 2020 removal efforts led to reduced removal efforts in 2021. Catch rates, estimated population sizes, and estimated biomass (kg ha-1) of large bass declined from 2020 to 2022 at both impoundments, but results for small bass were variable. Largemouth Bass condition increased at both impoundments, and size structure increased at Lake Oliphant. Bluegill catch rates increased at Lake Oliphant but remained low at Jonesville Reservoir. Bluegill condition and size structure declined at both impoundments from 2020 to 2022. We speculate that presence of Threadfin Shad *Dorosoma petenense* contributed to more successful efforts at rebalancing the fishery at Lake Oliphant than at Jonesville Reservoir, which does not have a shad population. Removal efforts likely need to be repeated at both impoundments at regular intervals in the future, raising the question of whether these populations should be renovated and restocked using modified stocking rates or other innovative options to achieve management goals more efficiently.

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Mercury Trophodynamics in Great Smoky Mountains National Park Streams: Implications for Smallmouth Bass (Micropterus Dolomieu) Contamination

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Though mercury is a naturally occurring metal that can be found in most natural environments at low levels, anthropogenic sources of mercury contamination can be highly problematic. Mercury biomagnification, or the increase of mercury concentration with trophic level can pose substantial risk to the health of both humans and wildlife. Despite these serious risks, the dynamics of mercury biomagnification in stream ecosystems are not well understood. This study seeks to elucidate how feeding relationships might influence biomagnification of mercury in three streams within Great Smoky Mountains National Park: Little River, Abrams Creek, and Little Pigeon River. In 2016, precautionary fish consumption advisories were issued for Smallmouth Bass from Abrams Creek and Little River within Great Smoky Mountains National Park. Our study seeks to compare how trophic position and mercury concentrations differ across these streams by measuring stable isotope ratios and tissue mercury concentrations in eight food web components that span stream trophic levels. To represent basal resources we analyzed leaf detritus, periphyton, and filamentous algae. Heptageniid mayfly nymphs, Central Stoneroller, dragonfly nymphs, and crayfish were chosen as intermediate consumers. Smallmouth Bass were chosen to represent the top aquatic fish predator and the primary route of human exposure to mercury from these systems. The outcomes of this study will help us better understand the dynamics of mercury in aquatic ecosystems and shed light on potential pathways of mercury biomagnification that are leading to differential levels of mercury in Smallmouth Bass tissue.

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Tradeoffs between fishing quality and economic performance with increasing tournament effort in an Alabama black bass fishery

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Largemouth Bass *Micropterus salmoides* and Alabama Bass *M. henshalli* are native centrarchid species within Alabama that are a focal point of modern recreational fisheries in the state. Across the state and much of the south, black bass populations are subject to high amounts of angler effort partly attributable to the popularity of fishing tournaments. As tournaments gain popularity, agencies lack important information regarding the population level effects of size-selective catch-and-release angling. Systems with high catch-and-release rates, and low post-release survival can result in catch-and-release mortality rates that exceed harvest mortality, possibly resulting in negative effects on fishing quality. Tournaments may have a 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 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 used a dynamic age structured model that included a submodel 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 will be informed by published creel and economic surveys and a current intensive reward/telemetry tagging study being conducted on Neely Henry. Agencies can utilize this information to construct appropriate management regulations to maximize the benefits of the tournament fishing industry as well as support a high quality fishery with desirable catch rates and size structure.

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Long-term evaluation of Black Crappie growth in Florida's changing climate

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Black Crappie *Pomoxis nigromaculatus* are popular and widely distributed sport fish in the United States. Therefore, evaluating Black Crappie population dynamics in a changing climate is important from multiple perspectives (e.g., angler satisfaction, fisheries sustainability). Fish growth and survival are known to vary with latitude, a point of particular importance for species at the southern end of their range, such as Black Crappie in Florida. However, habitat availability and complexity can also impact these population parameters. We assessed the effects of latitude, temperature, and precipitation on Black Crappie growth across Florida over two decades. Utilizing data from the Florida Fish and Wildlife Conservation Commission, we found that, statewide, Black Crappie mean length did not change significantly over time. However, Black Crappie growth was greatest in northern Florida, while declining significantly through time in southern Florida. As climate change intensifies throughout Florida and the Southeast, continued research on Black Crappie populations will be important for developing adaptive management programs and policies.

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Innovative electrofishing equipment: data, mapping, and standardization made simple

Patrick Cooney*, Science Director, Smith-Root

Electrofishing is a leading method for collecting freshwater fish for scientific research. Newly innovated electrofishing technologies were developed to improve usability, safety, standardization, mapping, and reporting of electrofishing efforts. Advancements include integrated Global Positioning System, on-screen graphing and recording of electrical input and output data, built-in electrical settings recommendations for varying environmental conditions, and waterproof USB drive to allow export of data for mapping and standardization analysis. The presentation will demonstrate how agencies are using these new innovations to improve freshwater fish management and conservation. Further, combining the new electrofishing technology with innovative eDNA equipment enhances certainty with fish detection.

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Population characteristics of juvenile Atlantic Sturgeon in the Winyah Bay system, SC

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The Winyah Bay system is believed to be an important nursery area for juvenile Atlantic Sturgeon, particularly for individuals from the Great Pee River population. However, there is limited information on basic characteristics of juveniles (abundance, growth) using this system and how they use it. We sampled Atlantic Sturgeon during December 2019 – July 2022 with gill nets to (1) identify areas where juveniles concentrate, (2) determine if there is evidence of spring and fall spawning cohorts, and (3) estimate growth. Additionally, we conducted a capture-recapture experiment during May – October, 2021 and 2022 to estimate the abundance of individuals ≤ 1050 mm total length (TL). During December 2019 – July 2022, 804 individual Atlantic Sturgeon were captured 890 times, and ranged in size from 198–1751 mm (mean = 706 mm). Forty-four Atlantic Sturgeon (589–1118 mm) were previously tagged in another system (24 unknown, 7 Altamaha River, 8 Savannah River, 4 Edisto River, 1 North Santee River). Plotting TL at day-of-year suggested that there are two annual cohorts of Atlantic Sturgeon from the Great Pee Dee River, but a small sample size of the presumed spring cohort and substantial overlap of seasonal cohorts (and year classes) prevented us from making definitive conclusions about the proportional contribution of each seasonal cohort. Abundance estimates of sturgeon ≤ 1050 mm were dependent on if daily (2564; 95% CI = 1885–3539) or monthly capture histories (1484; 95% CI = 887–2719) were used, but were comparable to estimates from other southeastern U.S. rivers.

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Validating recreational fishing effort estimates produced by a mail-based probability sample survey

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Florida's recreational reef fish fishery consists of 650 thousand anglers and operates over a diffuse area from a variety of access points, which makes census-based monitoring for managing catch impractical. Florida's State Reef Fish Survey (SRFS) collects information from recreational reef fish anglers to produce catch and effort estimates for a suite of reef fish species. The SRFS was purposefully designed to minimize known sources of bias by accounting for factors that influence fishing avidity, e.g. proximity to coast and/or boat ownership, and by framing the particular recall period of the survey with a calendar to guide the respondent to provide accurate information. Probabilistic sample surveys are widely used to collect fisheries dependent information, however, there are few published studies that verify the accuracy of survey estimates and evaluate potential unknown sources of bias. We conducted two separate tests to explore recall bias and to validate effort estimates produced by the SRFS. To test recall bias, we compared three survey types: two 'count' question types where anglers report the number of trips taken, either over a one- or two-month recall period, and the SRFS where respondents are given a calendar to bind recall within the asked about month. To independently validate the results of the SRFS, we conducted on-site counts of recreational boats egressing inlets into the Gulf of Mexico in Florida's panhandle. Here we present results from these studies.

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Feeding and trophic ecology of invasive Blue Catfish *Ictalurus furcatus* in the Nanticoke River, MD/DE

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Invasive species can cause dramatic ecological impacts in aquatic systems by altering community and ecosystem structure. Blue Catfish *Ictalurus furcatus* were introduced into the Chesapeake Bay in the 1970s to provide fishing opportunities and have since expanded in geographic distribution and population size throughout the Bay. Now classified as an invasive species, diet studies from the Chesapeake Bay's Western Shore indicate that Blue Catfish consume native species of economic and conservation concern with diet composition varying by tributary. To address tributary specific management goals, we assessed Blue Catfish diet and trophic ecology in an Eastern Shore tributary of the Chesapeake Bay. We analyzed stomach contents from 1,017 Blue Catfish collected throughout the Nanticoke River watershed in Maryland and Delaware. Prey items were identified visually and using molecular analysis. Additionally, we collected white muscle tissue samples from Blue Catfish and species that make up their diet to analyze stable isotopic ratios of carbon, nitrogen, and sulfur as a secondary method of investigating feeding and trophic ecology. Our results indicate patterns in diet composition that vary spatiotemporally and by size of Blue Catfish. Large Blue Catfish (>550mm) pose the greatest threat to species of economic and conservation concern in the Nanticoke River as they prey heavily on White Perch *Morone americana*, river herring *Alosa* spp., Atlantic Menhaden *Brevoortia tyrannus*, and Blue Crab *Callinectes sapidus*. Fisheries managers should continue to monitor populations of these particularly impacted prey species of concern in the Nanticoke River and implement further conservation measures as necessary.

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A database on larval Anguilliformes for biodiversity and ecological analyses

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One group of fish that is widespread in the Atlantic but have not been the focus of many ichthyoplankton studies are the Anguilliformes (true eels). Anguilliformes are characterized by a unique larval form, called a leptocephalus, that can remain pelagic for months to a year. Few studies have examined factors influencing taxonomy and interannual variations in abundance of leptocephali, even for commercially-important species of catadromous eels in genus Anguilla. Developing predictive frameworks and integrating environmental stressors in a spatial context is an important area for future research as circulation patterns in the Atlantic may shift with climate change. We discuss initial work on a largescale database of Atlantic, Caribbean, and Gulf of Mexico leptocephali. The database currently encompasses 97,145 larvae from historical and current sampling programs, museum collections, and public databases. Anguillid eel surveys provided the core of the data and are included in the database, along with larvae of marine taxa such as congers and morays. We also present preliminary results examining how environmental factors influence taxonomic diversity in the Carolina Province (northern Gulf of Mexico and shelf region extending from Florida to Cape Hatteras) and the Greater Caribbean province (extending from Bermuda to the Amazon River and including all Atlantic tropical waters north of the equator).

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An analysis of monitoring data for Largemouth Bass *Micropterus salmoides*: comparing Georgia reservoirs with low and high catches of *Micropterus sp.*

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Long-term monitoring is critical when looking at sportfish populations. Largemouth Bass are a highly desired sport fish in the state of Georgia, where Largemouth Bass fisheries may be under threat by Spotted Bass, Alabama Bass, and their hybrids. The Georgia Department of Natural Resources (GADNR) has been monitoring reservoirs within the state for over 30 years. We examine size and catch data of Largemouth Bass, provided by the GADNR, to compare reservoirs with low or high catches of Alabama Bass and Spotted Bass. Size metrics for Largemouth Bass were similar between reservoir groups. However, significant differences were observed in predicted catches. Additionally, the variability of the predicted catch data differed between low- and high-catch reservoirs. Spotted Bass and Alabama Bass may pose threats to Largemouth Bass fisheries, as evidenced by observed differences in relative abundance. Data from additional reservoirs may provide more evidence for these conclusions.

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Differential effects of non-native Alabama Bass on Smallmouth and Largemouth Bass fisheries in north Georgia reservoirs

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Georgia is home to more native black bass species *Micropterus sp*. than any other state in the USA (N=12). One of these species, the Alabama Bass *M. henshalli*, is native only to a small part of Georgia (the Coosa River Basin) but has been introduced widely outside its native range by anglers. Fisheries biologists have hypothesized that Alabama Bass compete directly with native black bass and can also impact congeners through introgressive hybridization. We present a case study of Alabama Bass introductions in North Georgia using long-term datasets from four reservoirs (Lake Lanier, Lake Chatuge, Lake Nottely, and Blue Ridge Lake) to document effects on native Smallmouth Bass *M. dolomieu* and Largemouth Bass *M. salmoides* fisheries. Various sampling data (electrofishing, gillnetting, cove rotenone) were used to assess long-term, population-level effects of Alabama Bass introductions on native congeners. The outcomes from these four focal reservoirs suggest that Largemouth Bass fisheries were relatively unaffected by Alabama Bass introductions, even as Alabama Bass populations increased over time. Conversely, a popular Smallmouth Bass fishery in Lake Chatuge was quickly extirpated by Alabama Bass over a relatively short period of time, and similar extirpation is likely occurring at Blue Ridge Lake despite efforts to support the fishery through fingerling Smallmouth Bass stockings. Results of this case study suggest that prevention of illegal stockings is the best safeguard against Alabama Bass introductions, and the consequences of Alabama Bass on native fisheries can be difficult to predict as they likely depend on several abiotic and biotic factors

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The guide-based Trinity River Alligator Gar tagging program: a win-win for management

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Growing interest in charismatic megafauna, along with recognition of the importance of apex predators, has elevated the status of the Alligator Gar among anglers and biologists. Although populations across much of their range are depressed due to historic mismanagement and habitat degradation, Texas is home to healthy Alligator Gar stocks that support a popular recreational fishery and guiding industry. Growth of the fishery prompted the Texas Parks and Wildlife Department (TPWD) to actively manage populations, including efforts to regulate harvest and understand population dynamics and movement. Alligator Gar are periodic strategists that exhibit sexual dimorphism in both size and longevity and these life-history characteristics result in sensitivities to overharvest, requiring managers to monitor populations. However, fishery-independent sampling is plagued by low catch rates and insufficient data to detect trends. Therefore, TPWD partnered with Alligator Gar catch-and-release fishing guides and anglers on the Trinity River – Texas' premier Alligator Gar fishery – to initiate a catch-tag-release program in 2019. To date, over 2,800 Alligator Gar, ranging from 559 to 2,464 mm, have been fitted with individually numbered T-bar anchor tags, providing information on abundance, distribution, movement, and return to the fishery of caught-and-released fish. Based on the average catch rate during fishery-independent, riverine sampling for Alligator Gar by the TPWD, tagging an equivalent number of fish would have required over 10,000 man-hours. Thus, our partnership with anglers provides an efficient way to monitor the fishery and accumulate valuable biological data, maintain and enhance relationships with constituents, and provide anglers with information of interest.

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Intra-annual ontogenetic growth variation in age-0 Spot *Leiostomus xanthurus*

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Juvenile Spot *Leiostomus xanthurus* typically enter estuarine nursery habitats as sequential cohorts during winter and spring. Spot cohort ontogenetic growth was described for juvenile cohorts using Crabhaul Creek within North Inlet estuary, SC. Spot were collected (1/4" mesh seine) biweekly and measured (standard length, mm; biomass, g dry tissue; n ≥ 30 fish per collection) from February-November 2020. Cohorts were identified by SL analyses (FiSAT) and assigned to 8 collection water temperature (°C) categories for subsequent analyses. Growth rates (SL, mm/d) and the relative condition index were used to describe ontogenetic growth. Three spot cohorts entered North Inlet between December 2019 (12-14°C) and April 2020 (18-20°C). Growth in all cohorts changed from isometric to allometric at ~60 mm SL. Juvenile spot entering the estuary when water temperatures were 12 – 14°C had significantly lower growth rates throughout estuarine residency (0.22-0.24 mm/d) than fishes entering at 18 – 20°C (0.29 mm/d; ANCOVA, $P<0.05$). By mid-August 2020, cohorts attained mean SLs of 62.2 ± 2.9 (December 2019 ingress), 53.8 ± 3.0 (January 2020), and 44.3 ± 2.9 mm (April 2020), respectively. The April 2020 cohort had significantly greater relative condition than the December 2019 and January 2020 cohorts (ANCOVA, $P<0.05$). Ambient productivity controlled growth for December and January cohorts but was secondary to day length for the April cohort (PCA, $p<0.05$). The timing of estuarine ingress inversely influenced age-0 Spot growth with later cohorts using estuarine nurseries during the most productive seasons to achieve faster growth in fewer days.

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Flow regime and recruitment in Gulf Sturgeon in the Apalachicola River, Florida

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The Gulf Sturgeon *Acipenser oxyrinchus desotoi* is a threatened anadromous fish species that historically occurred across the northern Gulf of Mexico from the Mississippi River to Tampa Bay. Overfishing and habitat destruction led to population declines and extirpation from some rivers; the species now occurs in just seven systems, including the Apalachicola River in Florida. Since 2013, University of Georgia researchers have been estimating recruitment (i.e., age-1 abundance) in that system through mark-recapture sampling and Huggins closed-capture models since 2013. The first objective of this study was to quantify recruitment in 2021–2022. We found that in 2021, there were 139 (95% CI) recruits, and in 2022 there were 161 (95% CI). Recent genetic evidence indicates that there are separate, genetically distinct fall- and spring-spawning populations – we are currently working on refining annual recruitment estimates for each population. Our second objective is to investigate the relationship between recruitment and seasonal hydrological conditions for the spring spawn. We developed a suite of hypotheses relating flow metrics (e.g., discharge, discharge variability, acre-days of spawning habitat inundation, etc.) during specific time periods (e.g., spawning, early life history, age-0 overwintering) was related to the estimated abundance of each age-1 sturgeon cohort. Because flow in the Apalachicola is controlled at Jim Woodruff Lock and Dam, these results have important implications for how flow is managed to improve recovery of Gulf Sturgeon populations in the Apalachicola River.

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Extent of suitable habitats for juvenile Striped Bass: dynamics and implications for recruitment in Chesapeake Bay

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Estuarine environments are dynamic ecosystems that sustain critical nursery habitats necessary for fish production. The production of Striped Bass *Morone saxatilis* in Chesapeake Bay supports recreational and commercial fisheries along the Atlantic coast of the United States, but factors that contribute to high abundance and successful recruitment of juvenile life stages are not fully understood. To address this question, catch data from monthly fishery-independent surveys were coupled with hindcasts from a pair of numerical models to quantify the extent of habitats used by young-of-the-year Striped Bass throughout Chesapeake Bay for 1996-2019. Environmental conditions at the time and location of sampling were used to develop nonparametric habitat suitability models. Specific conditions that defined suitable habitats for juveniles varied across seasons and among years, reflecting changes in water quality conditions and ontogenetic changes in habitat use. Shallow, nearshore areas throughout the Bay consistently supported suitable conditions for juveniles. For all seasons examined, relative abundance of juveniles appeared to increase with greater extent of suitable habitats. However, suitable habitat extents during early summer, declined significantly since 1996, reflecting a change in suitable environmental conditions that may become limiting. Given the high degree of interannual variability in abundance that is characteristic of Striped Bass, the availability and quantity of suitable habitats at the scale of individual tributaries and Bay-wide may play an important role in production of this species.

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Advanced Bluegill stockings as an integrated pest management tool for biocontrol of Common Carp at Lake Mattamuskeet, North Carolina

Kevin Dockendorf* (North Carolina Wildlife Resources Commission)

Stocking of advanced Bluegill *Lepomis macrochirus* in whole-lake experiments has been found to be an effective biocontrol mechanism because Common Carp *Cyprinus carpio* eggs and larvae are a preferred food for Bluegill. At Lake Mattamuskeet (16,187 ha), the overpopulation of Common Carp (2018 estimate of 900,000 Common Carp weighing 4 million pounds) has contributed to the devastation of the submerged aquatic vegetation (SAV) that is integral to migratory waterfowl of the Atlantic Flyway and fish and wildlife resources present at Mattamuskeet National Wildlife Refuge. Common Carp are known to uproot aquatic vegetation during feeding in shallow water lakes. The overabundance of Common Carp increases turbidity and exceeds the capability of the existing population of bluegills and other predators to limit Common Carp abundance. In March 2021 and 2022, NCWRC staff and local volunteers stocked advanced sized Bluegill (2-4 inches) prior to Common Carp spawning and with the intent for Bluegill to prey on Common Carp eggs. Coupled with preventative barriers to keep adult Common Carp out and upcoming biomass removal of adult Common Carp, these advanced Bluegill stockings are intended to limit the recruitment of Common Carp by predation of the Common Carp eggs and larvae. These integrated pest management approaches are intended to contribute to the overall goal to significantly reduce the Common Carp biomass at Lake Mattamuskeet and improve the SAV abundance to benefit the unique lake ecosystem.

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Genetic monitoring of Striped Bass *Morone saxatilis* stocking in South Carolina

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Striped Bass *Morone saxatilis* are a valuable and popular commercial and game fish throughout their native range. Evidence of population declines in South Carolina led to the formation of a stocking program in 1984. Stocking across major watersheds occurred until 1997, when genetic data showed allelic differences between populations. Since 2006, SCDNR has maintained a genetic tracking program for Striped Bass in South Carolina and monitored hatchery contribution to SC waterways. Cultured female fish became the majority of broodstock caught by 2011 and remained so up to the present. Cultured males have made up the majority of broodstock since 2010. In Lakes Marion and Moultrie, continuous standardized winter gillnet sampling has seen greater than 80% contribution to most Age 0-6 cohorts, and often >90%. High hatchery contribution is expected in such reservoir systems, and the wild reproduction is likely occurring upstream in riverine stretches. Despite such high hatchery contribution, standard genetic metrics do not show any negative trends in diversity or inbreeding. Phase I versus phase II stocking doesn't show any differential success until Age 2, but low catch rates for older fish complicate further analyses. Stocking in the Pee Dee River has also seen a rapid increase in stocked fish contribution and has leveled off around 61-64% for recent years. Genetic monitoring has been a useful tool to assess the condition of the Striped Bass fishery beyond what abundance and standard measurements could reveal and has the potential to answer new questions in the future.

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Alabama Bass invasions across North Carolina: 20 Years of expansion and an uncertain future

Lawrence Dorsey* (North Carolina Wildlife Resources Commission), Scott Loftis - North Carolina Wildlife Resources Commission

In 2001, Alabama Bass *Micropterus henshalli* were documented for the first time at Lake Norman, NC. Since those first samples were documented, Alabama Bass have rapidly expanded their range to include large portions of the state. At present there are 21 individual waterbodies that have been genetically confirmed to contain the presence of Alabama Bass. With the exclusion of several river drainages that feed directly into coastal estuaries, Alabama Bass have been documented in all major river basins except the Cape Fear and Neuse systems. Impacts on existing black bass fisheries have been dependent on the pre-existing black bass species assemblages of individual waterbodies. Largemouth Bass *M. salmoides* populations have been negatively affected through apparent competition for overlapping habitats while Smallmouth Bass *M. dolomieu* and Spotted Bass *M. punctulatus* have been affected through genetic mixing. These changes appear to be permanent and, in many cases, particularly with genetic mixing, the impacts have worsened over time. Education efforts have been ongoing but largely ineffective. Going forward, management and research will focus on effectively managing these new species complexes and attempting to preserve pure Smallmouth Bass genetics where possible through stocking. None of the current management efforts have certain outcomes and time has shown that Alabama Bass will likely persist on the landscape indefinitely.

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A multiscale conceptual framework to predict movement and habitat associations of an imperiled megafish, the Alligator Gar *Atractosteus spatula*

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Increasing popularity of Alligator Gar as a sportfish combined with changes to the riverscapes they inhabit create a need for greater information on the ecology of the species to enhance management. Ecological theory predicts that movement by riverine fishes at the population level is characterized by heterogenous mixtures of stationary and mobile individuals that together contribute to a leptokurtic (i.e., high peak, long tails) distribution of movement distances. We evaluated movement and habitat associations of Alligator Gar in the Brazos River of Texas at fine (every 2 hours for 24 hours) and coarse (every month for 16 months) temporal scales to test for (1) the presence of leptokurtosis and (2) relationships between movement distance and habitat dissimilarity or the amount of time fish were at large. Dispersal by Alligator Gar with >8 relocations at coarse (n = 13 fish) and fine (n = 5) scales revealed leptokurtosis at the coarse but not fine scale. There was no relationship between dispersal distance and habitat at the fine scale, but dispersal was positively correlated with time. Movements by fish with >2 relocations at the coarse scale (n = 43) revealed highly mobile fish moved longer distances over longer time periods to access novel habitats. Our results revealed that Alligator Gar moved nearly constantly without strong habitat associations over short time periods (hours to days), but highly mobile members of the population moved long distances to novel habitats (e.g., from river mainstems to inundated floodplains) over longer time periods (seasons to years).

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Genetic diversity of crayfish species within Georgia's southeastern Coastal Plain

Valeria Ensenat Rivera* (Georgia Southern University), J. Scott Harrison and J. Checo Colon-Gaud (Georgia Southern University)

Crayfish are freshwater decapods related to shrimps, crabs, and lobsters. The state of Georgia has a substantial diversity of crayfish, containing over 30 species in the genus *Procambarus*. As highly endemic organisms, many of the species found in these river basins occur nowhere else in the world; however, little is known about their ecology and distribution. This project aims to bridge the gap in knowledge by using a combination of morphological and genetic techniques to identify species sampled in the Coastal Plain of Georgia and by assessing the variation of the mitochondrial Cytochrome Oxidase I (COI) genes present in select species along various river basins within Georgia's Coastal Plain. Crayfish were obtained from the Savannah, Canoochee, Ogeechee, Altamaha, and Satilla River basins as well as from Sapelo Island using passive (e.g., baited minnow traps) and active sampling techniques (e.g., dip nets and kick nets). Tissue sample was extracted from tail muscle and the presence of genetic material was quantified using the NanoDrop spectrophotometer. Polymerase chain reaction (PCR) was used to isolate and amplify a 600bp fragment of the COI gene which was subsequently sequenced. After obtaining the information, the sequences were matched with those on the NCBI database and used in phylogenetic analysis with sequences of known species. At the end of this project, we will be able to contribute new information regarding the variation of COI genes, distribution, and phylogeny of the crayfish species that inhabit Georgia's Southeastern Coastal Plain.

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Long-term monitoring informs data-poor marine species in the northern Gulf of Mexico

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Fisheries monitoring programs around the world are often designed to provide information on a wide range of species that come into contact with the program gear(s). Within the collected information, such programs may provide untapped abundance and distribution data for species of greatest conservation need (SGCN) and other rare or data-deficient species. We examined more than 30 years of fish sampling data from coastal Louisiana and found that 13 of 18 SGCN marine fishes were represented in existing routine monitoring data. Although some species were rarely reported, over 100 records were available for seven species, with some species being reported several thousand times. Using these records, we were able to provide species-specific information about gear, season, location and timing for several marine fishes that were previously considered largely unknown. Given the paucity of information available for these species and the rapidly changing Louisiana coast, these biogeographic data may be important in the development of future conservation and management programs.

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Population genetics as a conservation tool for the Robust Redhorse

Daniel Farrae* (South Carolina Dept. Natural Resources), Robust Redhorse Conservation Committee

Robust Redhorse *Moxostoma robustum* is a large-bodied catostomid that occurs in several large southeastern Atlantic Slope rivers. After being lost to science for about 100 years, documentation of Robust Redhorse in the Pee Dee, Savannah, and Oconee Rivers in the 1990s represents an extraordinary scientific rediscovery. In the years since the species' rediscovery, substantial efforts have been made to use stocking to enhance extant populations and reestablish extirpated populations. Genetics has been a critical tool to understanding broodstock selection based on population structure, management of broodstock crosses, identification of cultured fish, and monitoring of genetic diversity and inbreeding across their range. Early stocking efforts in Georgia may have been unsuccessful in long-term support of populations as catch rates have declined. Conversely, more recent stocking efforts have potentially succeeded in the re-establishment of a population in the Santee-Cooper System and enhancement of the Pee Dee River population. A lack of juvenile captures, population declines of adults in some areas and unknown status in other areas have led to the development of an environmental DNA (eDNA) tool for the Robust Redhorse. This tool will allow for the passive detection of juveniles and/or adults in habitat reaches that are challenging to sample through traditional methods and identify the presence or absence of the species in locations where status is unknown. The incorporation of genetic tools provides key pieces of information that are important component of the conservation planning and management of Robust Redhorse.

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Vulnerability of the Virginia Department of Wildlife Resource's coastal assets to sea level rise

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Since its inception in 1916, the VA Department of Wildlife Resources (VDWR) has accumulated assets to grow conservation capacity and improve the quality and quantity of wildlife-related recreating opportunities for all. Many of the agency's tidally-influenced assets now face threats of permanent inundation due to rising sea levels – and with it partial or complete loss of usability. Using the best available sea level rise (SLR) models and resources unfurled with the 2021 VA Coastal Resilience Master Plan, we identified all agency assets vulnerable to SLR and forecasted the probable timing of inundation and loss of usability at each asset location. In total, 50 VDWR boat ramps, 18 wildlife management areas (WMA), seven fishing piers, one reservoir, and one field office is already or will be impacted by SLR by 2080. Half of these boat ramps are expected to be inundated daily by the mean high water mark (usage compromised) by 2050. Over 21,000 acres of WMA, roughly 10% of the agency's land area, is expected to be permanently submerged by 2080. Given the likely necessity of triaging resources to abate these future losses, 12 prioritization criteria were developed to enable a more objective and equitable agency approach to adaption. The findings reported here fulfill a critical first step in ensuring DWR makes climate-informed, fiscally-responsible investments moving forward. The VA Department of Conservation and Recreation's updated Virginia Outdoor Plan will feature this study's white paper (emphasizing methodology) to facilitating similar assessments across other state agencies and coastal organizations.

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Detection and identification of white spot syndrome virus in farmed Louisiana crawfish

Mahala Gambill* (Louisiana State University), Dr. Stephen Midway, Louisiana State University; Dr. John Hawke, Louisiana State University

Crawfish harvests constitute the bulk of the commercial aquaculture profits in Louisiana, and the recent identification of white spot syndrome virus (WSSV) in cultured populations of red swamp crawfish *Procambarus clarkii* within Louisiana has caused serious concern, because of the virus' ability to induce mass mortality events with little to no notice. Several studies have demonstrated differences in WSSV strain virulence in crustaceans, however, WSSV in Louisiana aquaculture crawfish has not been exclusively quantified or described. Three metrics are often used detect WSSV in crawfish ponds — Polymerase Chain Reaction (PCR) test results, Ct values, and farmer identification. WSSV PCR results from submitted tests were compared over three years: 2020, 2021 and 2022 to investigate annual infectivity or ponds that exhibited biannual infectivity. Logistic regressions with a random effect for each pond was used to examine the correlation between farmer assessed outbreak and reported Ct score value to examine the correlation between PCR testing and Ct score value for ponds testing positive in 2021 and 2022. Individual farmers have voiced concern about transmission, identification, and long-term effects of WSSV since it was identified in Louisiana. This clarity on the relationship between known diagnostic metrics, assessed data on the spatial extent of the virus and continued partnership and collaboration with stakeholders in this industry will allow for the identification and continued clarity of multiple additional variables at play surrounding this complex virus within the context of Louisiana's crawfish aquaculture industry.

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Thermal tolerances and physiological responses of juvenile Tennessee Heelsplitter *Lasmigona holstonia* to environmentally relevant temperatures

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The freshwater mussel *Lasmigona holstonia* is endangered in Virginia and is a candidate for federal listing. This species prefers cool headwater streams; however, our long-term in-stream temperature monitoring data suggests that these streams are warmer and more variable than expected. As coolwater species are more likely to be threatened by rising water temperatures, it is important to understand their thermal tolerances. Using a small-scale laboratory mesocosm, we exposed ~2-month-old juvenile mussels to environmentally relevant summer temperatures (18, 22, 28, and 32°C) in June 2021. Sub-lethal endpoints (growth and heart rate) were measured on days 0, 7, 14, 21, and 28 of the 42-day trial. Final growth and survival were assessed on Day 42. Survival ranged from 29% to 52% for mussels in the 18, 22, and 28°C treatments. Five mussels in the 32°C treatment were still alive on Day 14, which was a higher survival than expected for this treatment. Mussels in the 22 and 28°C treatments grew over 0.5 mm, while mussels in the 18°C treatment grew an average of 0.03 mm, suggesting that 18°C was too cold to support growth. On Day 0, average heart rate ranged from 34 beats per minute (BPM; 32°C) to 59 BPM (18°C), and decreased 12–20 BPM by Day 28. Results suggest that L. holstonia juveniles can temporarily withstand higher and more variable water temperatures, although long-term exposure may result in a decline in mussel health and survival. These results provide critical information for understanding the thermal tolerances of this headwater species.

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Genetic diversity and population structure of the Big Sandy Crayfish *Cambarus callainus*: utilizing genetics for captive propagation planning

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

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 *C. 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 75 individuals at 18 sites from the Levisa, Tug, and Russel Fork watersheds in the summer of 2021 and sent to Floragenex (Beaverton, OR) for RADseq library preparation and Illumina sequencing in 2022. Approximately 4 million raw reads were generated for each of 171 samples (museum samples and freshly collected); ~2 million reads remained after filtering and trimming of low-quality sequences and ambiguous barcodes. Thousands of unique SNPs have been identified within the dataset. Further downstream analysis of the resulting population genomic sequence data will provide a greater understanding of the genetic distinctiveness of the sampled *C. callainus* populations and help to identify potential broodstock target areas for planned propagation efforts.

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A novel approach to examining spatial movement patterns of Gray Snapper and Sheepshead in Tampa Bay, Florida

Zoe Golden* (The University of Tampa), Bridgette Froeschke, The University of Tampa

This project used a conservation approach of developing models to successfully predict fish behavior and environmental preferences at different life stages. Spatiotemporal length distribution models of Gray Snapper *Lutjanus griseus* and Sheepshead *Archosargus probatocephalus* were developed to predict essential fish habitat, recruitment patterns, population aggregations and salinity preferences in Tampa Bay, Florida. All fish length and environmental data were collected as part of the Independent Monitoring Program at Florida Fish and Wildlife Research Institute from 1996 to 2020. Hot Spot (Getis-Ord Gi*) analysis was performed on fish length- both monthly and seasonally per species to examine spatial patterns among life history stages. Kriging was conducted on environmental parameters. A General Additive Model was conducted to examine the relationship of spatial (distance to the inlet), temporal (month), and environmental (salinity, temperature) factors with size classes of each species. Results suggest Gray Snapper recruit during the summer at high salinities near inlets, migrate to low salinities in Upper Tampa Bay as adults, and move back to higher salinities in the fall to spawn. According to spatial analysis, Sheepshead recruit in the winter at low salinities near freshwater inflow, while adults cluster in high salinities near inlets. There were significant spatial patterns identified for both estuarine dependent fish species in Tampa Bay. Spatiotemporal distribution models allow for the establishment of essential fish habitats, nursing grounds, and fisheries management strategies that are critical for sustaining commercially and recreationally valued fish populations.

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Effects of introduced Alabama Bass on an existing Largemouth Bass fishery in Moss Lake, North Carolina

David W. Goodfred* (North Carolina Wildlife Resources Commission), Chris J. Wood, North Carolina Wildlife Resources Commission

Negative impacts from non-native congener introductions have emerged as an immediate threat to black bass conservation and management. Largemouth Bass *Micropterus salmoides* historically comprised the sole black bass fishery in Moss Lake, North Carolina. Alabama Bass *M. henshalli* were illegally introduced into Moss Lake and were first detected during a 2008 electrofishing survey conducted by the North Carolina Wildlife Resources Commission. Since their detection, Alabama Bass rapidly increased in abundance throughout the reservoir, while Largemouth Bass abundance declined concomitantly and reached a low equilibrium, except within cove habitat of the upper reservoir. Although compositionally dominate, Alabama Bass were overall smaller in size and in poorer condition than Largemouth Bass. Alabama Bass mean size exhibited an increasing trend, which correlated to their expanding population. Alabama Bass were smaller than Largemouth Bass at ages 1-2; however, by age 3, growth rates of both species converged and became similar thereafter. Our findings improve understanding of black bass population characteristics changes following the introduction of Alabama Bass on an existing native Largemouth Bass fishery. Fisheries agencies are encouraged to implement preventative and adaptive control measures to both discourage illegal fish translocations and coordinate unified practical management approaches to the ever-present threat of invasive species expansion.

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Highs and lows of a tailwater: creel survey challenges and solutions for a large river trout fishery

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Abstract: The White River below Bull Shoals Dam (Bull Shoals Tailwater) is the most popular and economically important trout fishery in Arkansas. Therefore, it is extremely important to continue to manage the fishery in a way that meets the desires and expectations of its stakeholders. The objective of this presentation is to discuss logistical challenges associated with collecting human dimensions data on a large, tailwater fishery (~90 mi.) and how the Arkansas Game and Fish Commission (AGFC) has adapted its sampling methods in order to overcome them. Challenges include the size/length of the fishery being surveyed, diversity of access to the fishery (public/private), and the highly commercialized nature of the fishery (guided trips). Non-residents constitute the majority of trout anglers on the Bull Shoals Tailwater, which further challenges managers because their motivation, preferences, and satisfaction may differ from Arkansas anglers. Examples will be provided based on creel survey methodologies used and data collected by the AGFC over the past 20 years. This presentation will also illustrate ways in which the AGFC's public input process could be refined over time in order to develop best management practices for its resources and stakeholders.

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

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Gear bias is an important factor that influences data collected during fisheries sampling. Though the bias of many fisheries gears has been studied, gear bias of low-frequency electrofishing (LFE; <30 pulses per second) has received less attention. LFE is a common method used when assessing Blue Catfish *Ictalurus furcatus* populations. Blue Catfish are a popular sportfish amongst anglers in the United States due to their trophy size potential and edibility. In Oklahoma, a one fish over 30-inch (760 mm TL) regulation was implemented with the goal of increasing abundance of large fish. Anecdotal evidence from Oklahoma Department of Wildlife Conservation (ODWC) standardized sampling suggests that LFE may underrepresent the larger size classes of fish (>760 mm TL). If LFE is biased against larger size classes, it limits the ODWC's ability to assess the effectiveness of the one fish over 30-inch regulation. Therefore, we designed a study to quantify the size bias associated with Blue Catfish LFE sampling. Blue Catfish were sampled using LFE, gill nets, and juglines and tagged with modified Carlin dangler tags in three Oklahoma reservoirs. Our size-structure data suggests LFE captures smaller catfish relative to gill netting. Cormack-Jolly-Seber models suggest that capture probabilities for LFE are higher for stock-sized Blue Catfish relative to Blue Catfish that were preferred-sized and larger. However, this result may be lake specific, potentially due to lake morphometry or size structure of each Blue Catfish population. Additional mark-recapture data are currently being collected on a fourth Oklahoma reservoir.

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Examining literature trends with the fish and climate change (Ficli) database

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Inland fishes and fisheries are an important resource to communities worldwide. They support industries, livelihoods, and culture and by providing the sustenance, recreational opportunities, and ecosystem services that shape our lives. Inland fishes can be particularly vulnerable to climate change due to the varying physical characteristics of freshwater habitats, including sensitive thermal regimes and changes in streamflow. But, uncertainty in these impacts makes informed management efforts difficult. The Fish and Climate Change database, FiCli (pronounced “fick-lee”), can help identify appropriate management strategies. It is a comprehensive, online, public database of peer-reviewed literature on documented and projected climate impacts to inland fishes which includes a suite of summary tools to make more informed decisions. Each year since its formation, FiCli has been updated by a systematic literature review of peer-reviewed journal publications describing projected and documented examples of climate change impacts on inland fishes. The database allows researchers and managers to query on specific inland fish families, species, response types (i.e., fish assemblage dynamics, demographic, distributional, evolutionary, phenological), or geographic locations to obtain summary information on fish responses to climate change and recommended management actions. This presentation will both introduce FiCli and its capabilities, and explore observed trends in inland fish research, both hotspots (i.e., well studied) and gaps (i.e., understudied). It will then highlight common linkages among life-history traits found in papers (e.g., thermal guilds, feeding type, parental care, habitat type) and temporal trends in documented and projected studies.

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Effective and efficient or oversimplification? Experimentally testing the efficacy of a standardized barrier survey.

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Within rivers, culverts are the most common type of barrier to aquatic organismal passage (AOP). Barrier surveys have been developed to rapidly assess culverts for AOP, but research on headwater fishes and the efficacy of these surveys are lacking. More information is needed to understand the connectivity of small-bodied headwater fish which account for much of the freshwater biodiversity in the southeastern U.S. The goal of this study was to 1) use a novel experimental approach to assess the efficacy of a common barrier survey, and 2) to determine the connectivity of stream fish within the range of the federally threatened Louisiana Pearlshell Mussel *Margaritifera hembeli*. We conducted SARP (Southeast Aquatic Resource Partnership) barrier assessments at all accessible sites across four watersheds. 6 sites with varying SARP AOP scores were selected to conduct mark-recapture studies and an additional 35 were selected for community samples. Of the 89 culverts surveyed, 20 (22%) were identified as moderate barriers and 13 (15%) were identified as significant or severe. Mark-recapture surveys resulted in the marking of 5,947 fish across 41 species. The mean recapture percentage was (11.6%), but varied depending on the site. Our results suggest that the weighting of variables in the SARP protocol should be altered to better represent local conditions. However, this data is only representative of the few species, and the limited spatiotemporal scale calls for further larger scale studies. Based on our results, we have recommended several culverts for removal or restoration as they represent significant barriers to AOP.

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Florida's Black Crappie management plan: guiding future management

Ryan Hamm* (Florida Fish and Wildlife Conservation Commission)

Black Crappie *Pomoxis nigromaculatus* is a highly valued sportfish throughout much of North America, including Florida. Despite the popularity and value of Black Crappie angling to the state of Florida there has been relatively little directed management for this species. In order to best direct management and research for this popular species, FWC assessed current and future crappie management directions through a comprehensive stakeholder engagement plan using Human Dimensions and biological data. The end result of this effort is the FWC's Black Crappie Management Plant (BCMP). This BCMP employs a set of goals and objectives related to 4 main topic areas. These topic areas in the plan have been utilized to guide FWC's approach to Management, Research, Promotion, and Stakeholder Engagement.

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Alabama Bass threaten world class black bass fisheries in Tennessee

John Hammonds* (Tennessee Wildlife Resources Agency), Mike Jolley - Tennessee Wildlife Resources Agency

Movement of the Alabama Bass outside its native range has resulted in challenges for fisheries managers across the southeast. Hybridization with Smallmouth Bass and the ability to displace Largemouth Bass represent significant threats of Alabama Bass movement into Tennessee's waterways. Since the discovery of Alabama Bass in Tennessee in 2001, we have seen changes in Black Bass genetic composition and changes in the dominant Black Bass species within two reservoirs. Most recently, the presence of Alabama Bass genes has been documented in new, sporadic locations in Tennessee, indicating these fish are likely being moved by people across waterbodies and watersheds. A major concern of this illegal movement is the threat to native black bass populations across the state, including the possibility of eradicating a world class Smallmouth Bass fishery at Dale Hollow Reservoir.

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Addressing the need for lab experiments to fill the temperature gap in trait-based approaches in fishes

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Trait-based approaches for fishes are increasing in use for their potential ability to predict species responses from patterns present in the community and to infer mechanisms driving community assembly. These approaches can be used to address important issues, including determining the role of the environment and anthropogenic influences on shaping communities, which is becoming increasingly important with the effects of climate change. This work primarily uses traits related to habitat use, trophic ecology, and life history, with fewer studies using metabolic and defense traits. A current limitation with trait-based approaches is a lack of metabolic trait data, particularly related to the thermal ecology of fishes. Furthermore, most of the thermal traits currently being used in trait-based approaches are qualitative traits which are less informative. Previous work has suggested that metabolic traits improved our understanding of mechanisms structuring a stream fish assemblage during different stages of drought, thus supporting the future use of quantitative traits related to fish thermal ecology in trait-based approaches. To accomplish this, we will discuss the types of laboratory studies that can be used to determine a suite of thermal metrics to improve our understanding of upper and lower thermal limits for survival, optimal temperatures for growth and performance, and preferred temperature in fishes. Assessing multiple thermal metrics allow us to make comparisons among thermal metrics, and it also provides a more complete understanding of the lethal and sub-lethal effects of temperature on fishes which could play an important role in the conservation and management of fishes.

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Captive care, rearing, and release of the imperiled Big Sandy Crayfish *Cambarus callainus*

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The Big Sandy crayfish *Cambarus callainus* is native to the upper Big Sandy River basin within West Virginia, Kentucky, and Virginia, USA. This species was listed as federally threatened in 2016 due to its limited range, population declines, and the increase in nearby anthropogenic stressors. To protect this species, both captive holding and rearing efforts were conducted. Thus, in July of 2021 we begun captive care for *C. callainus* collected from a bridge construction site located in the Tug Fork River of McDowell County, West Virginia. Individuals were held in care until Nov 4th, 2022, when the construction was complete. Three females that were captured had sperm plugs and became ovigerous in captivity. Eggs from these females hatched in September 2021 and 52 juveniles were independent at stage 4 within 30 days. Over 50% of young born in captivity have survived to 70mm carapace length. The next stages of recovery will be to implement captive breeding to reintroduce tagged individuals into areas of historic range. A combination of all these ex-situ efforts should provide an increase in population as well as habitat restoration throughout the watershed.

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A non-lethal method for extracting diet items from darters (Etheostomatinae)

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Diet data collection is increasingly difficult for darters, as most methods require the dissection of each specimen and the removal of the digestive tract, which is fatal. The collection of diet data is a crucial step in better understanding and managing these fish, especially those listed as species of consecration concern. We wanted to apply “small scale” gastric lavage techniques to darters and assessed its success and impact on the fish. We used “gastric lavage on ~40 individuals each of Redfin Darters *Etheostoma whipplei* and Greenside Darters *E. blenniodes*. This procedure was completed twice on each individual fish. All stomach contents were preserved in 70% Ethanol. Twenty of these individuals were vouchered to get an estimate of gastric lavage success. Each fish was monitored for 30 min after gastric lavage to monitor behavior and survival. Total length (mm) and weight (g) were measured for each individual fish. The threshold for mortality with gastric lavage appears to be 35 mm in Redfin Darters and 45 mm in Greenside Darters. The median (range) success of gastric in Redfin Darters was 87.0% (66.7%-100%.) and 75.0% (66.7%-100%) for Greenside Darters. This research is important for the understanding of darter diets and provides a non-lethal method to collect this information. Future research should explore the use of these technique on other darter species and other small-bodied species like madtoms *Noturus*.

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Impacts of Hurricane Michael on Shoal Bass within the Chipola River, Florida

Ryan Henry* (Florida Fish and Wildlife Conservation Commission), Brandon Barthel, Andy Strickland, Stephen Stang, and Bryan Winston (Florida Fish and Wildlife Conservation Commission)

Shoal Bass *Micropterus cataractae* are listed as a species of greatest conservation need by the Florida Fish and Wildlife Conservation Commission. The only known naturally reproducing population in Florida is found in the Chipola River. Hurricane Michael devastated the Chipola River in 2018, and several fish kills were documented in the immediate aftermath of the storm. Major declines in Shoal Bass relative abundance were observed in 2019. The objectives of our study were 1) to conduct a mark-recapture population estimate to compare the abundance of the Shoal Bass population to earlier estimates produced from sampling in 2009-2011, 2) to estimate the effective population size of the Shoal Bass population and 3) to assess the current state of hybridization between Shoal bass and non-native black bass species within the Chipola River. A mark recapture population estimate took place over 9 days in October and November 2021. The Schnabel population estimate suggested that there were 1,039 Shoal Bass) from Spring Creek to Johnny Boy Landing in fall 2021. This is 52% lower than the estimate produced when the same stretch was sampled in 2009. Genetic results indicate that the Chipola River Shoal Bass population currently has very low levels of hybridization with non-native black bass. The effective population size of the Shoal Bass population was estimated to be less than 50. This suggests the population would be vulnerable to introgressive hybridization, genetic diversity loss, and inbreeding depression if the population remains at this level.

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Simulating fish passage impacts on American Paddlefish metapopulation dynamics

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Riverine fish species have suffered massive population declines as a result of dam construction. Dams can destroy and block access to spawning habitat as well as divide populations into segments with potentially different dynamics. The viability of the resultant metapopulation then depends on connectivity between segments, particularly when spawning habitat and production varies across dams. Given this, demographic rates within segments may depend on passage rates across dams. We simulated the effects of dispersal across dams on metapopulation dynamics of a riverine species, American Paddlefish. Using an agent-based model, we evaluated the effects of different simulated passage rates across three dams in a reservoir chain on overall metapopulation stability in the system. Scenarios were designed based on recent passage rate data from the Alabama River. Juveniles were allowed to pass downstream via passive dispersal regardless of upstream passage probability at the dams. We found that under current demographics and current passage rates at the dams (estimated from telemetry studies by Auburn University), the metapopulation declined to 0 within 100 years in all simulations (n=100). The downstream-most population segments acted as population sinks, accumulating biomass over the time series until the upstream segments declined to the extent that they could no longer support production downstream via juvenile dispersal. Once upstream subsidies were depleted, the downstream segments declined to 0 as well. Scenarios with increased passage rates at multiple dams resulted in more metapopulation stability than scenarios that only increased passage rates at one dam.

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Assessing the unknown: understanding the degree of aquatic habitat fragmentation from road crossings in the southeastern United States

Kathleen Hoenke* (Southeast Aquatic Resources Partnership)

Fragmentation of river habitats by anthropogenic barriers is one of the primary threats to aquatic species in the United States. However, the degree of fragmentation of aquatic habitat from undersized and perched road crossing structures is largely unknown. Over two million road crossing structures exist in the Southeastern United States, yet only 40,000 have been assessed to determine if they are barriers to aquatic organism passage. Since 2015, as a part of its Aquatic Connectivity Program, the Southeast Aquatic Resources Partnership (SARP) has been leading an effort to collect data using a standardized protocol developed by the North Atlantic Aquatic Connectivity Collaborative (NAACC). Since that time, over 300 people from a variety of partner organizations have been trained to use this protocol and have collected data at over 13,000 road crossings using SARP's field application and Aquatic Barrier Inventory. These assessments have resulted in the replacement of more than 20 road crossing structures as well as a better understanding of the impacts of road stream crossing structures on aquatic organisms and their habitats across the region.

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Blotchy bass syndrome in the lone star state: a synergistic approach to citizen and agency science integration

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Recent studies have determined that blotchy bass syndrome (BBS) in black basses in the northeastern United States has been associated with a family of viruses. In 2022, Texas Parks and Wildlife (TPWD) partnered with the United States Geological Survey (USGS) and West Virginia University (WVU) to collect distribution and prevalence data on blotchy bass syndrome in black bass species in Texas. For this effort, we implemented a two-pronged approach leveraging state agency biologists and anglers. Each of the 15 inland fisheries and river studies districts received sterile swabs from USGS and WVU to collect DNA samples from fish displaying blotchy bass syndrome collected during standard electrofishing surveys. At the time of this abstract, five districts have collected and shipped swabs to USGS for analysis. The effort is expected to continue until the end of the calendar year, and additional sample collections are anticipated. Simultaneously, we solicited anglers' reports via social media, ultimately requesting they submit photos and catch location information to us via email. At the time of this abstract, almost 900 individual submissions have been submitted. The majority of submissions have been Largemouth Bass, though presumptive cases of BBS have been documented in all four black bass species found in Texas. In the coming months, the team at USGS and WVU will determine the presence and novelty of viruses in Texas black basses.

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Oh, the places they'll Go! Seasonal movements of juvenile Gulf Sturgeon in Pensacola Bay watershed

Kirsten Humphries* (Florida Fish and Wildlife Conservation Commission), Bradford Warland, John Knight

Juvenile Gulf Sturgeon *Acipenser oxyrinchus desotoi* movements and estuarine habitat use in the Yellow and Escambia Rivers are currently being monitored in an ongoing 4-year project that commenced in 2020. For the first three years of this study, age-1 to age-5 juvenile Gulf Sturgeon were tagged with Vemco V7 or V9 acoustic transmitters during the spring, summer, and fall. Tagged individuals were then monitored by acoustic receivers (n=~70) in the Pensacola Bay watershed. Coordinated seasonal movements were observed in the Yellow and Escambia River watersheds. However, due to several factors, each system's population exhibited unique patterns. Individuals age-1 to age-3 demonstrated high fidelity to the river mouths while age 4+ had an expanded range in estuarine movements. In both systems, individuals were observed inhabiting shallow water areas (<2 meters) for significant periods of the winter. The vulnerability of these individuals while in shallow water habitat needs to be further studied. Understanding habitat use of juvenile Gulf Sturgeon is crucial in aiding future conservation efforts for the recovery of the species.

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Habitat-specific abundance and mortality of juvenile Blue Crab *Callinectes sapidus* with Bayesian inference; influences of post-larval abundance, seasonality, and water clarity

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Nursery habitats confer higher food availability and reduced predation risk and disproportionately contribute more individuals per unit area to the population compared to other habitats. Nursery status is inferred through evaluation of four metrics: density, growth, survival, and linkage between juveniles and adults. If all four metrics are higher when compared to all other habitats, a selected habitat is considered a nursery. We evaluated two nursery metrics, abundance, and survival, with respect to juvenile Blue Crab across two structurally complex habitats — seagrass meadows and salt marshes — and an unstructured control in the York River of the Chesapeake Bay while also considering effects of spatial orientation, seasonality, and physicochemical variables. Abundance was positively associated with both seagrass and salt marshes, salt marsh turbidity values, and post-larval abundance. Survival was positively associated with juvenile size and structurally complex habitats relative to unvegetated controls. Survival peaked in April, reached a seasonal minimum in August, and increased throughout fall. Moreover, habitat-specific survival was dependent on spatial position, such that upriver salt marsh and unstructured sand habitat both conferred substantially higher survival relative to downriver counterparts. Taken together, abundance and survival results indicate that salt marshes offer comparable per unit area nursery function to seagrass meadows. When extrapolated at the scale of the river to consider the relative abundance of each habitat, results indicated that salt marshes contributed a majority of secondary production. Hence, salt marshes should be considered a key nursery habitat for Blue Crab, even where extensive seagrass beds occur.

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Assessing effects of bigheaded carp establishment on lower Mississippi River fish assemblages

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Bigheaded carps *Hypophthalmicthys spp*. first invaded the Lower Mississippi River (LMR) in the 1980s. However, there have been few attempts to assess their possible ecological effects on native fish assemblages. During 1995-1997 prior to bigheaded carp establishment in the LMR, an intensive fish assemblage dataset was compiled across seven secondary (side) channel locations spanning 900 river kilometers. Sampling locations in the study ranged from the Kentucky-Missouri border downstream to the Mississippi-Louisiana border. Fish assemblages were assessed at three different macrohabitats, namely sandbars, steep natural banks, and dikes. Additionally, annual fish sampling coincided with falling river stages (July-August) and low river stages (September-October) at each site. Comparable fish sampling occurring during 2021-2022 following the wide establishment of bigheaded carps yielded individuals representing 34 different species and 17 families. Silver Carp alone comprised 15% of the numerical catch, but were estimated to have contributed as much as 50% of the total fish biomass. Given that many aspects of LMR fisheries are not well understood, this study represents a unique opportunity to assess fish assemblage responses over broad spatial and temporal scales to invasive carp establishment, which is pervasive throughout many rivers in the midwestern and southern U.S.

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Chattahoochee Bass distribution, genetic integrity, and habitat associations in the Chattahoochee River basin

Chad Kaiser* (Georgia DNR), Bryant Bowen

Historically, Georgia is home to the richest diversity of *Micropterus* species in the world. To conserve this diversity, Georgia DNR is conducting surveys to better understand how black bass populations are partitioned across the landscape and what issues they face. The Georgia DNR Stream Survey Team began assessing the distribution and genetic integrity of Chattahoochee Bass throughout its range in 2018. Our objectives were to delineate the current distribution of Chattahoochee Bass; assess the genetic integrity of Chattahoochee Bass populations; and to characterize the watershed and reach level habitat impacts on Chattahoochee Bass distribution. We sampled 154 sites from 2018 to 2020. Pure Chattahoochee Bass were found at 42 (27%) sites. Molecular surveys revealed that the genetic integrity of Chattahoochee Bass populations is threatened by introgression with the non-native Alabama Bass, *M. henshalli.* While genetically intact populations persist in places above barriers in minimally disturbed watersheds, abundances have largely declined and have become fragmented, with populations declining by an estimated 88% of their historic range. Some historic populations appear to have been extirpated completely. The two forces driving range restriction of Chattahoochee Bass are introgression through hybridization with non-native Black Bass species and habitat changes from increased anthropogenic disturbance.

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Comparison of finfish and crustacean assemblages among established marsh terraces, new marsh terraces and open water in a restored brackish marsh

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Louisiana has lost approximately a quarter of coastal lands that were present in 1932 from a variety of natural and anthropogenic factors, thus necessitating restoration activities. One technique is creating marsh terraces in areas where marsh has been degraded to open water. Terraces provide edge habitat and slow land loss by reducing wave energy in surrounding marsh. This study evaluated the influence of marsh terraces on finfish and crustacean assemblages in a brackish marsh east of Golden Meadow, Louisiana. The habitats evaluated included new terraces built in 2022, established terraces built in 2017, and an open water area. Gee's® minnow traps, gill nets and a shrimp trawl were used to sample along terrace edges, terraces channels and in open water. Sampling occurred twice a month May through October 2022. Finfish and crustaceans were identified to species, counted and measured (mm). Catch per unit effort (CPUE) was calculated as number of individuals collected per unit of effort for each gear type. Gulf Killifish *Fundulus grandis* collected in minnow traps had a higher mean CPUE (± SE) in established terraces (0.26 ± 0.08) than new terraces (0.01 ± 0.01; $F_{1,22} = 13.43$, $P = 0.001$), but no differences were detected for other species. Differences between established and new terraces may indicate changes in edge habitat quality for some species while trawl data indicate finfish assemblages are not different among habitats. Examining finfish and crustacean assemblages provided insight into possible ecological effects of terraces and how those effects may change over time.

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Regional and demographic patterns of early pandemic recreational fishing

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In 2020, the COVID-19 pandemic disrupted individual and social behaviors and norms, including outdoor activities. A recreational angling survey of 18,000 licensed anglers from 10 states (AR, CT, FL, IA, MO, NC, SC, TX, UT, WY) was conducted in summer 2020 to understand recreational fishing trends during the first few months of the pandemic. The study presented here builds off this survey by combining the survey data with county level human population density and spring 2020 per capita COVID-19 cases. Specifically, we wanted to know if population density or per capita COVID-19 cases influenced angler-reported: 1) changes in license sales, 2) number of fishing trips, and 3) reasons for fishing. Preliminary results suggest that per capita COVID-19 cases was more influential in driving angler behavior than was population density. Specifically, we found that in counties burdened with greater COVID-19 case counts, there was greater angler recruitment and earlier license purchases. Anglers aged 40 and older and earning $50K and greater living in areas of greater per capita COVID-19 cases also went on more fishing trips than they would in a typical year. Angler motivation varied across gradients of population density, both before and during the pandemic, as well as per capita COVID-19 cases, indicating that increases in recreational fishing may have been driven by increased free time and a desire to get away and be in nature. Thus, at the onset of the pandemic, high COVID-19 case counts were associated with an uptick in recreational angling activity.

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Evaluating movement and habitat selection by Alabama Bass and Largemouth Bass in Lake Hartwell, South Carolina

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Alabama Bass *Micropterus henshalli* were illegally introduced into the upper Savannah River Basin 15-20 years ago and have since become abundant as well as problematic ecologically. Acoustic telemetry was used to quantify diel movement, habitat use, and habitat selection of Alabama Bass and Largemouth Bass in Lake Hartwell, SC across seasons (June 2021-July 2022) with the goal of informing ongoing habitat enhancement efforts. Across all seasons, Alabama Bass conducted diel horizontal migrations from deeper offshore habitats during the day to nearshore, shallow habitats at night. Daytime Alabama Bass movement rates in offshore waters were higher than nighttime movement rates. Largemouth Bass remained in shallow, nearshore habitats during both day and night and moved less at night. When both species were nearshore at night, Alabama Bass used deeper habitats than Largemouth Bass potentially indicating habitat partitioning between species. During spring, Alabama Bass used deeper habitats compared to Largemouth Bass, suggesting differences in spawning habitats may exist. Discrete choice models revealed that Largemouth Bass had positive selection for all habitat structure classifications with the strongest odds of selecting installed woody structure during the day. Alabama Bass selection for rocky structures was highest across a diel period while selection for installed course woody structures was weak. Our results suggest key differences in movement behavior, habitat use, and habitat selection of both species residing in the same system. Moreover, installed woody structures placed in shoreline habitats would likely benefit Largemouth Bass in Lake Hartwell while providing limited benefits for Alabama Bass.

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Creating a systematic prioritization of stream reaches for conservation of aquatic species

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Human impacts to aquatic ecosystems have resulted in systemic declines of global freshwater species abundance and richness. Conservation and governmental groups worldwide have designated protected areas to preserve the remaining diversity. The biodiversity hotspot approach, which designates areas based on high levels of species richness, has been useful for identifying areas to protect both terrestrial and aquatic species. However, for freshwater species, additional approaches are warranted to identify specific stream reaches for protection and/or restoration. To address this issue, we present methodology to create a Gridded River Identification System (GRIS) for river segments based on 30-second arc grids (~0.9km) combined with the USGS National Hydrography High Resolution Dataset. To demonstrate the utility of this approach, we obtained occurrence data for six imperiled freshwater species in Texas and created ensemble species distribution models (ESDM) based on climate and topographical variables. Predicted occupancies were overlaid onto the GRIS in Texas and rank ordered from 1 to 5, with 1 being lowest probability of occupancy and 5 being the greatest. The rank ordered segments were then used to identify priority reaches for conservation and restoration activities. Our approach is widely applicable to other freshwater species so long as distribution information is available. The GRIS can also be easily developed for stream systems outside of the current study area. Future studies could build upon our framework by incorporating additional taxa data and projected changes in climate and land use to assess distribution stability.

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Climate change and water quality influence on Atlantic Sturgeon aggregation in the Altamaha River, Georgia

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Water quality degradation is an important threat to remaining populations of the federally endangered Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus*. Juvenile Atlantic Sturgeon congregate in the estuaries of their natal rivers in the summer, where water quality conditions (i.e., temperature, dissolved oxygen [DO], and salinity) are highly variable. Young sturgeon are vulnerable to extreme water quality conditions, which are likely to be exacerbated by climate change. Climate change induced shifts in water quality may restrict available habitat, impairing species recovery. University of Georgia researchers have collected data on juvenile Atlantic Sturgeon catch and water quality in the Altamaha River estuary according to a consistent sampling protocol for 20 years. Using these data, we fit negative binomial mixed-effects models describing water quality conditions related to catch per net-hour of juvenile and age-1 Atlantic Sturgeon. Water temperature and DO concentration were significant positive predictors of juvenile catch, and salinity was a significant negative predictor. Among interaction and quadratic terms tested, only the interaction between temperature and DO contributed significantly to the model. Models fit using only age-1 catch data were similar, except that DO was not a significant predictor. We then predicted future water temperatures using publicly available long term water quality data and climate modeling projections. We coupled these predictions with catch models to forecast future catch and spatial distribution of juvenile Atlantic Sturgeon within the estuary, providing insights into how the changing climate may affect sturgeon nursery habitat use.

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Why did the federally listed fish cross (or not cross) the road?

Bernie Kuhajda* (Tennessee Aquarium Conservation Institute), Shawna Fix, Southeast Aquatic Resources Partnership

Many aquatic species listed under the Endangered Species Act suffer from habitat fragmentation due to road related stream crossings. The federally endangered Laurel Dace *Chrosomus saylori* and federally threatened Blue Shiner *Cyprinella caerulea* are two species in which habitat fragmentation has been listed as a cause for population declines. The Laurel Dace historically occurred in only eight streams on Walden Ridge (Cumberland Plateau) in Tennessee. To determine the extent of habitat fragmentation, SARP barrier assessment protocols were used to evaluate 24 culverts within the range of the Laurel Dace. Twelve barriers were considered moderate, significant, or severe. Of these 12 barriers, funding has been secured for design of new culverts at two sites and replacement at one of these sites. Both are on a landowner's property, which will help us become a trusted partner in the local community for additional on the ground conservation efforts. The Blue Shiner is native to the Coosa River system in Alabama, Georgia, and Tennessee. In Alabama, Blue Shiners are found in low abundance in Weogufka Creek, but are common in Choccolocco Creek. Due to the similar size and habitat of the two creek systems, we investigated whether habitat fragmentation was a factor causing low numbers of Blue Shiners in Weogufka Creek. Using the SARP barrier assessment protocol, 26 culverts were assessed and 11 were found to be moderate, significant, or severe barriers. Work to improve fish passage for the Laurel Dace and the Blue Shiner could significantly increase the health of their populations.

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Analysis of the impacts of the gulf Menhaden fishery on the Spotted Seatrout stock in the northern Gulf of Mexico

Robert Leaf* (University of Southern Mississippi)

Large-scale monitoring efforts for gulf Menhaden and Spotted Seatrout are undertaken by both federal and state entities in the northern Gulf of Mexico, and these efforts support quantitative statistical assessments for both stocks. Statistical stock assessment modeling supports decision-making for fishing activities. An open question is how monitoring and modeled population data can be used to inform the interactions of different stocks in the ecosystem. The abundance and biomass of a stock at any time are simultaneously influenced by a variety of interacting environmental and biological factors that influence mortality, movement, growth, and reproduction. Here we investigate whether patterns in Spotted Seatrout abundance, landings, recruitment, and condition are influenced by the biological and population characteristics of gulf Menhaden. In this work, I use monitoring data to evaluate the hypothesis that the Spotted Seatrout stock is deleteriously impacted by Menhaden reduction fishery operations. There are a variety of hypotheses regarding why the Spotted Seatrout stocks in Louisiana and Mississippi are depressed. These include but are not limited to 1.) changes to the prey base in terms of its condition, oil content, abundance, and age structure, 2.) recreational fishing pressure on the stock, and 3.) changes to the Spotted Seatrout stock due to impacts on water and habitat quality. This work serves as an exploratory analysis to evaluate patterns in both stocks using the best available modeled and observed data.

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Examining the relationship between flow and year-class strength of Striped Bass in the Roanoke River, North Carolina

Laura M. Lee* (North Carolina Division of Marine Fisheries), Charlton H. Godwin, North Carolina Division of Marine Fisheries

The North Carolina Division of Marine Fisheries (NCDMF) recently performed a benchmark stock assessment of the Albemarle Sound-Roanoke River (A-R) striped bass stock in North Carolina. While an external peer review panel endorsed the final model for management use for at least the next five years, several uncertainties were noted. One key uncertainty was the potential cause for the recruitment decline observed in recent years. The review panel recognized the decline in recruitment was not solely a result of reduced stock abundance due to harvest (i.e., overfishing) and recommended future assessments consider key abiotic and biotic drivers of recruitment. Spring flow conditions in the Roanoke River (the spawning grounds for A-R striped bass) are believed to influence recruitment and ultimately stock abundance and was included as a high priority for further evaluation in the stock assessment's research recommendations. Rulifson and Manooch (1990) investigated the relationship between Roanoke River flow and subsequent striped bass recruitment in the western Albemarle Sound nursery area. Simple comparison of the available flow data and juvenile index led them to conclude that strong year classes in the Roanoke River are associated with moderate river flows (5,000–11,000 ft3/s) based on data collected from 1955 through 1986. The reported results were consistent with earlier studies. This study investigated whether the results would be consistent with findings in Rulifson and Manooch (1990) if the time series was extended to include more recent data (through 2021). The specific question is whether there is a certain range of flow associated with weak year classes and strong year classes.

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Survey of hybridization between sympatric Redeye Bass *Micropterus coosae* and Alabama Bass *M. henshalli* in Mobile River basin, Alabama

Matt Lewis* (Auburn University)

Hybridization by introduced taxa is one of the main threats to the diversity among the black basses *Micropterus spp.* and particularly relevant to the Redeye Bass *M. coosae* (REB). The Mobile River Basin in Alabama contains one of the largest populations of native REB; however, little is known about hybridization between sympatric REB and Alabama Bass *M. henshalli* (ALB) in this system. We used 64 diagnostic SNP loci to determine the extent of hybridization in 2,679 fish collected from 135 sites across three major river systems. About 28% (750/2,679) were identified as hybrids, 42% (1,135/2,679) were identified as pure REB, 21% (552/2,679) were identified as pure ALB with the remaining composed of other *Micropterus spp.* We found evidence of hybridization at 54% of the sites (73/135) with only 46% of sites (62/135) having no evidence of hybridization. We found that hybridization rates varied among river drainages and among streams within those drainages. The Black Warrior River drainage contained the highest levels of overall hybridization (34%). The Cahaba River drainage had an overall hybridization rate of 31% followed by the Tallapoosa River (13%). Based on our sampling, individual streams ranged in hybridization rates from 0-75%. Most hybrids (76%) were between REB and ALB, and primarily consisted of backcrossed individuals (71%) indicative of a bimodal hybrid zone between these two sympatric populations. Introgressive hybridization is occurring at levels in these co-evolved species that equal and in some cases, exceed hybridization rates between previously allopatric black bass populations, threatening the local biodiversity of these limited REB populations across the heart of their native range.

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Does the use of analogy change angler attitudes more than scientific evidence alone?

Steve Lochmann* (University of Arkansas at Pine Bluff), Uttam Deb (UAPB)

Many scientists are moving away from the deficit model of science communication. Simply sharing our science with the public results in less than satisfactory outcomes. There is a movement toward strategic approaches to science communication, which includes communication theory, explicit communication goals and objectives, and strategies for achieving objectives. One such strategy is the use of analogy. Is the use of analogy really more effective than simply providing scientific evidence? We used a before-after-control-intervention study design to examine the change in attitude regarding the practice of catch and release before and after reading an article on the subject. A control article provided evidence that catch and release is not always appropriate for a fishery. Treatment articles provided the same evidence but included one of two analogies to reinforce the evidence. Pre- and post-intervention surveys were analyzed to determine the change in survey respondents' attitudes toward harvest and toward catch and release as a general conservation practice. Results from a survey of anglers will be presented. Thus, the work provides empirical evidence of the influence of analogies on effectively communicating messages with anglers.

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Using a boosted regression tree model to predict road-Stream crossing barrier severity scores in the Ouachita Mountain ecoregion in west-central Arkansas

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Global biodiversity declines are exacerbated by stream habitat fragmentation due to poorly constructed road-stream crossings. Efforts to restore habitat connectivity to areas impacted by road-stream crossing barriers are hindered by a prioritization challenge. There are more than 1.4 million road-stream crossings in the United States. Methods for predicting barrier severity without visiting crossings would be useful. We assessed 300 crossings within the Ouachita Mountain Ecoregion using the SARP protocol. Barrier severity scores range between 0 (severe barrier) and 1 (no barrier). We used boosted regression tree modeling to predict severity scores based on forty-one landscape variables and three local variables. The landscape variables were derived from existing databases and GIS layers. A second model included only the landscape variables. About half the crossings were insignificant barriers. Nine percent were severe barriers. In the first model, outlet shape (a local variable) had the highest relative influence (67%). Eight variables had more than 1% relative influence. In the second model, soil landform (16%), stream order (13%), and road type (11%) had the greatest relative influences. Fifteen variables had at least 1% relative influence. Cross-validation correlation for each of the models was 0.67 and 0.47, respectively. Correlation coefficients relating observed and predicted barrier scores were 0.66 and 0.62 for the two models, respectively. The ability to predict barrier severity score without visiting a crossing could support efforts to prioritize crossings for removal or replacement. Predicted barrier severity scores might also be used to create a short list of sites to visit before prioritization.

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Benefits to multi-jurisdictional monitoring of a premier catch-and-release Largemouth Bass fishery

Joseph Love* (Maryland Department of Natural Resources), Mary Groves, Dan Goetz, Maryland Department of Natural Resources; John Odenkirk, Mike Isel, Virginia Department of Wildlife Resources; Luke Lyon and Christopher Adriance, District Department of Environment

Management for Largemouth Bass *Micropterus salmoides* fisheries in Chesapeake Bay tidal rivers occurs within jurisdictional boundaries. While its limited home range once justified this scale of management, translocation of Largemouth Bass among rivers during catch-and-release fishing has now resulted in a disconnect between fishery management and population demographics. Anglers who cross jurisdictional boundaries create an inter-jurisdictional spatial scale of management. In 2019, the Interagency Cooperative for Largemouth Bass Monitoring in Tidal Potomac River was formed to evolve current management and included four jurisdictions (Maryland, Virginia, Washington D.C., and Potomac River Fisheries Commission). These jurisdictions met multiple times to create a standard operating procedure and in 2021, tagged 791 fish (200 mm – 572 mm total length), of which anglers reported catching 89 at least once between April 2021 and March 2022; no bass were reportedly harvested. Adjusting for a reporting probability of 0.35, approximately 16% of the tagged population had been caught once, and four fish had been caught twice. Eleven of the reported fish (12%) had been translocated. Population size estimated from recaptures observed during five bass tournaments was approximately 137,000 for 4845 ha of tidal freshwater. Benefits of monitoring population size with multi-jurisdictional monitoring include: 1) standardizing methods across management agencies; 2) establishing a monitoring program at an appropriate spatial scale for the fishery; and 3) structuring communication among agencies, anglers, and industry. This project advances management of the Potomac River bass fishery by furthering conservation for one of the top bass fisheries in North America.

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Thermal vulnerability of spring associated fishes in an urbanizing, groundwater dependent stream

Nick Loveland* (University of Texas at San Antonio), Matthew Troia (UTSA), Marty Kelly (TPWD), David Young (TPWD)

Anthropogenic climate and land use change is altering thermal regimes of freshwater habitats and causing thermal stress to aquatic organisms. Spring influenced streams are especially vulnerable to this change due to their reliance on groundwater, an increasingly valuable human commodity in urbanizing landscapes. Although stream temperature may be the most important abiotic factor affecting the physiology of stream dwelling fishes, there is a paucity of stream temperature data in the heavily groundwater dependent streams of the Edwards Plateau in Texas. In this study, 52 in-stream temperature sensors were deployed every 50 meters along the 2.1 km Honey Creek from the headwaters at Honey Creek Cave to the mouth at the Guadalupe River. Additionally, continuous stage/flow measurements are gathered, and biological surveys are performed. These field data will be integrated with lab-based thermal tolerance data for three spring associated fish species endemic to the Edwards Plateau: Plateau Shiner, Guadalupe Roundnose Minnow, and Guadalupe Bass. Preliminary analysis of in-stream sensor data indicates that more stable diel temperature cycles near springs may provide thermal refuge in summer months. This information will help forecast future thermal vulnerability of spring-associated species of greatest conservation need and inform conservation and management of ecologically significant stream segments.

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Population estimates and habitat associations of American Eel in a hydroelectric reservoir

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Yellow American Eel utilize diverse habitats including large freshwater impoundments created by hydroelectric dams where they remain for many years prior to outmigrating to the sea. Habitat associations of eels during freshwater residency provides understanding on the carrying capacity of the system when evaluated in the context of population size and habitat-specific densities. This study estimated the population size of yellow and silvering eels in Roanoke Rapids Lake, NC, a 5,000 acre hydroelectric reservoir, and evaluated habitat utilization during a 3-year baited trap survey. Habitat stratum, bottom temperature, depth, and survey month significantly predicted eel CPUE while bottom dissolved oxygen levels were not observed to have a significant impact on CPUE. Eel CPUE was significantly higher in offshore shallow and offshore deep strata compared to the other habitat strata (i.e., natural shoreline, manmade shoreline, and tailrace of the upstream Gaston Dam), but not significantly higher than the shallow vegetated stratum. Eel CPUE was significantly higher during the May-July period when water temperatures were warmer. Higher eel captures during this period may have been a function of more actively feeding eels and thus a greater susceptibility to baited traps. Based on two years of mark-recapture data from trapped eels, the population of potentially outmigrating eels (≥ 300 mm TL) was estimated to be 3,575 (95% confidence interval = 2,324 - 7,745). Habitat mapping during a related study will be paired with the habitat-specific abundances described in this study to develop an independent estimate of eel population size for Roanoke Rapids Lake.

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Evaluation of population characteristic differences between Largemouth Bass and its backcross following long-term stocking in a large reservoir

Sean C. Lusk* (Arkansas Game and Fish Commission), Christopher R. Middaugh (Arkansas Game and Fish Commission)

Allison Asher (Arkansas Game and Fish Commission)

Florida Bass (FLMB) *Micropterus floridanus* are commonly introduced into extant Largemouth Bass (LMB) *M. salmoides* populations throughout the southern United States with the intent of increasing the trophy potential of those waterbodies. Although these introductions have increased trophy production in some waterbodies, a more common result is a population level shift in the genetic composition towards hybrid bass which are predominantly LMB with low levels of FLMB alleles (FX-LMB). Despite their increasing prevalence throughout the southeast, little work has examined FX-LMB population vital rates and whether these hybrids increase the trophy potential of a waterbody. Our study fills a void in existing research by comparing population characteristics of FX-LMB and LMB in a major waterbody. Lake Ouachita is a large, highland reservoir in Arkansas which was stocked with >800,000 fingerling FLMB between 2007–2015. In 2019, we collected 1,000 bass from throughout the reservoir and determined the level of FLMB introgression for each using a diagnostic single-nucleotide polymorphism panel. We then investigated relationships between %FLMB alleles or genotype and several population characteristics. Our results indicate that FX-LMB hybrids likely do not mature earlier, survive longer, have better body condition, or have greater growth potential than native LMB in Lake Ouachita. We conclude that a subtle shift in the genetic composition towards the FX-LMB genotype will not increase the trophy potential of a population. To maximize effectiveness, stocking programs should be focused on maximizing abundances of fish with high levels of FLMB genetics.

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Effects of tagging on endemic Bartram's Bass and non-Native Alabama Bass

Kathryn Lusk* (Clemson University), Dr. Brandon Peoples, Tyler Zumwalt, Preston Finley (Clemson University)

Radio tags and passive integrated transponders (PIT) tags are used in tracking fish in their own environment. Using telemetry and radio tags along with PIT tags for these species proves vital for preservation and analysis of movement, population estimations, mortality rates, etc. The objective of our study was to quantify tag retention and tag-induced mortality of Bartram's Bass *Micropterus sp. cf. coosae*, Alabama Bass *M. henshalli*, and their hybrid congeners. Radio tags and PIT tags were placed in the peritoneal cavity of Bartram's Bass, Alabama Bass, and hybrids. Individuals were assigned to radio-tagged, PIT-tagged, and control groups. 45 individuals were assigned to each group: 15 Bartram's, 15 Alabama Bass, and 15 hybrids, yielding a total of 135 fish. Mortality and tag shedding were then monitored for 30 days. We calculated shedding and mortality rate for each tag type and species. We then used Chi-squared tests to analyze shedding and mortality rates and an ANOVA to test for differences among species and tag types. Like other studies, we expect to see no more than 30% mortality and minimal tag shedding for each species and tag type. We also expect tagging wounds to heal within 30 days. Such results will yield estimates on tag shedding and mortality that can be incorporated into future tagging studies of black bass.

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Lots of carp, but no spawning: the comings and goings of Bighead and Silver Carp

Aiden Maddux* and Shannon Brewer, Auburn University, Alabama Cooperative Fishery Research Unit

Invasive Bighead Carp *Hypophthalmichthys nobilis* and Silver Carp *H. molitrix* are successful invaders perceivably due to their variability in habitat use, spawning patterns, and movement rates. These species are major threats to native fish assemblages due to competition and rapid population growth. They have invaded most of the Mississippi River basin and continue to expand their range. The lower Red River is an understudied catchment in the context of Bighead and Silver Carp. Current research on the lower Red River conducted from 2021-2022 targeting adult and larval carp found noticeable differences in population demographics compared to other established populations. The youngest adult carp captured was estimated to be 3 years old. No juvenile or larval carp were detected during both studies, and no successful spawning was observed despite the fish sampled being full of eggs. This leaves several knowledge gaps related to spawning and movement patterns in the lower Red River. Using acoustic telemetry, we will determine movement patterns and habitat selection by Bighead and Silver Carp. This study will aid in more efficient management efforts by identifying areas and times when carp may be susceptible to capture. Moreover, we may better understand our current observations related to the apparent lack of or intermittent spawning in the catchment.

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Predicting outmigration of American Eel *Anguilla rostrata* to Improve eel survival at a hydroelectric facility on the Roanoke River, North Carolina

Chris Manhard* (AKRF, Inc.), Justin Krebs (AKRF), Peter Sturke (Dominion Energy), Taylor Allen (Dominion Energy), Carlos Lozano (AKRF), Corey Chamberlain (Dominion Energy), and Fred Jacobs (AKRF)

Downstream migration and passage of yellow and silver American Eel *Anguilla rostrata* were monitored for three years in Roanoke Rapids Lake (lake), a reservoir formed by the Roanoke Rapids Power Station and Dam (station). Acoustic-tagged eels were monitored during the 2019, 2020, and 2021 outmigration periods using acoustic telemetry receivers placed upstream and downstream of the station. The timing of eel outmigration from Deep Creek, the largest tributary of the lake, and the timing of downstream passage through the station were determined using acoustic detection data. Poisson regression models were used to analyze detection data in the context of a suite of environmental variables that were hypothesized as potential cues to outmigration. Outmigration probability from Deep Creek was influenced by time of day, precipitation, and lunar phase, whereas outmigration probability of inhabiting the lake was influenced by time of day, precipitation, and change in lake elevation. These results suggest that management actions, such as scheduled water releases from a dam and the consequent change in lake level, can influence the onset and timing of eel outmigration to the Sargasso Sea. These acoustic telemetry data are being used to develop a predictive model of eel outmigration timing at the station.

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Florida's statewide crappie regulation review

Allen D. Martin* (Florida Fish and Wildlife Conservation Commission)

A comprehensive review of all of Florida's crappie regulations was conducted in 2020-2021. The statewide regulations of no minimum size limit and a 25 fish daily bag limit were adopted in 1988. Since that time several resource specific regulations had been put in place without much evaluation, and there had not been any comprehensive regulation evaluation. A team of Florida Fish and Wildlife Conservation Commission staff including managers, researchers, law enforcement, and human dimensions specialists, along with Dr. Mike Allen from the University of Florida reviewed all of the crappie regulations in the state. The team used both biological and human dimensions data to determine if any changes were needed. While many anglers expressed the desire for a statewide 10-inch minimum length limit, biological data did not indicate a need for such a regulation. The biological data also indicated that not only would such a regulation would not improve fishing for most resources in the state, but it would be detrimental to many Florida crappie fisheries. This presentation will focus on the review of biological data, the collection of human dimensions data, and how the two types of data were utilized and balanced in the decision-making process for Florida's crappie regulations.

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Is crappie year class strength set at the larval phase? Is larval crappie sampling worth the effort?

Adam Martin* (Kentucky Department of Fish and Wildlife Resources), Nick Simpson, Kentucky Department of Fish and Wildlife Resources; Justin Graben, Kentucky Department of Fish and Wildlife Resources

Crappie *Pomoxis spp.* populations often exhibit high levels of interannual variation in recruitment. While much research has been conducted regarding the cause of that variation, generally the findings have been inconclusive or incongruent. One key component of the debate is whether crappie year class strength is set during prespawn, or after the first winter, or some point in between. Using 8 years of weekly neustonic ichthyoplankton trawls, we explored whether year class strength was set by the pelagic larval phase in Kentucky Lake, a large southeastern mainstem reservoir. We also explored the utility of weekly ichthyoplankton trawling to estimate hatch dates by comparing hatch data derived from the length frequency observed in our ichthyoplankton trawls with hatch data derived from juvenile otolith daily ring analysis. Further, we make the case that the factors affecting crappie recruitment may be best explored at the daily or weekly temporal scale rather than the more common interannual scale seen in studies relying purely on trap net or electrofishing data.

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Updated assessment of American Eel demographics at the Toledo Bend hydropower project, Sabine River, Gulf of Mexico

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A range-wide decline in the status of the American Eel *Anguilla rostrata* has prompted efforts to pass eels upstream of migration barriers to historical freshwater habitat. In 2014, the Federal Energy Regulatory Commission issued a new license to the Sabine River Authorities for the continued operation of the Toledo Bend Hydropower Project on the Sabine River, Texas and Louisiana. Included in this license is a condition to pass American Eel upstream of the project dam if certain conditions are met. Upstream passage operations and electrofishing surveys were initiated in 2017; suspended in 2018 to repair the dam; and resumed in 2022. Boat electrofishing catch rates ranged from 0 – 48, 0 – 11, and 0 - 18 eels per hr. in 2017, 2018, and 2022, respectively. Additionally, 334 eels were captured during a backpack electrofishing event in 2019, during which the catch rate was 95 eels per hr. The pooled length-frequency distribution of eels captured at the project ranged from 140 – 700 mm, with the majority <350 mm. The pooled age-frequency distribution ranged from 0 – 16 years, with the majority <4 years. All eels sexed at the project were female or undetermined. Growth parameters suggest eels grow slowly at the project relative to other locations. This presentation will review the results of upstream passage and electrofishing operations to date, including total catch, relative abundance, size and age structure, sex ratios, growth, and habitat use patterns of eel captured. The presentation will also outline unforeseen obstacles and operational adjustments proposed for upstream passage.

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Diel behavior and home range of juvenile Sheepshead *Archosargus probatocephalus* associated with a commercial oyster lease determined by acoustic telemetry

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As oyster aquaculture continues to expand in the eastern United States it is important to understand how structure-oriented species will use lease installations as habitat; the addition of a lease converts a previously unstructured environment into a densely structured one. Sheepshead *Archosargus probatocephalus* are an economically important species that are known to depend on highly structured habitat throughout their life. To address the question of oyster leases serving as habitat, we installed an Innovasea (VEMCO) acoustic receiver array (VPS) on a floating bag oyster lease in Cedar Island Bay, North Carolina and surgically tagged 27 juvenile Sheepshead (103mm - 193mm) with acoustic transmitters in order to track their movements at the fine spatial scale from July through November 2020. Juvenile Sheepshead were detected significantly more frequently in the lease than in the surrounding embayment when the results were standardized by area. Tagged individuals frequently left the lease area to move along a mudflat or marsh edge and returned to the lease later in the same day, we expect that these movements were related to foraging behavior. Sheepshead showed particularly high residency during nighttime hours as they rested in and around the refuge of the lease. These results indicate juvenile Sheepshead are frequently associated with oyster leases, and lease habitat appears to provide refuge from predators and access to prey items associated with oyster communities. These data and analyses will provide insight into the amount of available habitat for juvenile Sheepshead and the ecological benefits of oyster aquaculture.

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Simulating Florida Bass stocking in southeastern reservoirs to inform duration and rate of stocking programs

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Management agencies throughout the southern United States widely stock Florida Bass (FLMB) *Micropterus floridanus* into extant Largemouth Bass (LMB) *M. salmoides* populations with the intent of increasing the trophy potential of those waterbodies. These stockings commonly lead to fast shifts in the system-wide genetic composition towards a population dominated by hybrid bass which are predominantly LMB with low levels of FLMB alleles (FX-LMB). However, to our knowledge there is no available guidance to managers on how adjusting stocking rate and duration could affect FLMB genetic levels in a system. To examine this, we created a simplistic individual-based model parameterized based on recent work in Lake Ouachita, AR. Our model simulates a stocking program with primary inputs being FLMB genetic level before stocking, stocking duration, and stocking rate. We measured the % FLMB levels in the population after stocking as well as numbers of different genotypes (i.e., LMB, FX-LMB, F1, etc.). After successfully recreating stocking results of several systems using published input parameters, we applied the model to simulate a hypothetical stocking scenario in a generic southeastern reservoir. Model results indicated that even low levels of FLMB stocking lead to long-term shifts in system-wide genetic composition. However, high stocking rates over long time periods are needed to shift the population towards a majority of fish containing high levels of FLMB genetics. Our results are intended to provide guidance to managers making FLMB stocking decisions by helping to set stocking rates and durations based on target FLMB genetic introgression levels.

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Too hot to fish? Effects of weather, hurricanes, and Covid-19 on angling effort

Steve Midway* (Louisiana State University), Paul Miller, Louisiana State University

Recreational angling is a very popular outdoor activity in the US and throughout the world. Decisions about going angling often hinge on weather conditions (among other factors), although fine-scale investigations of weather and fishing are rare. In this study we used weekly estimates of fishing effort throughout coastal Louisiana to understand how effort changed in response to weather conditions such as maximum temperature, precipitation, maximum wind speed, and small craft advisories. Although we found evidence for some effect of all the weather variables, temperature reported the greatest number of monthly effects (i.e., months in which temperature was significantly related to effort), along with an overall declining effect throughout the calendar year. We also examined how tropical storms and hurricanes reduce fishing effort, and the rate at which effort recovers—which is generally fast for most storms. Finally, we had the opportunity to look at fishing effort during the first year of the pandemic (2020) compared to previous years and found some monthly increases exceeding 100% of normal effort. Understanding angler motivations and decisions remains an important part of both fishery management and human behavior, and in a future with changes to weather and climate, increasing hurricanes, and global health crises, we can now know a little more about how dynamic environmental factors change angling effort.

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Microplastic presence in Dallas-Fort Worth lacustrine fish communities

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Microplastics have recently gained attention as concerning pollutants capable of altering the physiology of organisms. However, studies on lacustrine organisms in urban waterways are less common. We sampled 136 fish of 14 different species from four Dallas-Fort Worth reservoirs and examined their gastrointestinal (GI) tracts for microplastics. For each fish, the entire GI tract was removed, pulverized in distilled water, and subsampled to count microplastics. We counted over 109,000 microplastics from 408 subsamples of GI tract contents. All of the samples contained microplastics. Most microplastics were fragments (99.96%) though we identified some fibers (0.04%). River Carpsucker *Carpiodes carpio* had the highest average concentration of microplastics followed by Gizzard Shad *Dorosoma cepedianum*, Smallmouth Buffalo *Ictiobus bubalus*, and Yellow Bass *Morone mississippiensis*. The larger lakes, Arlington (1897 ± 365) and Worth (762 ± 119) had higher average microplastic concentrations (mean ± SE) than the smaller lakes, Bachman (324 ± 69) and Marine Creek (370 ± 61). Though the study was not intended to determine the effect of microplastic concentrations on urban lacustrine fish communities, there is strong evidence to suggest microplastics negatively impact fish growth, reproduction, and survival. Moreover, microplastics can transfer from the gut to the filet which may pose serious risks to human health. As such, this study indicates the need for further examination of the prevalence of microplastics in urban waterways and their impacts on fish communities.

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Role of flow and environmental variables on stream biodiversity

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Flow is referred to as a 'master variable' in stream systems, as it has been shown to determine instream habitat types, and therefore impacting local species richness. Flow also interacts with aspects of the environment, thus having both direct and synergistic effects on biodiversity. Therefore, in order to advance the use of flow metrics in the management of stream systems, a better understanding of how flow interacts with all aspects of the environment is needed. To address this knowledge gap, we analyzed macroinvertebrate, and fish datasets covering South Carolina wadable streams, utilizing variance partitioning to determine the contribution of flow metrics, anthropogenic variables (e.g., number of road crossings, and percent developed land) and environmental variables (e.g., climate, and elevation), as well as their interactions on local species richness (alpha diversity). We found that variation in alpha diversity was determined by all these factors, as well as interactions, suggesting the inclusion of flow and anthropogenic variables will enhance stream research.

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How hatchery management of vulnerable stream fishes can predict impacts of climate change

Shannon Murphy* (Conservation Fisheries)

Stream fish have particular breeding methods that are influenced heavily by changes in temperature. In a hatchery setting the main goal is to replicate as many conditions as possible to stimulate each species to spawn. We do this with recirculating systems containing several clear tanks ranging from 20 gallons to 120 gallons, depending on the species size and needs. These clear tanks allow biologists to closely observe behavioral and physical changes in each fish when hatchery conditions, particularly water temperatures, change. A change in temperature can be detrimental to species: a) with a narrow temperature tolerance, whether it be a gradual or acute increase or decrease in temperature; b) that need a drastic change in temperature to trigger their spawning season, such as species that spawn in the late winter or early spring; c) in which males and females can be thrown out of sync due to an irregular change in temperature. In addition to negative impacts on spawning, changes in temperature can possibly weaken a fish's immune system, allowing pathogens to invade, leading to mortalities. Making such observations in a hatchery setting can predict possible impacts of changing temperature dynamics in streams and rivers due to climate change, and can help inform management practices to allow for the best case scenario for small stream fishes.

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Diel or no diel? Benthic fish assemblages on gravel bars vary with season, depth, and time of day

Chelsea Myles-McBurney* (Florida Fish and Wildlife)

Gravel Bars are dynamic riverine habitats that harbor a diversity of organisms and contribute unique ecological values within the active channel of rivers (Zeng 2015). Little directed sampling efforts have been conducted on gravel and pebble habitats for fishes that have an obligate relationship to these habitats. Furthermore, few studies have documented entire fish assemblages and their diel, depth and seasonal patterns on gravel bars. In Florida, gravel and pebble substrate are almost found exclusively in the upper reaches of the Escambia River. The Escambia River drainage supports the richest assemblage of fish species compared to any other Florida stream with 85 native freshwater species recorded along with several rare and threatened species (Boning 2007). In order to effectively sample small benthic fishes, a Siamese trawl with a dual-mesh bag was selected to sample gravel bar habitat. The purpose of this study was to examine fish assemblages across gravel bar habitats within the Escambia River. Furthermore, determining if changes in fish assemblage differ among times of day, depths, and seasons. Over 66 trawls, 1,130 individuals, comprised of 30 species were collected. Overall catch composition was significantly different among day and night trawls ($R = 0.33$, $P < 0.001$), shallow and deep trawls ($R = 0.14$, $P = 0.04$) and among trawls conducted at different sites ($R = 0.36$, $P < 0.001$). By utilizing different sampling techniques, such as trawling, we can determine the most effective species-targeted surveys along with collecting the most comprehensive data on fish assemblages on gravel habitat within the Escambia River.

Change of Summer Flounder abundance in the Chesapeake Bay, and ecosystem-based evaluation

Josephine Oakley, Yan Jiao, Eric Smith, Kevin Friedland, Rob Latour, Mary Fabrizio, Tom Miller

Summer Flounder *Paralichthys dentatus* are an important species in the Chesapeake Bay, both economically and ecologically. Summer Flounder population has declined drastically in recent years along the Atlantic Coast and in the Chesapeake Bay. It is important to assess which conditions are contributing to the population decline and if other fish species within the community are exhibiting similar trends. To improve our understanding of Summer Flounder abundance, we examined the population trends, local water temperature, life history traits of the fish community in the Chesapeake Bay, and large-scale climate ocean oscillations to determine if population trends are related to these factors. Based on fishery-independent trawl survey data in the Chesapeake Bay from 2002-2018, a correlation analysis was done to identify species with similar or contrary trends in interannual abundance to Summer Flounder. We found that the Atlantic Croaker, Windowpane, Clearnose Skate, Smooth Dogfish, Smooth Butterfly Ray, Bay Anchovy, Weakfish, and Spot have similar trends as Summer Flounder in the Bay. Among the factors examined, water temperature in the Bay has increased since 2005, while mean bay temperature range and gradient both decreased after 2005 based on change point analyses. Summer Flounder and correlated species have declined in abundance since 2005, which demonstrates significant correlations between water temperature range and gradient, and species abundance. Future studies on the life history traits and their influence on species abundance under local environmental changes are needed to better understand responses of Summer Flounder in the Bay.

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Niche structure for coastal sharks in the U.S. southeast Atlantic Ocean and Gulf of Mexico

Kaitlyn O'Brien* (Virginia Institute of Marine Science), Rob Latour

Understanding spatial ecology and predicting animal movements in response to environmental changes (e.g., anthropogenic climate change and multidecadal variability) impacting coastal waters is critical for effective conservation strategies. Coastal sharks are integral to the coastal ecosystems of the U.S. southeastern Atlantic and Gulf of Mexico as they occupy the mid to upper trophic levels and can significantly impact ecosystem functioning and stability. Niche partitioning is key to coastal shark species and life stages coexisting in U.S. southeast Atlantic and Gulf of Mexico waters to limit inter and intraspecific competition. This study analyzed data collected from four fishery-independent bottom longline surveys to develop ecological niche models. These models were coupled with dynamic high-resolution ocean models to project suitable abiotic habitats from 1994 to 2019 for fourteen size classes of small and large coastal sharks. The estimated catch from models provided weightings for five centers of gravity, which were utilized to evaluate shifts in abiotic habitat over time and estimate correlation with three indices of large-scale climatological trends. The predicted relative abundance across measured abiotic variables differed slightly for small coastal sharks with a general association toward warmer, high salinity, shallow benthic waters close to shore. There was no overarching niche for large coastal sharks, which varied appreciably across species and size classes. Evidence of ontogenetic segregation was present for both small and large coastal shark species. Overall, niche structure for coastal sharks is evident, and the provided framework can help guide spatial management decisions to support sustainable fisheries.

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Differentiating between spawning and non-spawning habitat for Brown Trout using side-scan sonar from Greers Ferry Tailwater, Arkansas

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The Greers Ferry Tailwater (GFTW) in the northern portion of central Arkansas contains an intricate and highly variable network of structure and substrate types largely due to Greers Ferry Dam being constructed in the early 1960s. The dam's construction converted the GFTW from a warm water river to a cold-water system through hypolimnetic release. Rainbow Trout were introduced shortly after the dam began operation and Brown Trout would soon follow. Brown Trout have not been stocked in the GFTW since the early 1970s. However, Brown Trout successfully spawn and self-sustain within the GFTW, unlike any other system in Arkansas. The spawning success of Brown Trout in the GFTW has generated a vast biological and economical interest from anglers and fisheries managers. One recent interest is how much Brown Trout spawning habitat is in the GFTW compared to non-spawning habitat? To assess the quantity of spawning habitat compared to non-spawning habitat, side-scan sonar was used to capture images of the bottom of the river throughout the 48km GFTW. The images were pieced together to form a side-scan mosaic. Grids with approximately 5 meter squared cells were placed on each side-scan mosaic. Cells were assigned a color based on which structure or substrate type made up the majority of the cell's area. Structure and substrate types were delineated cell by cell for the entire GFTW. Totaling each structure or substrate type by number of cells allowed for estimates of spawning and non-spawning habitat in square kilometers throughout the GFTW.

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Ecological correlates of native and nonnative black bass occurrence in the upper Savannah River basin

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Bartram's Bass is endemic to the upper Savannah River basin of GA, SC, and NC. This species is threatened by habitat degradation and hybridization with nonnative Alabama Bass. Despite recent advances, our understanding of the distribution and habitat correlates of Bartram's Bass and hybrids remains patchy. Moreover, many locations where pure Bartram's Bass have been encountered in the recent past now contain only native Largemouth Bass. We sampled 116 sites using backpack electrofishing and angling. We used multistate occupancy and multivariate models to quantify detection, occupancy, and habitat correlates of pure Bartram's Bass and other black bass species. We also used multispecies occupancy models to investigate hypotheses about whether co-occurrence of Bartram's Bass and Largemouth Bass are affected more by biotic interactions or habitat alterations. Occupancy models and principal coordinates analysis indicated that Bartram's Bass were more likely to occur in less disturbed streams that were further from reservoirs. Segments occupied by pure Bartram's Bass occurred differed from those where hybrids or only Largemouth Bass occurred in numerous dimensions of the natural flow regime. Evidence from multispecies occupancy models supported hypotheses that co-occurrence patterns of Bartram's Bass and Largemouth Bass is driven by land cover effects on instream habitat, not biotic interactions. Overall, our results suggest that land cover change and instream flow are key features affecting occurrence of Bartram's Bass, and that these factors are mediated by connectivity with reservoirs—key source pools for nonnative Alabama Bass and native generalist Largemouth Bass.

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Fishscales: a contemporary stream fish community database for the conterminous United States

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Large-extent, cross-scale inference requires seamless transboundary datasets. Several large stream fish community datasets are publicly available, but data from most state agencies remain unincorporated. FishScales is a dataset of contemporary stream fish community monitoring data collated from state and regional environmental management agencies. FishScales currently contains data from 32 US states, with data pledged from another 8 states. Each record indicates a sampling event intended to characterize the entire stream fish community, improving inference on species absences. Both current and recently revised taxonomic information are included to facilitate the rapid re-description of new species. Records are georeferenced as fine as the reach scale, and will be linked to widely used geospatial datasets such as the National Hydrography Dataset and Watershed Boundary Dataset to facilitate cross-scale analyses.

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Fish assemblage structure along an existing aridity gradient mirrors future assemblage projections under climate change scenarios

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Anthropogenically-driven climate change combined with existing ecosystem degradation is projected to cause future losses of global freshwater biodiversity, particularly in arid and semi-arid areas within temperate climate regions. It is therefore necessary to understand both contemporary drivers of freshwater biodiversity loss as well as how future climatic conditions might affect humans and nature. Analysis of existing environmental gradients has the potential to aid in projecting climatic influences on a variety of organisms. We present a multi-scale, spatiotemporal approach to predictive ecological modelling that ultimately demonstrates that an existing aridity gradient is a reasonable proxy for freshwater fish assemblage response to climate change projections for the same region. We conducted our study using fish collections from 100 sampling reaches distributed across the central Colorado River basin of Texas. We combined fish assemblage surveys, local habitat characteristics, remotely sensed geospatial riverscape data, and climate change projections for air temperature and precipitation to analyze: (1) spatial variation in fish-environment relationships under current conditions, and (2) variation in fish assemblage structure under multiple emissions scenarios. Our results revealed that spatial shifts in fish assemblage structure along an existing aridity gradient mirrored the modelled assemblage-level shifts under climate change projections for Representative Concentration Pathways 4.5 and 8.5 projected through 2100. The model predicts a general shift towards invasive, warm-water assemblages and potential loss of endemic, cool-water-dependent species. Our framework underscores the importance of multiscale, spatiotemporal modelling approaches that consider multiple dimensions of the total environment while assessing patterns and predictors of ecological change

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Can Threadfin Shad and juvenile Paddlefish impact noxious planktonic cyanobacteria?

Peter Perschbacher* (retired UAPB)

Noxious cyanobacteria are often present in the plankton of eutrophied natural and manmade water bodies, and may form unstable surface blooms and produce toxins to humans and animals and off-flavors in fish and shrimp. Abundances of three major groups were studied with Threadfin Shad *Dorosma petenense* and juvenile Paddlefish *Polyodon spathula* at the University of Arkansas at Pine Bluff. Threadfin Shad at 23, 15-g fish in three of six, 0.5-m3 tanks filled with adjacent catfish pond water removed 100% of *Oscillatoria chalybea*, and 88% of *Anabaena spp*. in 48 h (Perschbacher 2003). And in six of twelve, 0.1-ha catfish production ponds co-stocked with 8, 5-g shad/m3, *A. circinalis* and *O. chalybea* were absent (Green, Perschbacher, Ludwig, and Duke 2010). Juvenile Paddlefish were stocked at 8.8, 20-g fish/m3 in a 1250 –l tank filled with water from various catfish ponds in 4 trials. After 72 h, an average of 68% of *O. chalybea*, 78% of *Microcystis aeruginosa*, and 100% of *A. circinalis* were eliminated (Perschbacher and Kahrs 2005). The short exposure time in two of the studies may be assumed to reflect top-down effects, and in the season-long pond study also bottom-up effects from stimulation of competing smaller phytoplankton. The high densities used could be encountered in response to patchy food prey and during reproduction. The large cyanobacteria likely were damaged in the crop of Threadfin Shad and the spiral valve of Padddlefish and excreted, even if not utilized.

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Road/stream crossing replacements in east Tennessee

Sally Petre* (Tennessee Wildlife Resources Agency)

Poorly designed road/stream crossing structures, such as undersized or too few culverts, negatively affect stream habitat, fishes, and the surrounding community. Replacing them with aquatic organismal passage (AOP) friendly alternatives can be challenging but beneficial. Here, we review projects and lessons learned from culvert replacement projects in east Tennessee. Specifically, we focus on tributaries to the upper Cumberland River in Campbell County Tennessee, which contain federally endangered Cumberland Darter *Etheostoma susanae*, federally threatened Blackside Dace *Chrosomus cumberlandensis* and state listed in need of management Cumberland Arrow Darter *E. sagitta* in streams with severe rated barriers according to the Southeastern Aquatic Restoration Partnership Barrier Assessment Protocol. The Tennessee Wildlife Resources Agency partnered with USFWS (Partners for Fish and Wildlife and Southeast Aquatic Resources Partnership programs), Campbell County Roads Department and Tennessee Dept. of Transportation to replace the culverts with AOP friendly structures. Although there is a national initiative to accomplish AOP projects, navigating these projects and obtaining funding, contractors, and engineers to complete these projects can be a challenge. Partnerships are an essential part of this work and necessary for protecting these resources in the future.

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Investigating use of oxytetracycline in age estimation of fishes

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Age data provides important information for fisheries science because it is used to understand growth, mortality, and life history, and in turn, guide management strategies. Effective management strategies are reliant on accurate age data; therefore, age estimation methodology must be validated. Oxytetracycline (OTC) is used as an aid to validate annual increment formation because it binds to calcium and serves as a time stamp in calcified structures. Typically, OTC marks are viewed using fluorescence microscopy; however, there have been recent independent observations of visible OTC marks in calcified structures viewed under natural light. Our objective is to determine if there is a relationship between potential factors (species, structures, season of OTC injection, and length of fish) and the visibility of OTC marks with and without the use of fluorescence microscopy. Four species representing taxa with cellular (Gray Redhorse *Moxostoma congestum* and Channel Catfish *Ictalurus punctatus*) or acellular bone (Redbreast Sunfish *Lepomis auritus* and Guadalupe Bass *Micropterus treculii*) bone were injected with saline or OTC during the midpoint of each season in 2021 and were housed in experimental ponds until summer 2022. We examined the visibility of OTC marks in spines or fin rays and otoliths from each species using standard light microscopy and fluorescence microscopy, and then used logistic regression to identify factors influencing the visibility of OTC in these structures. Results from this study will provide additional guidance on the use of OTC as a chemical marker for age validation studies.

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What a difference 45 Years makes: comparing nekton communities of the late 1970s with the 2020s for the Winyah Bay estuary

Bruce W. Pfirrmann* (Baruch Marine Field Laboratory, University of South Carolina), Matthew E. Kimball, Baruch Marine Field Laboratory, University of South Carolina; Curtis J. Szewczyk, Indian River Research and Education Center, University of Florida

Estuarine nekton play key ecological roles and support valuable commercial and recreational fisheries. The river-dominated Winyah Bay estuary, located in northern South Carolina, drains the third-largest watershed on the US East Coast, yet only a few studies have examined nekton assemblages throughout this large estuarine system. The last comprehensive study of the estuary-wide nekton community was a monthly trawl survey of nekton assemblages at nine fixed sites ranging from inside the inlet to middle bay to tidal freshwater tributaries, conducted over two years in 1977-1978. Beginning in January 2022, we replicated this earlier study and began sampling nekton assemblages monthly using the same protocols (20' otter trawl) at the same nine historical sites. Using data from our first year of contemporary sampling, we compared nekton distribution, abundance, and diversity among sites, seasons, and between data sets (historical and contemporary). Contemporary sampling (to date Jan-Oct only) yielded over 40,000 individuals and at least 61 species, with seven estuarine transient species comprising >90% of the catch. Mean trawl catches were greatest at the middle bay sites and in the summer (July). Several species exhibited substantial changes in relative abundance between historical and contemporary data sets; in particular, white shrimp and bay anchovy increased from <3% of the overall historic catch to >50% of the contemporary catch. Long-term comparisons such as this can provide useful insights into the influence of climate and anthropogenic change on nekton communities, and help inform fishery and estuarine management in the southeastern US and beyond.

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Collapsed oyster populations in large Florida estuaries appear resistant to restoration using traditional cultching methods — insights from ongoing efforts in multiple systems

Bill Pine* (University of Florida)

Depressed oyster *Crassostrea virginica* populations in the northern Gulf of Mexico have been the target of numerous post-Deepwater Horizon restoration projects, which primarily focus on replacing oyster cultch (substrate) to promote spat settlement, increase recruitment, and bolster adult oyster populations. I will show that large restoration programs in three Florida estuaries (>$14M US in expenditures) are not having the desired outcome of increasing live oyster populations of any size class. This may be because these systems are trapped in a resilient but low-oyster-production state that is resistant to restoration, or that the restoration programs (as designed) were ineffective at shifting populations from the low production state. My work suggests that substantial uncertainty persists in how to restore oyster populations at large scales in Florida successfully. Addressing these uncertainties will require strong leadership from agency, academic, and industry leaders to conduct restoration projects in frameworks that allow for better learning to increase the likelihood of successfully restoring oyster populations.

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Gulf Sturgeon *Acipenser oxyrinchus desotoi* mesohabitat use in the lower Pearl River Louisiana-Mississippi

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After spring migrations to natal rivers, Gulf Sturgeon *Acipenser oxyrinchus desotoi* reside in freshwater holding areas prior to fall emigrations to nearby estuaries. Limited published information on the physical habitat characteristics of these holding areas is available, especially in the western portion of Gulf Sturgeon distribution. To further investigate freshwater habitat associations, 32 acoustic receivers were deployed from late April to October of 2021 in 1600-m reaches distributed in three channels of the Pearl River, Louisiana-Mississippi, the westernmost river within their current distribution. A hierarchical generalized linear model was used to determine what physical habitat characteristics influenced Gulf Sturgeon mesohabitat occupancy by pairing daily detections of acoustically tagged juvenile and subadult Gulf Sturgeon (n= 93) with physical habitat characteristics (i.e., depth, woody debris accumulation, sinuosity). Greater depth and woody debris accumulation were found to positively influence Gulf Sturgeon occupancy. Model results for occupancy across the 32 reaches yielded high but variable occupancy probabilities (70-97%) across Middle and East Pearl River reaches with similar depth ranges ($P < 0.01$). Occupancy probabilities were lowest for shallow reaches of the West Pearl River (0-55%), where increasing sedimentation has resulted in reduction of deep-water refuge. Defining the habitat characteristics that drive riverine occupancy at the mesoscale allows us to better estimate availability of preferred holding areas within natal rivers. These data will be used to inform future models regarding summer riverine occupancy and inform habitat conservation and restoration efforts by identifying usage patterns in relation to mesoscale habitat availability.

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Effects of size-selective catch-and-release angling on population size structure of two black bass *Micropterus spp.* species in an Alabama reservoir

TJ Pullen* (Masters Student at Auburn University), Matthew Catalano - Associate Professor at 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 and by sampling size distributions of both species from the creel. Creel samples will be used to construct size distributions for fish that were: harvested, weighed-in at a tournament, culled in a tournament, released immediately. 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 will be used to predict size distributions under a range of fishery scenarios that will be selected to represent the fishery at Neely Henry Reservoir and the southeastern U.S. more broadly.

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Evaluating consumer-grade live sonar for freshwater fisheries research

Kyle Rachels* (NC Wildlife Resources Commission), April Boggs

Freshwater fisheries researchers began using live sonar in the early 2000's following the release of dual-frequency identification sonar (DIDSON). DIDSON was the first sonar system to provide near video-quality imaging of fish in turbid freshwater environments. Primarily used for run counts of anadromous fishes, the widespread adoption of DIDSON may be hampered by high initial cost and considerable data post-processing. Consumer-grade live sonar debuted in 2018 and has been quickly adopted by recreational and tournament anglers. We evaluate the utility of a consumer-grade live sonar (Lowrance ActiveTarget) by assessing video quality, describe a process for converting recorded video into usable count data, and compare resulting sonar counts with boat electrofishing relative abundance. Future scientific uses of consumer-grade live sonar may include estimating anadromous fish run counts, evaluating fish habitat, and investigating fish behavior.

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Citizen science bio surveillance of blotchy bass syndrome using a gamified smartphone application

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Blotchy bass syndrome is characterized by the manifestation of variable, discrete areas of hyperpigmentation (melanosis) on the external surface of black basses. Advances in discovery and diagnostic capabilities have augmented surveillance efforts, and subsequently led to the discovery that this condition is associated with viruses of the family Adomaviridae. The public is often aware of and interested in fish and wildlife diseases, particularly those that lead to changes in appearance of animals or affect species of high recreational or commercial value, such as black basses. Reporting observations of disease by citizens and community members thus could be an additional mechanism to expand traditional bio surveillance efforts by fish and wildlife agencies. We opted to leverage crowd-sourcing efforts using existing frameworks of smartphone applications and virtual fishing tournaments to increase community engagement and buy-in. During the Summer and Fall of 2022 a virtual BioBlitz was conducted using the Angler's Atlas MyCatch smartphone application, incentivized with prizes awarded by Bass Pro Shops. The tournament was launched in July of 2022 and encompassed all freshwater waterbodies within the United States and Canada. A total 205 water bodies were sampled within 21 states and 6 Canadian provinces consisting of 2736 hours of direct angling efforts (equivalent to ~$76,000 agency personnel time). Data collection remains ongoing and is expected to increase with additional resources and further grassroot campaigns. A repeat effort is planned for Spring of 2023 to capture additional spatiotemporal variability. This talk will outline the advances made and pitfalls encountered navigating this international effort.

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Spatial segregation and shared landscape relationships of a crayfish assemblage of the Ozark highlands

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Although the importance of crayfishes to ecosystem dynamics and energy transfer is well recognized, we lack information on distributions and associated habitat use for many species globally. Within our study area, three crayfishes are considered of conservation concern (*F. nana, F. macrus, F. meeki brevis*), whereas two native species are considered strong competitors that often invade new habitats (*F. neglectus neglectus* and *F. virilis*). We used field-collected covariates and geospatial data in a multispecies occupancy model framework to determine multiscale factors related to both crayfish detection and occupancy. For all species, detection probability was relatively high and negatively related to water clarity. 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; however, *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. Otherwise, *F. neglectus* and *F. virilis* had opposite relationships with other reach and landscape factors. Our results suggest mechanisms associated with disturbance across the landscape negatively affects 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.

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A meta-analysis of Red Snapper *Lutjanus campechanus* discard mortality in the Gulf of Mexico

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Red Snapper *Lutjanus campechanus* is an economically important fishery in the Gulf of Mexico. Red Snapper are subject to discard mortality from barotrauma as this species is physoclistous, demersal, and are often caught in deeper waters. Novel research to address discard mortality since a 2014 meta-analysis on this topic has been extensive, with a focus on also estimating delayed mortality rather than just immediate mortality at the surface (i.e., swim or float). To synthesize research on discard mortality of Red Snapper we conducted a meta-analysis, combining 11 studies, with 84 distinct estimates from 34 years of research. Only studies that assessed both immediate and delayed mortality were included. We assessed if depth, season, release method, or region could significantly predict discard mortality and generate estimates. We found a significant positive relationship between depth and discard mortality and that, in the western Gulf, fishing in the summer significantly increases discard mortality compared to fishing in other seasons. We found no effect of release method or region on discard mortality. Our mortality estimate, including both immediate and delayed mortality measures, is 34% at the average depth studied (45m), which more than doubles the estimate of discard mortality generated by a previous meta-analysis on this topic. Given that this meta-analysis generated estimates from both immediate mortality and delayed mortality from capture, we propose that these updated and higher estimates of discard mortality are likely more representative of the mortality experienced by the fishery.

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Context dependency of *Lepomis* nursery habitat in the lower Red River catchment

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Freshwater fishes represent one of the most threatened taxa in North America, and nursery habitats are important for successful recruitment. Historically, nursery habitat in large rivers has been defined simply as shallow, calm waters; however, nursery habitats are likely to vary based on other coarse-scale habitat factors. The objective of our study was to describe nursery habitat of large river fishes that are understudied. We focused on seven species of *Lepomis* (e.g., Bluegill *L. macrochirus*, Orangespotted Sunfish *L. humilis*, Warmouth *L. gulosus*, Longear Sunfish *L. megalotis*, Redear Sunfish *L. microlophus,* Green Sunfish *L. cyanellus* and Bantam Sunfish *L. symmetricus*) because of their value as both sportfish and forage species. An occupancy model framework was used to determine the influence of field and geospatial covariates on the detection and occupancy of juvenile Lepomis fishes. We found species detection was positively related to water temperature and negatively related to dissolved oxygen. Nursery habitat occupancy within Lepomis was related to a variety of factors. Juvenile Bluegill tended to occur in reaches that were relatively straight, whereas juvenile Green Sunfish were more likely to occur in more complex, sinuous reaches. Warmouth juveniles were more likely to occur in river reaches that were wide and shallow. Bantam and Longear Sunfish were both more likely to occur in reaches comprising shallower water. Lastly, Orangspotted Sunfish tended to occur in reaches with lower discharge restricting them spatially within the catchment. Our results suggest an important context dependency of nursery habitats even within fishes that are taxonomically similar.

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Hot and bothered: thermal tolerance of Texas Hornshell *Popenaias popeii* in the Black River, New Mexico

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Freshwater mussels are globally imperiled due to their sensitivity to changes in hydrology such as streamflow and temperature. The Black River in southeastern New Mexico hosts a stronghold population of the federally endangered unionid Texas Hornshell *Popenaias popeii* and severally regionally endemic fishes. The species has experienced population decline, attributed in part to declining discharge; however, the role of changing stream temperatures in its decline has not been investigated. We evaluated the upper thermal tolerances (LT05 and LT50) of larvae (glochidia) and newly transformed juveniles from the Black River. Individuals were acclimated to 27°C, and then immersed at five experimental temperatures (28, 30, 32, 24, and 36°C) and non-acclimated control for 12-h and 24-h (glochidia) or 96-h (juveniles). Thermal tolerances of *P. popeii* and its presumed host fish were superimposed on in situ water temperature and discharge data to determine exceedances. Temperature was hind-casted to 2007 to temporally expand the dataset. For glochidia, LT05 was exceeded frequently and LT50 was exceeded occasionally, while juvenile thresholds were never exceeded. We demonstrate how laboratory derived physiological thresholds can be used in conjunction with environmental data to evaluate the hydrologic needs of aquatic organisms, which is useful for environmental management.

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Utilization of genetic data to inform native Brook Trout conservation in North Carolina

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As North Carolina's only native salmonid, Brook Trout *Salvelinus fontinalis* is a fish of considerable ecological and cultural significance in the state, but anthropogenic alterations to the landscape and introductions of nonnative salmonids have fragmented and reduced its native range. As a result, the North Carolina Wildlife Resources Commission (NCWRC) has enacted numerous efforts to help conserve the species. Annual demographic surveys of self-sustaining Brook Trout populations have been on-going since 1978, which have also included successful efforts to document previously unidentified populations. Beginning in earnest during the 1990s, allozyme testing was used to assess patterns of hatchery introgression, with over 480 collections genotyped at the creatine kinase locus. In 2010, the NCWRC began using microsatellite markers to conduct an extensive survey of Brook Trout genetic diversity and variation. To date, 541 Brook Trout collections representing 11,090 individuals have been genotyped at 12 microsatellite loci. These data have provided insights into evolutionary relationships among populations, spatial patterns of genetic diversity, and the extent of hatchery introgression within populations. Ultimately, increased understanding of genetic diversity and relatedness have been informative for determining that Brook Trout management in North Carolina is likely best enacted at the level of individual populations. Moreover, we have used these data to actively guide stream restoration and population reintroduction activities. Over the last 15 years, NCWRC and its partners have used genetic data to prioritize habitat enhancement activities and guide 17 Brook Trout population reintroduction projects. In the future, we plan to continue expanding the microsatellite genetic baseline while also exploring the utility of phylogenomic analyses to inform Brook Trout conservation activities. Genetic and genomic approaches have great potential to improve the efficacy of conservation actions for Brook Trout in North Carolina and throughout its native range.

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Semi-anadromous Potomac River herring identified with otolith chemistry

T. Reid Nelson* (George Mason University), Kiah Gallaher

Blueback Herring *Alosa aestivalis* and Alewife *A. pseudoharengus,* collectively referred to as river herring, are anadromous fishes that once supported valuable fisheries along the east coast. Unfortunately, populations have drastically declined due to habitat loss and overfishing. Although populations are depleted, adults return to Chesapeake Bay tributaries to spawn. Knowledge of past habitats and migration strategies utilized by these successful recruits can elucidate essential resources needed to help maintain and rebuild populations. To this end, we determined past habitat use of spawning Blueback Herring (n = 29) and Alewife (n = 29) collected from three freshwater tributaries of the Potomac River using otolith Sr:Ca as a retrospective proxy of salinity exposure. The duration of freshwater and estuarine habitat use for both species is greater than that found in previous studies and expected anadromous patterns. Based on our Sr:Ca proxies, no Blueback Herring migrated to marine waters and only 21% of Alewife did. While this low degree of anadromy has not been documented in these species, migration plasticity has been found elsewhere. Furthermore, historic accounts indicate that Chesapeake Bay herring may remain in freshwaters through year one and freshwater emigration is delayed in large estuaries. Finally, elevated mortality in marine waters is a contributing factor to continued population depletion and a semi-anadromous life history could buffer against this morality. Although further work is needed, these results indicate that freshwaters and estuarine salinities (<15 psu) are important habitat for Potomac River herring throughout life.

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Morphological divergence of an undescribed catostomid, the Llano River Carpsucker *Carpiodes sp. cf. carpio* in the Colorado River basin of Texas

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There is evidence of an undescribed species of carpsucker, the Llano River Carpsucker *Carpiodes sp. cf. carpio*, within the Colorado River of Texas. The Llano River Carpsucker is thought to possess a more elongated body than the sympatrically occurring, broadly distributed River Carpsucker *Carpiodes carpio*. The objective of this study was to assess morphological variation among members of the genus *Carpiodes* inhabiting the Colorado River basin of Texas. Sampling during the summer of 2022 resulted in the capture and preservation of 197 adult specimens. Photographs of specimens were digitized, and 17 homologous landmarks were used to perform a morphological analysis assessing spatial gradients of body shape variation. A canonical multivariate analysis was performed on specimens pooled across the waterbodies to determine shape features that best explained morphological variation. We hypothesized that dorsal fin position, pelvic fin position, and caudal peduncle depth (CPD) were the most important variables in explaining morphological variation in body depth among the waterbodies. Shape variation was driven by a gradient in body depth that varied across the waterbodies sampled. Specimens collected from the Llano and San Saba Rivers were the most elongated and had smaller CPD values, whereas specimens from the Concho and Colorado Rivers exhibited deeper bodies and larger CPD values. This study provides insight into the morphological variation among members of *Carpiodes* within the Colorado River basin. Further research investigating covariance between morphological and genetic variation of these populations is ongoing and could provide evidence for multiple species of *Carpiodes* within the basin.

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Black Crappie regulations and management in B. Everett Jordan Reservoir, NC

Kelsey Roberts* (NC Wildlife Resources Commission)

The North Carolina Wildlife Resources Commission has monitored the Black Crappie *Pomoxis nigromaculatus* population in B. Everett Jordan Reservoir (Jordan Lake) since 1986. The reservoir was impounded in 1981 and initially had no length or size restrictions for the crappie fishery. In the early 1990's, a 203 mm minimum size limit and 20 fish per day creel limit was implemented to allow harvest while protecting younger fish in the lake. In 2004, the minimum size limit was changed to 254 mm while the daily creel limit remained at 20 fish per day in response to survey results that showed poor recruitment after Threadfin Shad *Dorosoma petenense* kills. Initially, anglers were concerned with the increase in the minimum size limit and the potential impacts on their ability to harvest crappie. While the regulation was needed at the time of implementation, data collected over the past 15 years has indicated that the minimum length limit could be reduced back to 203 mm, and a few attempts have been made to propose this change. However, many anglers have opposed this change even though it would increase their ability to harvest a larger proportion of the population. The Jordan Lake crappie fishery is a clear example of the conflicts that exist between data driven fisheries management and the perceptions and desires of anglers.

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Assessing differences in feeding ecology among Neosho Bass, Smallmouth Bass, and their hybrids within Ozark highland streams

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Distinct lineages of Smallmouth Bass have been recognized since 1940. Neosho Smallmouth Bass were previously described as a subspecies based on morphological differences, but recent phylogenomic analyses of ddRAD elevated Neosho Bass from synonymy with Smallmouth Bass. Neosho Bass are fluvial specialists endemic to the Ozark Highlands and Boston Mountain ecoregions. In the early 1990's, the Oklahoma Department of Wildlife Conservation stocked nonnative Smallmouth Bass into Tenkiller Reservoir. Over time, Smallmouth Bass invaded the tributaries of Tenkiller Reservoir, which led to introgressive hybridization with native Neosho Bass. This presents a unique opportunity to assess food web interactions among Neosho Bass, Smallmouth Bass, and their hybrids coexisting in the same environment. Stomach contents from 350 individuals were collected across four streams of varying size and hybridization rates. Fish were genotyped with a low-density SNP panel, then two complementary analyses were conducted to elucidate genetic identity. First, we used STRUCTURE to estimate member coefficients for each fish. Second, we used NewHybrids to assign each fish to a hybrid class (i.e., non-hybrid parental species, F1, F2, or backcrosses). A suite of diet analyses will be run to determine how stream, genetic identity, and bass TL relates to prey consumption and to what extent differences may exist in diet composition, feeding strategy, trophic position, diet breadth, and size selection of prey. Species conservation and management relies on a solid understanding of basic biology and ecology. Our research will help determine if important differences in feeding ecology exist between Neosho Bass and Smallmouth Bass.

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Environmental factors related to hatch timing of Shoal Bass *Micropterus cataractae* in the lower Flint River catchment

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Changes in environmental factors have important implications for the successful completion of life history for stream fishes. Shoal Bass *Micropterus cataractae* is an endemic black bass to the Apalachicola-Chattahoochee-Flint (ACF) River Basin and is considered a habitat specialist requiring moderate velocities. Little is known about Shoal Bass reproductive requirements, especially in the lower Flint River. This portion of their range has a unique hydrology and lithology compared to the rest of the highly impounded ACF, providing an important opportunity to study how environmental variability affects recruitment success. Our study objective was to determine how flow patterns, water temperature, and photoperiod affect hatch timing of Shoal Bass. We used otolith daily bands of age-0 Shoal Bass to back calculate hatch dates. A total of 153 age-0 Shoal Bass were collected from two of the four major tributaries and the mainstem Flint River. Shoal Bass hatched between April 29th and June 2nd, 2022 and tended to hatch earlier in the mainstem river than in the tributaries. Knowledge of Shoal Bass spawning dynamics over multiple years will provide information useful to agencies concerned about natural recruitment in these populations.

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How accurately can Sea Scallops be aged?

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Sea Scallops *Placopecten magellanicus* are assessed with a catch-at-size length-structured assessment model due to difficulties associated with accurately and precisely aging shells. Development of an age-based assessment model hinges on the ability of scientists to collect shells across the resource and accurately age them. The Virginia Institute of Marne Science (VIMS) has collected shells since 2018 to support the development an age-based assessment. Shells were aged with the traditional external ring method as well as by aging an internal structure called the resilium. To assess ageing methods for accuracy, precision, and bias, annual age-length keys (2019-2022) were generated for both methods. Terminal age data for both methods were also compared to determine the relative performance of the resilium age method to the standard approach. Results for age-length keys indicated a misspecification of age, especially for the smallest and oldest scallops, for both age methods. VIMS also needs to collect a larger length distribution of scallops for ageing, as scallops < 80 mm were largely absent from collections. Despite these issues, there was general agreement between the two ageing methods in terms of age-length keys with an 88% agreement for assigned ages between methods for paired samples. While this work is ongoing, we may need to reexamine our ageing methodologies to determine where errors are occurring to support the development of an age-based assessment in the future.

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Estimating components of mortality for two black bass *Micropterus spp.* species at a large Alabama reservoir with high catch-and-release angling effort

Max Rubino* (Auburn University), Matthew Catalano-Auburn University

Post-release mortality associated with catch-and-release angling has the potential to negatively impact fishing quality in recreational fisheries. However, population level impact of catch and release angling is not yet well understood and depends on the magnitude of capture and post-release mortality rates. Post-release mortality rates associated with fishing tournaments are higher than non-tournament releases and could contribute substantially to total fishing mortality for some species. To better quantify the population-level impacts of catch-and-release angling, we conducted a combined high value reward and radio telemetry study to estimate natural, harvest, tournament hooking, and non-tournament hooking mortality rates of two black bass species at Neely Henry Reservoir in Alabama. We tagged 454 Largemouth Bass *Micropterus salmoides* and 348 *Alabama Bass M. henshalli* with high value external dart tags. In addition, 50 fish of each species were implanted with a radio transmitter that indicated mortality when tags remained motionless for 24 hours. All fish were collected using standard electrofishing procedures in late January and early February of 2022. Manual radio tracking was conducted monthly to monitor the mortality status of all telemetered fish. Preliminary results suggest annual capture rate for both species exceeds 0.5. Additionally, estimates of post-release tournament mortality (0.43), and annual natural mortality (0.61) are at the high end of literature values. There is an indication of possible angler selectivity towards Alabama Bass in some angling sectors. Results from this study should inform better recreational fishing management on high effort bass reservoirs in the southeastern US and beyond.

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Net positive impact for offshore wind: terminology, quantification, and requirements

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As planned offshore wind energy development in the United States continues to grow on the horizon, permitting agencies, developers, and stakeholders reckon with projected ecological effects of construction and operation. While such effects may be detrimental to certain species at certain times, offshore wind can also positively influence other aspects of the ecosystem, particularly if developers prioritize ecological benefits throughout the planning process. In Europe, some jurisdictions require new wind projects to demonstrate a “net positive biodiversity impact.” Here in the U.S., no such requirement yet exists; however, some developers are independently creating commitments to positively influence the ecosystems in which their projects will be installed. We explore “net positive” terminology, how scientists and policy makers might quantify net positive impacts, and what opportunities might be realistic for upcoming projects.

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What can island biogeography and shifting baseline syndrome tell us about the future of endemic black bass?

Steve Sammons* (School of Fisheries, Aquacultute, and Aquatic Sciences)

The theory of Island biogeography was originally developed to explain the pattern of the species–area relationship occurring in oceanic islands but has been applied to modern-day concepts such as national parks, land conservation, and protected marine areas or sanctuaries. It predicts that species richness is an inverse function of island size and distance from the mainland. In this context, freshwater fishes exist in "islands" of water surrounded by impassible land barriers. Riverine fishes once confined to specific basins or catchments now occur in increasingly smaller areas due to fragmentation by dams, reservoirs, or degraded habitats. Populations once connected via migration have been transformed into numerous isolated populations located various distances from larger source populations. A similar pattern has been observed in many native black bass species endemic to specific river basins in the southeastern U.S. These populations are further imperiled by unauthorized introduction of non-native congeners that are more tolerant of degraded habitats and have broader habitat preferences, the most prevalent of which is Alabama Bass *Micropterus henshalli*. Black bass communities are becoming homogenized through introgression, with natives replaced by hybrid swarms and few pure fish of any species. Younger anglers are confronted with fisheries that bear little resemblance to those found in these areas less than 50 years ago. As anglers age out, the next generation of anglers have no basis with which to assess current black bass fisheries, and often accept highly introgressed populations as the new normal. This can ultimately reduce support for and hinder conservation programs to restore native black bass.

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Testing responsiveness of stream fish functional traits to anthropogenic riverscape alterations

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Natural environmental filters that regulate the distribution of fish functional traits across riverscapes are affected by anthropogenic alterations. These alterations can include water quality degradation, flow regime homogenization, flow depletion, and stream dewatering. The objective of this study was to conduct exploratory analyses to identify the traits most responsive to anthropogenic environmental changes using fish assemblage data from four case studies. We used fish community data and widely available categorical trait data to calculate the occurrence and richness of trait strategist responses to environmental change documented in four case studies. We hypothesized that (1) fishes intolerant to anoxic conditions would be most responsive to improved water quality (Trinity River, Texas); (2) fishes that use rocky substrates and riffles would be most responsive to flow regime homogenization (lower Sabine River, Texas); (3) fishes considered to inhabit large rivers would be most responsive to groundwater overdraft (Republican River in Colorado, Kansas, and Nebraska); and (4) fishes occupying areas with lower temperatures would be most responsive to a strong aridity gradient (Colorado River basin, Texas). We used random forest models, variable importance plots, and partial dependence plots to determine trait-environmental relationships. Results from the models supported hypothesized relationships for H1, H2, and H3, but not H4. Our inclusion of multiple traits in each case study highlighted trait syndromes associated with anthropogenic alterations. For example, traits commonly associated with fish responsiveness to riverscape change were cruiser swimming, pelagic-broadcast spawning, preference for run habitats in mainstem rivers, and periodic-opportunistic life strategies.

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Mussel community, habitat associations, and water quality in the Sabine River basin with emphasis on species that are candidates for federal listing

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The Sabine River basin of Texas and Louisiana supports 32 native freshwater mussel species, including five state-threatened species. Two of the state-listed species (Louisiana Pigtoe *Pleurobema riddellii* and Texas Heelsplitter *Potamilus amphichaenus)* are candidates for listing by the USFWS under the Endangered Species Act. Threats to population viability include changes in water quality within the basin. Study objectives were to quantify mussel communities and habitats among 46 sites within five reaches (two mainstem reaches, three tributaries) of the Sabine River and to assess changes in water quality variables (e.g., dissolved oxygen, total dissolved solids, phosphorus concentrations) from 1970s through 2020. Surveys collected 9,244 individuals representing 28 freshwater mussel species. Louisiana Pigtoe (*n* = 57) and Texas Heelsplitter (*n* = 7) were only observed in the upper Sabine River with a CPUE of 0.51 for Louisiana Pigtoe and 0.06 for Texas Heelsplitter. Among all species, mussels generally were segregated along current velocity and substrate gradients. Since the 1970s, water quality variables remained consistent or improved though time with respect to water quality standards deemed suitable for aquatic life use. One exception was noted in the lower Sabine River and in one of the tributaries, where sulfides have increased within the last 20 years. This study provided an updated status on Louisiana Pigtoe and Texas Heelsplitter within the Sabine River basin and quantified water quality changes through time, which can inform future survey work and provides context to water quality changes within the Sabine River basin.

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Constraints to equitable access of marine protected areas in Florida, and tools to improve connection to these resources with implications to R3 initiatives

Christopher Schwinghamer* (West Virginia University), Ross Andrew, West Virginia University and Robert Burns, West Virginia University

While public waters such as marine sanctuaries are openly accessible to everyone, constraints to access exist due to numerous factors. Historically marginalized populations such as racial/ethnic minorities may not be able to access public resources equitably. Constraints to access can come from many sources such as income, education, and whether one feels confident in their skill, connection with a resource, or welcome. Pilot study data suggests that visitors to the Florida Keys National Marine Sanctuary (FKNMS) are largely white, highly educated, and high income. The local populations near this sanctuary though contain large proportions (~50%) of racial/ethnic minorities. The constraints that cause this disconnect between who is using the resources and who lives near them is not well understood. Using survey data of people from racial/ethnic minorities in the population surrounding the FKNMS, we evaluated factors that might result in unequitable access to the sanctuary and what tools might best improve access for these communities. Our data suggest that like the overall population using the FKNMS, those from racially marginalized communities that use the sanctuary are also highly educated with high income. This would suggest income is one of the key constraints to recreation in FKNMS. Additionally, camps, websites with data, and documentaries were all rated highly as tools that would be valuable in increasing connection with these resources. Programming that helps provide low-cost opportunities could help to relieve some of the constraints to use of these resources and improve the feeling of connection amongst historically underserved groups.

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Invasion and establishment of Alabama Bass in South Carolina thus far

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The unauthorized introduction of Alabama Bass *M. henshalli* to Upper Savannah River (Carolinas and Georgia) mainstem impoundments occurred in the 1980s, presumably by anglers intending to expand the scope of their quarry. Subsequent and apparently ongoing extensions of this activity have spread this invasion across the Santee River System to the east. To date, two primary consequences for fisheries conservation and management in South Carolina have been identified: catch rates of native congeners have been reduced in reservoirs, and introgressive hybridization with the Savannah River endemic Bartram's Bass has placed the native bass in jeopardy of extinction even as it's being formally described. Effects on native Largemouth Bass reservoir populations include reduced catch rates and body condition. Introduced Smallmouth Bass are experiencing introgression similar to Bartram's Bass, such that the genomes of both species have been or are becoming largely extirpated in impoundments where introgression has had the most time to operate, which bodes ill for systems elsewhere with important native Smallmouth Bass fisheries facing similar invasion. Conservation focus for Bartram's Bass is now in fluvial habitats of relatively fragmented tributaries, where hybridization has been documented but genetically pure endemic populations remain. Research continues on documenting invasion rates and covariates of non-natives and their hybrids with telemetry and the role of habitat quality as an influence on hybridization. Education about the threat posed by rampant introduction of non-indigenous biota is crucial here going forward. This natural resource challenge is emerging as among the greatest in freshwaters of South Carolina.

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Endangered Species Act recovery criteria and expenditures for fish managed by USFWS

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Endangered Species Act (ESA) recovery plans must meet legal requirements (1) to provide recovery time and cost estimates, (2) to set objective and measurable delisting criteria, and (3) to address the five factors that are considered when listing or delisting a species. These five factors include: threats to habitat or range, whether a species is subject to overutilization, presence of disease, existence of regulatory mechanisms outside of federal protection (i.e., the states), and if there are other natural or anthropogenic factors impacting continued existence. We reviewed recovery plans for ESA-listed fish managed by the Fish and Wildlife Service (USFWS) to determine how many meet these requirements. Of 105 recovery plans for fish taxa managed by the USFWS, 52% of plans estimated time to recovery, 44% plans estimated cost of recovery, and 61% of plans provided quantitative recovery criteria. Only one-third of these recovery plans specifically addressed the five delisting factors. Multiple log-linear regressions on combined state and federal expenditures for listed species for each fiscal year (FY) from 2012 to 2017 indicated that expenditures varied between USFWS regions and increased with species geographic range and if a species has been propagated in captivity or litigated. If a species is litigated, the corresponding expected increase in expenditures ranges from 166% to 606% depending on the year. If a species is propagated, the corresponding increase in expenditures ranges from 142% to 494% depending on the year.

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Accessibility and compatibility of fisheries-independent data in offshore wind areas

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The Responsible Offshore Science Alliance (ROSA) works to advance regional fisheries research and monitoring to assess impacts on fisheries from offshore wind development. Two aspects of that advancement are broadening accessibility of fisheries-independent data collected, and improving mutual compatibility of data. Existing fisheries-independent surveys completed by state and federal agencies and academic institutions may be impacted by, and in some cases suspended, due to offshore wind development. Subsets of fishery-independent data were requested from existing trawl fishery-independent bottom trawl surveys in the Northeastern United States to compare data fields and determine if de facto data standards had emerged independently of a guiding document. Major differences in the formatting of data fields such as date, geographical position, species code, and length were evident in all requested datasets. No existing set of data standards were found to be widely used. Upon evaluation of the requested materials, there was a lack of consistency in data collection, organization, and formatting. The absence of an existing set of data standards combined with the general incompatibility of existing datasets presents logistical challenges for the offshore wind community as projects continue to develop along the East Coast of the United States. Moving forward, ROSA will continue to seek solutions with stakeholders through a number of collaborative initiatives.

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Integrating species-specific fish swimming ability into a stream-crossing assessment framework

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

Aquatic habitat fragmentation has caused population declines in fish species globally. A factor causing this fragmentation is the installation of stream-crossing structures such as culverts. Stream-crossing structures often create impassable conditions for various fish species, but the extent to which they do so is poorly understood. While some efforts to assess stream-crossing passage barriers at a large-scale have been conducted, these studies often rely on simplifying assumptions that may limit the reality of their results. Variability in fish swimming speed creates differences in barrier permeability among species and barrier conditions; including swimming ability in barrier assessment will aid in the process for prioritizing barrier removal. We demonstrate the use of standardizable methods to include fish critical swimming speed (Ucrit) into the Southeast Aquatic Resources Partnership's (SARP) stream-crossing assessment protocol. We use Yoknapatawpha Darters in Mississippi's Yocona River watershed and Bluehead Chubs in South Carolina's Stevens Creek watershed as case studies. Darters had a mean Ucrit of 46.9 cm/s, and Chubs had a mean of 67.5 cm/s. Integrating this data into SARP's assessment protocol increased estimated barrier severity for Yoknapatawpha Darters in the Yocona River watershed, but not for Bluehead Chubs in the Stevens Creek watershed. Our results demonstrate the importance of including species-specific swimming data when assessing stream crossings, and the importance of determining in which contexts this inclusion is most critical.

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Using multiple sampling methods to evaluate Black Crappie *Pomoxis nigromaculatus* populations in coastal rivers of North Carolina

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

Black Crappie *Pomoxis nigromaculatus* is a popular sportfish that can be found throughout the United States. Recently, crappie fishing and tournaments have grown in popularity, especially in Chowan River and other tributaries of the Albemarle Sound in Northeastern North Carolina. Fisheries independent sampling methods such as sinking trap nets and boat electrofishing have variable success and may not be adequate to describe these highly desirable sportfish populations. While sinking trap nets are commonly used to sample crappie, this gear is less effective in coastal rivers that are often steep-sloped. Black Crappie tend to not respond to boat electrofishing in a similar manner as other sportfish; As a result, boat electrofishing for Black Crappie tends to consist of a lot of search time and targeting underwater structure or docks. The project objective is to evaluate the potential need for size and creel limit changes using a multiple gear approach. To collect the most robust data possible during this survey, sampling gears including, modified floating trap nets, modified electrofishing settings, and tournament angler weigh-in data are used to examine the Black Crappie population in the Chowan River, NC. A multiple gear approach will allow fisheries biologist to increase sample size, obtain sufficient representation of available size classes, and improve estimates of growth parameters.

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Age structure, growth, and movement patterns of American Eel in Texas

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American Eel *Anguilla rostrata* have a unique and complex life history that has been fairly well-studied on the Atlantic coast of North America, but less is known about eels that make their way into Gulf of Mexico drainages. To better inform conservation and management decisions, research is underway to describe the population structure, seasonal dynamics, and life history of American Eel in Texas. The primary objectives of our efforts are to assess the current and historical distribution and abundance, habitat use, movement patterns, parasite occurrence, diet, and population structure (genetics, age, sex, etc.) of American Eel across all life stages. This talk will highlight preliminary results on age, growth, and movement patterns of American Eel in Texas. A total of 139 specimens were collected across seven major river basins and several coastal tributaries; of these, otoliths were extracted from 98 specimens for aging and 113 specimens for otolith microchemistry. Individuals ranged in total length from 86 – 1,059 mm and weight from 0.9 – 2,750 grams. Continental age estimates ranged from age-0 to age-13 with the majority of eels ranging from 2-5 years. Otolith microchemistry was used to examine movement patterns between marine and freshwater systems by analyzing ratios of barium (Ba:Ca) and strontium (Sr:Ca) and applying breakpoint analysis to identify major transitions between habitats with heterogeneous element compositions. Results suggest that individuals undertake varied life history strategies in Texas, ranging from primarily freshwater residency to seasonal migration between elementally distinct habitats supporting their classification as facultatively catadromous.

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Using environmental DNA (eDNA) to monitor river herring movement within the lower Roanoke River basin

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Blueback Herring and Alewife are two threatened species of *Alosa* that utilize the coastal rivers and estuaries of Eastern North Carolina to spawn. In North Carolina watersheds, river herring were once highly sought after by commercial and recreational fisheries, but since the mid-to-late 20th-century populations have been on the decline with no signs of recovery. A technique to accurately monitor river herring spawning populations and juveniles both quickly and non-invasively would greatly assist in assessing the impact of population recovery efforts while monitoring fish movements. In this study eDNA from two species of river herring, Blueback Herring *A. aestivalis* and Alewife *A. pseudoharengus* were quantified using qPCR. Water samples were taken weekly along the Lower Roanoke River and its tributaries from February through November 2022. Data will better our understanding of the effects of water flows on adult river herring and juveniles' movement within the Lower Roanoke River basin. Since eDNA can be successfully detected and amplified within the river basin, eDNA sampling was used as a technique for monitoring river herring movements between Edwards Ferry and Plymouth, North Carolina for more than 40 weeks in 2022. Our results concluded that we were successfully able to detect both adult and juvenile river herring, sampling site locations located near each other showed similar trends in eDNA counts throughout the 2022 sampling season, and we confirmed that eDNA detected in late summer and early fall could be attributed to juvenile river herring through the use of nighttime electrofishing sampling.

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Summer habitat, exploitation, connectedness, and age structure of Striped Bass in the Ochlockonee River drainage, Florida

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Lake Talquin and the tailrace located below the Jackson Bluff Dam provide a popular 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 Striped Bass required for spawning purposes have become increasingly rare. Researchers aimed to understand the underlying causes behind the reduction of larger size classes. Water temperatures and dissolved oxygen concentrations of creeks used as thermal refuge in Lake Talquin were measured during the summers of 2020 and 2021. Marginal thermal refuge exists for adult Striped Bass, and the buildup of nonnative plants is degrading critically important habitat. A total of 201 Striped Bass were tagged in Lake Talquin and below the Jackson Bluff Dam between December 2020 - February 2021. Annual exploitation was 25% and there was evidence of population connectivity between Lake Talquin and the lower Ochlockonee River via dam escapement. Exploitation was focused below the dam on two cohorts of fish, and the harvest rate appears to be greater for fish of larger sizes. An age sample was obtained from December 2021 to January 2022 to examine population structure and total annual mortality. Striped Bass appear to be growing very quickly until age-3 before experiencing high levels of mortality. The results of this study highlight how habitat enhancement projects, harvest restrictions, and consistent stocking efforts are necessary to ensure the conservation of a species that is especially sensitive to a changing climate.

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Leveraging a century of stream fisheries surveys to inform conservation listings in Oklahoma

Trevor Starks* (Oklahoma Dept. of Wildlife Conservation), Anthony Rodger, Drew Wallace, Matt Pallett, Jim Burroughs - Oklahoma Dept. of Wildlife Conservation

In order for a species to be eligible for state wildlife grant (SWG) funded projects, it must be listed as a species of greatest conservation need (SGCN). Current SGCN tiers and the methodology for listing species are outlined in the most recent Oklahoma Comprehensive Wildlife Conservation Strategy. Tiering is dependent on five different ranking criteria, one of which pertains to a species' trend in population size or geographic range over the last 50 years. While historical data exists for many species, there is no empirical methodology for assessing changes in distributions in Oklahoma. Stream Program staff are currently collecting fish community data from around the state to update species distributions. A statewide sampling rotation of all watersheds within Oklahoma is projected to take years. In the meantime, historical fish community surveys from state agencies, university research projects, and museum collections have been collated into a stream sampling database so that hypotheses regarding species range shifts can be tested. The purpose of the current study seeks to develop a methodology for leveraging disparate datasets to identify SGCN, update species distributions, and assist with tiering existing SGCN. This methodology is conducted by addressing the following four questions: (1) Are there significant differences between historical and contemporary fish communities? (2) If so, what species are contributing to differences between historical and contemporary communities? (3) To what extent are those species driving differences between communities? (4) For those species that contribute the most to differences between communities, how do their distributions change through time?

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Enhancement of Beaver Lake fish habitat

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Beaver Lake is a large (11,500 ha.) flood control reservoir that is owned by the U.S. Army Corps of Engineers. Fish populations in Beaver Lake are managed by the Arkansas Game and Fish Commission and popular sportfish include Largemouth Bass, Spotted Bass, Smallmouth Bass, White Crappie, Black Crappie, Striped Bass, and Walleye. As with most large reservoirs in the southeast, Beaver Lake is aging (56 years old), and much of the original habitat has been lost. The AGFC worked with Beaver Watershed Alliance and at least ten different partners to obtain grants from the Reservoir Fish Habitat Partnership, Fish America Foundation and Bass Pro Shops to improve fish habitat in Beaver Lake and a tributary. Funds were used to conduct a bank stabilization project on Clifty Creek (Beaver Lake tributary) and 300 feet of shoreline was stabilized, reducing sedimentation into Beaver Lake. A total of 220 fish habitat sites have been placed in the reservoir to date, with each site holding up to six large cedar trees. Several sites have been placed close to bank fishing areas to improve fishing access and success of an underserved angler group on Beaver Lake.

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Using the electron transport system as an indicator of organismal thermal tolerance and respiration rate

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Temperature in many freshwater systems in North America is rapidly increasing. Therefore, it is important to understand species- specific responses to changing thermal regimes for fishes. Traditional techniques for determining thermal tolerances of species are often lethal and time consuming. Using enzyme activity of the electron transport system (ETS) within mitochondria has been suggested as an alternative and may provide a non-lethal, quick, and efficient alternative to traditional techniques. We used Largemouth Bass *Micropterus salmoides* a species with well documented thermal tolerance and respiration rates, to test the efficacy of using ETS to determine thermal tolerance and respiration rate in response to variable acclimation temperatures. Three tissue types (skeletal muscle, heart, and liver) were dissected from bass acclimated to 20, 25, and 30°C and used in ETS enzyme tissue assays at temperatures of 7.5 to 40°C. Although there were significant differences among the tissue types and acclimation temperatures, the maximal enzyme activity occurred from 25.2 to 31.9°C whereas traditionally derived CTmax resulted in loss of equilibrium at 39 to 42°C which is significantly higher than the upper optimum range determined via the enzyme assays. The respiration rate to ETS activity ratio was calculated using skeletal muscle tissue samples from fish acclimated to temperatures of 10 to 32.5°C and tested in an intermittent respirometer. This ratio increased with temperature with the largest changes occurring at the upper optimum thermal range determined by enzyme assays. These results suggest ETS analysis may contribute to bioenergetics modeling by estimating biologically relevant thermal tolerances and potentially predicting whole organism respiration.

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Environmental influences on Silver Carp population ecology across the Mississippi River basin

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When managing invasive species, state agencies must often assess management strategies with little biological information. In these cases, understanding the influence of environmental conditions on population parameters allows management agencies to predict potential scenarios given a set of environmental conditions. Due to broad environmental tolerances, Silver Carp *Hypophthalmichthys molitrix* have invaded much of the Mississippi River Basin. Despite their widespread invasional success in a variety of environments, established patterns between population demographics and environmental factors are largely lacking from the literature. As such, we assessed the influence of a suite of environmental variables on Silver Carp population demographics across the Mississippi River Basin. From 2019 to 2022, Silver Carp were collected using daytime, boat-mounted electrofishing from seven rivers (Arkansas, Cache, St. Francis, Mississippi, Red, White, and Yazoo rivers) within the Lower Mississippi River Basin. Raw data were compiled for populations throughout the Mississippi River Basin, including those in the Upper Mississippi, Missouri, and Ohio river basins. Standard population parameters reflecting growth, mortality, and recruitment were estimated for each population. A dataset of environmental factors associated with temperature and hydrology was compiled for each population. Simple linear models were used to examine relationships between population parameters and environmental variables. Significant variables were included in stepwise multiple regression models to generate predictive models for each population parameter. This study shows that variability in Silver Carp population demographics may be partially governed by environmental conditions. The resultant predictive equations may be used by state agencies to evaluate management alternatives in the absence of biological data.

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Population genetics of an undescribed member of the upland burrowing crayfish complex *Cambarus aff. dubius*

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The *Cambarus dubius* complex, which includes several putative species of burrowing crayfishes referred to as *C. aff. dubius* has a range spanning West Virginia, Virginia, and Kentucky, USA. This species complex contains three montane subpopulations, each with distinct color morphs wedged within the Allegheny Plateau and Ridge and Valley physiographic regions of central Appalachia. Color morphs in this complex are atypically distributed at both the watershed and geographic level. Phylogenetic and population genetic methods will be used to explore genetic relationships within this complex to assess the evolutionary history and conservation status of this species complex. We hypothesize that landscape, specifically ridge and valley geography, has affected the phenotypic attributes and genetic structure of this species complex. Thus, we can compare the population structure of this species' subpopulations to test for contrasting genetic patterns that would typically be exhibited by allopatric populations. A subset of *C. aff. dubius* populations will serve as a model for how next-generation sequencing method, restriction site-associated DNA sequencing (RADseq), can provide the genetic basis for understanding gene flow and effective population size in these montane crayfishes. Ultimately, we hope to determine the network structure, genetic connectivity, and genetic distinctiveness of this Appalachian endemic species.

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Developing an eel ramp network and utilizing eDNA sampling to monitor cryptic recruitment of juvenile stage (glass eel and elver) American Eel *Anguilla rostrata* in Texas coastal drainages

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American eel *Anguilla rostrata* is found widely in freshwater rivers, streams, and reservoirs in Texas and other areas of the Gulf Coast; however, historic research of recruitment and early life history of this species is largely unknown in this region. This species of fish is catadromous, undergoing migration from the Sargasso Sea in its larval stage before entering coastal estuaries and freshwater systems along the Atlantic, and presumably, Gulf Coast; however, larval and glass stage eels have never been observed in Texas waters. Collaborative efforts have been established to detect these early life stages in various estuarine and inland waterways to better understand American Eel recruitment in Texas. Recent sampling efforts involving eel mops and fyke nets in Texas estuaries were not successful at detecting juvenile stage eels (glass and elver). To supplement juvenile sampling efforts, passive sampling Irish eel ramps have been installed in twelve locations in upper coastal rivers, creeks, and bayous in Texas. In addition, this project utilizes eDNA water sampling to test for the presence of American eels in the ramp-fished areas of this survey, as eDNA is a useful tool for detecting species not easily caught in traditional sampling gears or methodologies. This presentation describes preliminary results from ongoing study efforts and presents future sampling strategies in the region to continue monitoring for these cryptic stages of American Eel along the Texas Gulf Coast.

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Increasing heatwave frequency in streams and rivers of the United States

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Heatwaves are increasing in frequency, duration, and intensity in ocean, coastal, and lake ecosystems. While positive water temperature trends have been documented in many rivers, heatwaves have not been analyzed. This study examined heatwaves in rivers throughout the United States between 1996 and 2021. Riverine heatwaves increased in frequency over the study period, with the most robust increases occurring in summer and fall, in mid- to high-order streams, and at free-flowing sites and sites above a reservoir. The increase in heatwave frequency was accompanied by an increase in moderate strength heatwaves as well as a doubling of the annual mean total number of heatwave days at a site. Riverine heatwaves were often associated with normal or below-normal discharge conditions and at sites with a mean annual discharge ≤ 250 m3 s-1. The southeastern region of the U.S. had the greatest increases in air temperature, riverine water temperature, and riverine heatwave frequency. These results provide the first assessment of heatwaves in rivers for a large geographic area in the United States.

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Fine-scale movements and habitat use of recreationally important reef fishes

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Artificial reefs can play an important role in marine fisheries management by supplementing or enhancing natural habitats. Despite their increased use in recent years, the choice of materials used at artificial reef sites remains largely haphazard due to the lack of information on their performance. There have been few studies that have examined the usage of different artificial reef materials at the individual fish level. In summer 2021, we tagged 25 Black Sea Bass *Centropristis striata*, 15 Gag *Mycteroperca mircrolepis*, nine Almaco Jack *Seriola rivoliana*, eight Red Snapper *Lutjanus campechanus*, and eight Greater Amberjack *S. dumerili* on two different artificial reef complexes near Cape Lookout, North Carolina. Artificial reef materials consisted of concrete pipe, cement manhole sections, reef balls, concrete H-units, and vessels. Tagged fish were tracked using a VEMCO Positioning System (VPS) for ~100 days. Black Sea Bass had high site fidelity to the artificial reef material that they were captured from and rarely ventured away from the material. Gag and Red Snapper moved larger distances away from artificial reef materials and routinely moved between materials. Jacks moved the largest distances from materials and were detected moving off site. Black Sea Bass, Almaco Jack, Greater Amberjack, and Red Snapper used all available material, while Gag used most available material. Our results suggest selection for low relief material such as concrete H-units by Black Sea Bass and high relief material such as vessels by Gag, Red Snapper, Almaco Jack, and Greater Amberjack.

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Regional variation provides context for differences in non-native stream fish drivers at a local scale

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

Although many established hypotheses exist to explain the drivers of biological invasion, the evidence for universal patterns is inconsistent across the currently published research. We shift our focus instead to understanding why universal patterns remain elusive. Using a stream fish community survey dataset compiled from state agencies across the United States and Bayesian hierarchical models, we examined whether drivers of non-native species richness are regionally contextualized in two case studies. First, we tested whether native stream fish diversity within sub-regions (gamma diversity of HUC 4) explains differences in local relationships between non-native and native stream fish richness. Second, we tested whether abiotic characteristics within ecoregions (EPA Level III) explain differences in local relationships between the proportion of non-native stream fish and human disturbance. In both cases, regional differences aid in our understanding of these drivers of non-native species richness in stream fish in the United States. As the availability of large, spatially explicit datasets increases, our results suggest that acknowledging the potential for regionally-based, cross-scale interactions will be important for understanding the mechanisms behind invasion patterns and processes.

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Freshwater conservation at scale: a 5-year review of successes, challenges, and adaptive thinking

Jason Throneberry, The Nature Conservancy

The Southeastern United States supports the highest aquatic biodiversity in North America. Many factors, including stream diversity, habitat diversity, geological variation, and seasonal variation contribute to the regions' unsurpassed freshwater diversity. Although Alabama ranks as one of the top five most biologically rich states in the nation, it is also foremost in the number of imperiled species, rate of endemism, and species decline. To address the ever-growing threats to these systems, it is necessary to use a watershed-scale conservation approach. Over the past 20 years The Nature Conservancy of Alabama (TNCAL) and partners have demonstrated how to develop and implement watershed-scale protection and restoration. Our extensive and persistent work includes over 60 conservation, restoration, and fish passage projects. This approach is a case study in successful watershed restoration. Currently, we have a grant through the Natural Resources Conservation Service to prioritize private agricultural lands for sediment abatement restoration in priority watersheds. Also, TNCAL is the sediment abatement lead for the Southern Appalachians landscape. In the urban corridor, we are engaging communities regarding stormwater, sediment abatement, and fish passage projects to bolster environmental planning and restoration through Green Infrastructure and Low Impact Development. TNCAL is also the non-federal sponsor for the Lower Alabama River Fish Passage Feasibility Study with the U.S. Army Corps of Engineers. This study will assess fish passage opportunities at Claiborne and Millers Ferry locks and dams on the lower Alabama River, which could ecologically reconnect the Cahaba River to the Gulf of Mexico and re-open a historic migratory corridor for fishes, including federally and state protected species.

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Effects of extreme flow events on community composition and habitat complexity of groundwater dominated systems

Josh Tivin* (Texas State University), Tim Bonner- Texas State University

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 surfaces flows provided primarily by groundwater discharges. The San Marcos and Comal rivers are the two largest karst spring 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) 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. Preliminary results show that deep habitats contain higher levels of habitat complexity and the fish community is less affected in deep habitat than shallow habitat.

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Genetic contributions of hatchery-stocked Walleye to Douglas Reservoir

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Walleye *Sander vitreus* has been a popular sports fish for anglers in Tennessee for many years. However, some reservoir populations of walleye are in decline and fail to naturally produce enough offspring to sustain fishery desires. To support reservoir populations, the Tennessee Wildlife Resources Agency (TWRA) has been stocking Tennessee reservoirs, oftentimes yearly, with hatchery-raised fish. Captive rearing programs for walleye are costly, and the contribution of stocked fish to the existing population is not well known. The objective of this project is to determine the genetic contribution of hatchery-reared fish to reservoir populations of walleye in Tennessee. We used genome-wide Single Nucleotide Polymorphisms (SNPs) to estimate the genetic contribution of hatchery-reared fish to the existing walleye population at Douglas Lake, a popular fishing reservoir in Tennessee. We genotyped hatchery brood stock and the existing reservoir populations prior to stocking and after stocking was initiated. Results from this study will be used to assess population introgression of stocked fish and the effectiveness of TWRA stocking practices on improving walleye populations.

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Population characteristics and parasites of American Eel *Anguilla rostrata* in Puerto Rico

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The population characteristics and geographical extent of parasite infections of American Eel *Anguilla rostrata* remain drastically understudied in the Caribbean region. We conducted the first study to evaluate the longitudinal distribution of American Eel density, length, and sex ratios in rivers across Puerto Rico. Additionally, we evaluated the presence of the swimbladder parasite *Anguillicoloides crassus* and Monogenean gill parasites, and their effect of American Eel body condition. We sampled 23 reaches across a longitudinal gradient in five rivers during two sampling events. We dissected 233 American Eel from five rivers in Puerto Rico for sex determination and the presence of *A. crassus* infection. We evaluated 79 of 233 American Eel for Monogenean parasite infection. We observed a mean American Eel density of 156.7 fish/ha, sex ratios disproportionately favored females (52:3). Linear regression modeling and generalized linear modeling indicate that low-density, upstream habitats may be optimal environments for the production of large female American Eel. We found that *A. crassus* is not infecting American Eel in Puerto Rico, but Monogenean prevalence was 41.8%, with a mean intensity of 10 parasites per-eel. Monogenean intensities increased with American Eel length and varied by river. Linear regression modeling indicated that intensity of Monogenean infection may be unrelated to American Eel condition. These findings strengthen the knowledge base on American Eel in the Caribbean and can be used to guide local and range-wide conservation and management efforts to ensure stream connectivity and access to optimal upstream habitats for the survival of the population.

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Estimating gear selectivity of Red Drum using 40+ years of tag-recapture data

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Red Drum *Sciaenops ocellatus* support large-scale commercial and recreational fisheries along the U.S. South Atlantic and Gulf of Mexico coasts, with there being a history of fishery overexploitation across the U.S. South Atlantic. However, uncertainty in key stock assessment parameters, including uncertainty in size- and age-based selectivity parameters, has led to regional assessments being of limited utility for the development of management advice for the U.S. South Atlantic stock. To address this uncertainty, we analyzed 40+ years of Red Drum tag-recapture data available from the South Carolina Department of Natural Resources (SCDNR). Further, we used fishery-independent survey recaptures of tagged fish to assess the length-based selectivity of survey gears. A dome-shaped pattern of recreational hook-and-line selectivity was observed for harvested and released fish in all management periods, though the size of maximum selectivity in South Carolina recreational fisheries varied based on size restrictions. The observed dome-shaped selectivity of the SCDNR stop net, electrofishing, and trammel net surveys is the result of ontogenetic shifts in habitat use with size by the species. The adult Red Drum longline survey exhibited flat-top (i.e., logistic) selectivity, though fish were not fully recruited to the gear until approaching near population growth curve asymptotic sizes. Notably, none of the fishery-independent gears were particularly selective of intermediate sized (~80-100 cm TL) fish noted to be commonly missing in regional fishery-independent surveys. The results of this study will provide essential information to be used in future Red Drum stock assessments and will subsequently influence management of the species.

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Thermal regimes of groundwater dependent streams in south Texas: a case study of temperature monitoring in San Felipe Creek

Garrett Tucker* (The University of Texas at San Antonio), Matthew Troia (UTSA)

The Edwards Plateau ecoregion of Texas is home to over 130 springs that support humans, flora, and fauna. These springs provide stable flow and thermal regimes necessary to harbor refugia critical for endemic taxa. Specifically, spring-associated fishes are threatened in these ecosystems due to land use change, climate change, and excess groundwater pumping that reduces spring flows and disrupts temperature regimes. Currently, limited temperature monitoring data are available for springs and spring-fed streams of the Edwards Plateau; this gap in knowledge of temperature regimes may misrepresent potential vulnerabilities of habitats and endemic species in Texas. Our objective was to study the thermal regime of San Felipe Creek using a spatiotemporal network of in situ temperature loggers to quantify how habitat quality and quantity are subject to change by increasing temperature and decreasing water availability. We deployed 35 temperature loggers along ~9 km of San Felipe Creek—the fourth largest spring complex in Texas. Preliminary monitoring data revealed that diel temperature cycling increased with increasing downstream proximity from the spring sources. Future endeavors with this temperature monitoring data will also be integrated with the thermal physiology data of spring-associated fishes (*Dionda diaboli, Etheostoma grahami*) to evaluate thermal vulnerability in San Felipe Creek.

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American Eel recruitment, demographics, and disease in Virginia

Troy D. Tuckey* (Virginia Institute of Marine Science), Mary C. Fabrizio, Virginia Institute of Marine Science

Recent investigations of American Eel *Anguilla rostrata* in the Virginia portion of Chesapeake Bay have focused on glass eel recruitment and yellow eel relative abundance, demographics, and disease status due to *Anguillicola crassus*. Glass eel recruitment has been monitored since 2001 in the Potomac, Rappahannock, York, and James river estuaries and the timing of arrival of glass eels at the monitoring sites is consistent with the distance of each site from the mouth of Chesapeake Bay. Relative abundance of glass eels varies by multiple orders of magnitude among sites and years. Yellow eel abundance has been monitored through a standardized trawl survey and relative abundance has declined since the late 1980s and remains below the historic average. Age composition of yellow eels taken from these same systems from trawl surveys from 2013 to 2015 range from age-0 to age-15 with most eels around three or four years old. Adult nematode prevalence in yellow eels averaged 46.2% and the annual survival rate of disease-positive eels was lower than that of disease-negative eels. Management of American Eel can be improved through further study of eel population dynamics throughout its range in support of developing biological reference points.

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Fish removal at Lake Wauberg to evaluate changes in growth of Black Crappie

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Lake Wauberg is a 150-ha hypereutrophic lake in North Central Florida. There have been multiple fish research projects on the lake in the past 25 years, and the Black Crappie *Pomoxis nigromaculatus* population has been monitored annually with trawl samples since 1998. It was known to have a highly dense fish community, with the Black Crappie population exhibiting slow growth with many individuals in upper age-classes stunted below 230 mm TL. Our objective was to evaluate changes in growth of the Black Crappie population in response to a fish density and biomass reduction. We used trawls to capture and remove fish from the lake, and evaluate changes in catch rates and size structures from our removal efforts. From 2014 to 2016, we pulled a total of 654 trawls and removed 60,788 fish weighing 6,897 kg from the lake during three removal events. Black Crappie made up the largest portion of fish removed during the three years of the removal efforts, consisting of 29,290 (48.2%) of the total fish by number and 1,960 kg (28.4%) of the total weight. Brown Bullhead *Ameiurus nebulosus* made up the second most fish removed with 15,944 (26.2%) of the total number and 3,605 kg (52.3%) of the total weight. Our removal efforts were successful at lowering the abundance of Black Crappie and Brown Bullhead based on large declines in CPUE. We continued to annually monitor the Black Crappie population after the removal efforts and evaluate changes in growth in response to changes in abundance.

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Structure and scale of spatial synchrony in southeastern US Brook Trout populations

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Spatial synchrony is a key element of macrosystem ecology that can influence extinction probability. As climatic changes alter thermal and flow regimes, Brook Trout *Salvelinus fontinalis* will face major challenges, particularly in their southern native range. Understanding patterns in synchrony and the influence of climate factors on spatiotemporal dynamics in Brook Trout populations will be critical for broad-scale conservation planning. Using spatial covariance techniques and a Bayesian population model, we measure the scales and drivers of spatial synchrony by size class and regional populations using electrofishing data at over 100 long-term sites in the eastern US. Synchrony was low, but stronger in young-of-year than adults. Northern populations experienced stronger synchrony than southern populations, and synchrony in all populations extended to 100-150km. Summer high temperatures were the strongest driver of population trends, followed by winter floods. Here, we characterize the linkages between abiotic conditions and trout population trends, as well as identify potential climate refugia. Our analysis offers unique insight into spatial patterns in threatened Brook Trout populations.

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Volunteer angler data reveal social-ecological responses to habitat manipulation in a new water management area

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The upper basin of Florida's longest river—the St. Johns—was leveed and drained for agriculture beginning in the early 1900s, resulting in removal of 62% of the basin's floodplains by the 1970s. Direct negative impacts on the Indian River Lagoon, St. Johns wildlife, and public water supply ensued, causing the Water Management District (WMD) and partner agencies to implement rehabilitation efforts focused on reestablishing floodplain connectivity. One primary river-floodplain rehabilitation strategy is the creation of water management areas (WMAs). Fellsmere WMA (hereafter FWMA) is a key component of the St. Johns River rehabilitation project. Before flooding FWMA, agencies sought to diversify and enhance habitat by investing $1.356 million to modify >800 ha which created a mosaic of habitats. Trophic upsurge in FWMA, combined with the land modifications and presence of stocked and naturally produced fishes, created optimal conditions for a popular Largemouth Bass *Micropterus salmoides* fishery. The WMA opened to motorboat angling in August 2020 and has since been named "Jurassic Lake" due to its renowned bass abundance and size structure. The Florida Fish and Wildlife Conservation Commission currently collects information on angler attitude and behaviors. We are using angler diaries in a volunteer angler data (VAD) program to examine bass catch, effort, condition, and bait preferences, and comparing these variables in treatment and control sections of FWMA. In determining if and how habitat modification has impacted the fishery, we will derive insights for fisheries management, emphasizing VAD programs and the benefits they offer.

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Genetic assessment of invasive crayfish dispersal in the coastal plain of the Pee Dee River basin, U.S.A.

Matt J. Walker* (South Carolina Department of Natural Resources), Michael R. Kendrick, Tanya L. Darden, Elizabeth B. Underwood, Peter R. Kingsley-Smith; South Carolina Department of Natural Resources

Understanding dispersal patterns of invasive species can help resource managers develop strategies to mitigate negative impacts associated with these non-native taxa. The red swamp crayfish *Procambarus clarkii,* is native to parts of the United States Gulf coastal plain, but due to its extensive use in aquaculture and live food/bait trade, as well as effective natural dispersal abilities in-water and overland, it is well-established in many areas of the country and world. A comparison of historic and contemporary records indicates that *P. clarkii* has been rapidly spreading through the coastal plain of the Pee Dee River basin of North Carolina and South Carolina, U.S.A. since the early 2000s. Population-level genotyping was used to determine patterns of population genetic structure within and among subbasins of the Pee Dee River. Overall, our results show a highly structured genetic landscape between the three subbasins, Winyah, Waccamaw, and Little Pee Dee. In the Winyah, an area of historic *P. clarkii* aquaculture activities, we found the highest level of genetic structure in the data set, with every sampling location being genetically distinct. It is unclear whether these 7 genetic lineages are the result of independent introductions related to farming or whether these populations, since the 1970s, have diverged due to a lack of gene flow/dispersal. Our results for the Little Pee Dee and the Waccamaw show rather stark contrasts to Winyah, with a longitudinal gradient of structure which is indicative of more natural and rapid range expansions in the past 20 years.

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Interannual variability in morphometric condition of larval fishes as a function of environmental variables in Beaufort, NC

Reece Warfel* (East Carolina University), Dr. Rebecca Asch, East Carolina University

While larval abundance has been surveyed in past three decades in Beaufort, NC, variations in larval abundance have not been consistently related to recruitment for many fish species, including larval Atlantic Croaker *Micropogonias undulatus*, Mojarra *Eucinostomus sp*., White Mullet *Mugil curema*, and Broad Striped Anchovy *Anchoa hepsetus*. By studying how environmental factors affect the morphometric condition of fish larvae, we may be able to better anticipate when a high or low recruitment year occurs since condition affects fish growth and survival. This project aims to understand the relationship between morphometric condition in comparison with environmental variables (e.g., temperature, mesozooplankton volume, density dependance) among larvae collected during 2017-2019 to determine if there is interannual variation in how oceanic conditions affect these fishes. We hypothesized that when zooplankton is abundant, there will be better morphometric condition of larval fishes. We tested if larval morphometric condition will decrease due to stress caused by summer temperatures. Lastly, we examined if larval body condition reacts consistently to these environmental variables across multiple years. Principal component analysis (PCA) indices are used in a generalized additive mixed model (GAMM) to determine if body condition was related to environmental variables. Results from this experiment shows that the interaction of zooplankton and temperature along with larval density are the most influential variables. Some species shown a differentiation in larval condition of specific year classes and that the early spawning season has mixed effects on condition. These methods can be used to aid future scientists predicting fisheries recruitment outcomes.

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Movement and habitat use of Alligator Gar in Pensacola Bay

Matthew G. Wegener* (Florida Fish & Wildlife Conservation Commission), Amanda Mattair & Calvin Beech , Florida Fish & Wildlife Conservation Commission

Conservation and management of Alligator Gar is an emerging topic, as the role of this apex predator continues to be better understood. In Florida, the conservation status is currently being re-evaluated, so an understanding of critical habitats is paramount for an accurate designation. Normally considered a riverine species, movement results during initial research indicated a remarkable ability for individuals to traverse saline waters. Additional telemetry results from a subsequent study indicated even more use of bay habitats and infrequent visits into riverine habitats where they were initially captured. These observations led researchers to broaden their telemetry project to include all of Pensacola Bay and its tributaries. Results suggest bay habitats are predominantly used from fall until early spring. Fish move into river habitats, primarily the Escambia River, in the spring and stay there through early summer. These movements generally coincide with rising river levels. It is unclear why this seasonal shift in habitat occurs, but the timing suggest it may be related to spawning. By midsummer, tagged Alligator Gar move from river to bay habitats, before settling in bay habitats for the winter. Coastal river and bay habitats are complex and understanding how Alligator Gar utilize individual components throughout their life cycle is critical to the future conservation and management of this species. Alligator Gar in Pensacola Bay utilize river and bay habitats at different times during the year and the Escambia River appears to be of particular interest during their spring migration.

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The influence of marine protected areas, reef habitat, and human population on changes in fish diversity in the center of marine diversity

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Kent Carpenter, Old Dominion University

The Central Visayas of the Philippines is a global epicenter of marine fish biodiversity. Hypotheses attribute this peak of species richness within the Coral Triangle to processes that occur at geological time scales. However, changes in biodiversity may occur on ecological time scales, allowing for the assessment of the potential impact of anthropogenic activities. Low species richness in the Central Visayas has previously been associated with stressors such as habitat degradation, overfishing, and harvesting individuals for the aquarium trade. Many marine protected areas (MPAs) have been established throughout the Philippines to mitigate the cumulative negative effect of these stressors. While most of the country's MPAs lie within the Central Visayas, this region has been termed the "epicenter of conservation adversity" within the Philippines. This study examines the effect of MPAs, reef habitat, and human population on changes in fish diversity in the Central Visayas between surveys conducted in the 1970s, 2010s, and 2020s. Individual- and sample-based species accumulation and rarefaction curves were used to create snapshots of species diversity from these distinct periods. Site-specific species richness and MPA indices (distance, size, age) were compared to determine the effect of MPAs on fish diversity. Preliminary results indicate a significant relationship between MPAs and species richness. However, there is a counterintuitive effect where MPA influence negatively impacts sites in the 1970s. This highlights the importance of incorporating other potential covariates like reef habitat and human population.

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Hybrid swarming of Neosho Bass with non-native Smallmouth Bass in the upper Illinois River basin and implications for individual growth

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Recent molecular investigations support the distinctiveness of the Neosho Bass *Micropterus velox* of the Ozark Highlands from Smallmouth Bass *M. dolomieu*. Like other endemic black basses, Neosho Bass are threatened by hybridization with non-native *Micropterus* forms. Non-native Smallmouth Bass were stocked in Lake Tenkiller in 1991 and 1992, resulting in introgressive hybridization with Neosho Bass in areas upstream of the impoundment. To inform management and conservation efforts, our objectives were to 1) characterize the spatial extent and directionality of introgressive hybridization, and 2) examine the influences of genetic identity on individual growth. From 2019-2021, 1272 specimens were collected longitudinally from localities along the Illinois River, Baron Fork, Caney Creek, Flint Creek, and Lake Tenkiller. We genotyped fish with a SNP panel designed to identify Smallmouth Bass, Neosho Bass, and interspecific hybrids. Analysis of SNP panel genotypes in STRUCTURE and NewHybrids revealed an ongoing hybrid swarm in the Illinois River mainstem, with some pockets of non-hybrid Neosho Bass remaining in far upstream reaches of smaller tributaries. For the second objective, three independent readers estimated the age of 650 fish using transversely sectioned sagittal otoliths. Aged fish ranged 0-10 yrs old and total length ranged 67-536 mm. We will pair age data with genetic results to parameterize von Bertalanffy growth functions that could help unravel the influences of genetic identity and environment on growth of Neosho Bass.

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Not all who wander are lost: upstream migration of natal and non-natal Atlantic Sturgeon in two mid-Atlantic rivers

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Atlantic Sturgeon is a long-lived, anadromous species that is broadly distributed along the Atlantic coast of North America. Despite being highly philopatric, subadult and adult Atlantic Sturgeon make extensive coast-wide migrations where they frequently occupy habitats in non-natal tributaries and estuaries. Ontogenetic changes in habitat use present a challenge for conservation, as threats to survival may occur across vast temporal and spatial scales that are difficult to detect. In addition, presence of non-natal individuals during demographic surveys reduces the ability to detect trends in local abundance and monitor recovery. As such, it is critical to understand differences in natal and non-natal habitat use in order to refine population estimates and protect vulnerable life stages. In this study, we leveraged over a decade of acoustic telemetry data to understand differences in natal and non-natal Atlantic Sturgeon habitat use in the Hudson and Delaware rivers. In both systems, there was substantial individual variation in the extent of upstream migration, with both natal and non-natal individuals occupying over 100 km upstream. Overall, this study highlights non-natal freshwater tributaries as important elements of the complex habitat mosaic that Atlantic Sturgeon use throughout their life cycle. It also suggests that caution may be warranted when making assumptions about individual stock origin during demographic assessments.

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Systematic de-complexing of a widespread crayfish species complex

Bronwyn W. Williams* (North Carolina Museum of Natural Sciences), David A. Lieb (Pennsylvania Fish & Boat Commission), David A. Foltz II (EDGE Engineering & Science, LLC), Zachary J. Loughman (West Liberty University)

Cambarus sp. C. is a widespread species complex, ranging from Columbia, South Carolina north to southeastern Pennsylvania. In 2018, we embarked on a large collaborative undertaking, using integrative methods to disentangle the *C. sp. C* complex, with an initial aim of identifying - and queueing for formal description - taxa of conservation concern. To date, we have systematically sampled nearly 1500 sites throughout the range of *C. sp. C* and have generated a multi-locus molecular dataset of over 2000 individuals. Results of our (still) preliminary analyses indicate the potential for more than 40 taxa within the complex, only six of which are currently named. Biogeographic context has been crucial to our efforts to understand species limits, identify putative introductions, and reexamine the diversity of other Atlantic Slope crayfishes. Our sampling scheme allows us to determine conservation status in "real time", which in turn strongly influences how we prioritize our taxonomic efforts.

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Multiple tracking methods reveal Guadalupe Bass dispersal is consistent with the restricted movement paradigm

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Fish movement and dispersal are critical factors influencing individual survival, metapopulation dynamics, and community structure. Movement of stream fishes was historically regarded as fundamentally restricted until research revealed populations of non-migratory fishes were composed of two components: a more abundant stationary component and a less abundant mobile component. Recognition of the existence of the mobile component led to development of the 'restricted movement paradigm', which is used to construct models predicting the movement of stream fishes, such as those implemented through the R statistical package 'fishmove'. We tested the validity of the 'fishmove' model for predicting dispersal of Guadalupe Bass *Micropterus treculii*, an imperiled black bass endemic to Texas. To achieve this goal, we assembled Guadalupe Bass radio telemetry data from three rivers in the Colorado River Basin of Texas as well as mark-recapture data from fish fitted with passive integrated transponder (PIT) tags from three rivers in the Guadalupe River Basin of Texas. Results revealed a consistent pattern of leptokurtic movement distances, a telltale sign of heterogeneous movements by stationary and mobile fish. Across rivers and repeated observations, predicted movement distances matched observed movement distances 56% (stationary components) and 67% (mobile components) of the time based on radio telemetry and 83% (for both stationary and mobile components) of the time based on PIT tag data. Our results provide evidence that the 'fishmove' package can be used to model Guadalupe Bass dispersal and ultimately improve management and conservation by informing habitat connectivity prioritization schemes and predicting colonization of restored habitats.

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Assessing densities and habitat associations of the endangered *Etheostoma fonticola* using a long-term dataset

Melissa Wolter* (Texas State University), Dr. Tim Bonner, Texas State University

Monitoring (e.g., quantifying densities through time) of endangered fishes is one of many conservation services of a USFWS Habitat Conservation Plan (HCP). Trends in fish densities can be used to document fish responses to low (e.g., droughts) and high flows (e.g., floods), instream habitat modification (e.g., bridge construction), recreational activities (e.g., swimmers, waders), and vegetation management (e.g., invasive species removal). However, a limitation in monitoring of endangered fishes is setting lower density thresholds to provide early warning of potential loss in population viability. Populations are expected to fluctuate through time based on density-dependent and density-independent factors but what density levels should prompt concern and additional conservation action? Objectives of this study are 1) to quantify trends in densities of the endangered Fountain Darter *Etheostoma fonticola* taken over an 8-year HCP-monitoring period among multiple sites and two river systems (Comal River and San Marcos River) with sites representing a suite of anthropogenic and natural disturbances, and 2) to describe habitat associations of the Fountain Darter within and among sites for the purpose of establishing lower densities thresholds that could be early warning of loss in population viability. Preliminary analyses suggest that densities in two sites on the San Marcos River and one site on the Comal River, where recreational activities are the greatest or where habitat modifications likely restrict the habitat of the Fountain Darter, could serve as the lower threshold for Fountain Darters at the other sites.

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Design and model-based approaches in estimating abundance of American Horseshoe Crab

Chad C. Wong* (Virginia Polytechnic Institute and State University), Yan Jiao (Virginia Polytechnic Institute and State University), Eric Hallerman (Virginia Polytechnic Institute and State University)

The American Horseshoe Crab (HSC) *Limulus polyphemus* is one of four species of horseshoe crabs found throughout the world and the only found in North America. It is an economically and ecologically important species throughout its native range from Maine to the Yucatan Peninsula. Harvested for fertilizer and livestock feed in the 19th century, the species is now harvested for bait for whelk and eel fisheries, and lymphocytes for the biomedical industry. The Atlantic States Marine Fisheries Commission (ASMFC) started formally managing HSC in 1998 through its Interstate Fishery Management Plan (IFMP). Since then, surveys of relative abundance have been conducted annually along the Atlantic coast, with an emphasis on the Delaware Bay region as it is the center of HSC abundance. Virginia Polytechnic Institute and State University has performed trawl surveys of the lower Delaware Bay and mid-Atlantic coast and estimated relative abundance in the area since 2000. This study represents a continuation of this effort. This study is the first to use model-based estimators in addition to previous design-based estimates. These estimates will be used to determine relative abundance of HSC within the Delaware Bay for 2021 and 2022 and analyze trends in abundance overtime. This analysis then can be used by ASMFC to inform harvest and management strategies, and to seek insight into factors contributing to changes in relative abundance overtime.

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Testing the efficacy of an aquatic nuisance species removal method in an urbanized Caribbean Island stream

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Aquatic invasive species (AIS) are a threat to native fish communities everywhere. This study addresses the efficacy of species removal in an understudied and particularly vulnerable region. On the ecologically diverse tropic island of Puerto Rico, AIS have been found in many water systems, including lotic, lentic and mixed systems. A marked increase in AIS has been observed in the Río Piedras, which runs through the capital city of San Juan, making it the most urbanized stream in Puerto Rico. A previous study of the Río Piedras has shown that the fish assemblage at one location has shifted dramatically from a native-dominated fish community to an ecosystem dominated by AIS. Backpack electrofishing has been shown to be an effective method to reduce the density of invasive fish species in Hawaiian streams. This study assesses the effectiveness backpack electrofishing for the physical removal of AIS with a before-after controlled-impact experiment. Native and AIS fish species densities was quantitatively estimated in pre- and post-removal periods at three paired removal and control sites within the Río Piedras. The results of this study can drive evidence-based policy about how to manage and, perhaps restore, the native fish communities of tropical watersheds.

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A novel and rapid qPCR probe assay for detection of Roseovarius Oyster Disease bacterium *Aliiroseovarius crassostreae* in the Eastern Oyster *Crassostrea virginica*

Lengxob 'Lenny' Yong* (South Carolina Department of Natural Resources), Ryan Carnegie (Virginia Institute of Marine Science); Peter Kingsley-Smith (South Carolina Department of Natural Resources); Tanya Darden (South Carolina Department of Natural Resources)

Roseovarius Oyster Disease (ROD) has been a significant cause of Eastern oyster *C. virginica* mortalities in parts of the northeastern United States since the late 1980s, and is an epizootic threat in both wild and aquaculture settings. The pathology and morbidity arising from ROD are attributed to the presence of *Aliiroseovarius crassostreae,* a marine alpha-Proteobacteria bacterium, in the tissues of infected individuals. Due to high rates of intraspecific transmission and a predominance of mortality occurring in young oysters, seed importation is of high concern in the shellfish industry as a potential pathway of the introduction for *A. crassostreae*. This concern has prompted the development of several diagnostic tools based on gross observations and histology, but these can be limiting for both pathogen detection in low abundance, i.e., cell and copy numbers, and quantitative purposes. Here, we report the development of a new probe-based qPCR assay for rapid, sensitive and quantitative detection of *A. crassostreae*. The probe targets a unique and small genetic region (139bp) of the interspacer region of the 16S-23S genes. Tested on *A. crassostreae* synthetic and bacterial DNA, the assay has an estimated detection limit of 1-3 copies per µL of DNA. The qPCR assay was also successfully implemented for rapid diagnosis on live oyster tissue and bacterial quantitation. Moreover, this new sensitive and diagnostic tool can help to illuminate basic aspects of ROD pathogenesis and dynamics, particularly infection level in asymptomatic oysters and disease spatial distribution, which together will help to reduce the spread of ROD.

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Mortality and movement of Greater Amberjack in the Gulf of Mexico and Atlantic Ocean off the Southeastern US

Samantha Young* (Auburn University), Matthew Catalano, Auburn University

Greater Amberjack *Seriola dumerili* are a popular species for sport and commercial fisheries across the southeastern United States. There are two Greater Amberjack stocks off the southeastern US: the South Atlantic and Gulf of Mexico (GOM) stocks. Currently, the South Atlantic stock is stable, yet the GOM stock is both overfished and undergoing overfishing. Obtaining independent estimates of exploitation for these stocks would aid management by supplementing existing stock assessments. We are conducting a large-scale multi-investigator tagging study to estimate regional fishing mortality, length-based vulnerability, and movements of Greater Amberjack. In summer 2022, we began tagging up to 1200 Greater Amberjack with conventional reward tags. Up to 400 of these fish were additionally implanted with an internal acoustic transmitter. The study area was divided into three regions: the Western GOM (Texas and Louisiana), the Eastern GOM (Mississippi, Alabama, and Florida), and the South Atlantic (Florida to North Carolina). Fish lengths were also stratified into three length intervals to estimate vulnerability to capture, harvest, and discard, and half of the fish were double tagged to estimate tag shedding rates. We will collect tag returns from both recreational and commercial fisheries with a $250 reward incentive for reporting external tags. Detections of fish tagged with acoustic transmitters will be obtained from new and existing receiver arrays to inform mortality estimates and detect fish movements. 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.

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Investigating potential impacts of live-imaging sonar on crappie fishing through creel surveys

Andrew Yung* (Arkansas Game and Fish Commission)

Crappie (Black Crappie *Pomoxis nigromaculatus* and White Crappie *P. annularis*) are the second-most sought after sportfish by Arkansas anglers and are extremely popular across the United States. Recently, crappie anglers have expressed concerns regarding the use of live-imaging sonar and the potential negative impacts its use may have on fish populations. Specifically, anglers voiced concerns that live-imaging sonar users are able to catch more crappie and are directing harvest towards the largest individuals in the population. Creel surveys were conducted at eight Arkansas waterbodies in 2021. Using data from these creel surveys, we investigated differences between anglers using live-imaging sonar and those without it. Significant differences were found in both catch rates and average size of harvested crappie. Findings from this analysis can provide a starting point for fisheries managers looking to further investigate the potential impacts of live-imaging sonar usage on their local crappie populations.

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The impact of road crossing barriers on karst headwater endemic species in northwest Arkansas

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The karst region of NW Arkansas is home to many endemic Species of Greatest Conservation Need (SGCN). Spring headwater endemics include the Midget Crayfish *Faxonious nana* and Meeks Short-pointed Crayfish *F. meeki brevis*, as well as the Arkansas Darter *Etheostoma cragini* and Least Darter *E. microperca*, both are genetically distinct from other populations throughout their ranges. NW Arkansas is rapidly urbanizing, increasing the need to construct structures like culverts, bridges, and fords. These man-made road crossings can cause habitat degradation and fragmentation, as well as impair overall stream connectivity. To evaluate the impact that road crossings have on SGCN species and their habitat, 30 headwater streams were sampled throughout NW Arkansas. At each site, fish and crayfish were identified, weighed (g), and measure (mm). Stream habitat variables were assessed using the EPA's Environmental Monitoring and Assessment protocol. The composition of fine sediment and aquatic vegetation, which is preferred habitat for these fish, was significantly lower at sites with road crossings as indicated by a Wilcoxon Test. Boxplots indicate overall, SGCN darters tended to occur less frequently at sites with barriers, and at smaller abundances. SGCN crayfish appeared to occur more frequently at sites with barriers that typically had larger substrate. An Analysis of Covariance indicated crayfish mass significantly increased with barrier presence. These data suggest the need for multispecies conservation approaches, as road crossings may affect SGCN's differently.

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Short-term mortality of nongame fishes shot with bowfishing gear

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Across the United States, nongame fishes are targeted through the growing sport of bowfishing with a generalized lack of management or regulatory protections. In eight states, including Oklahoma, the practice of shooting and immediately releasing nongame fishes is not prohibited, and advocates of this practice attest that survival of shot fishes is high. Studies on the traditional gear associated catch and release mortality of a diversity of freshwater fishes are abundant. However, short-term mortality of fishes shot with bowfishing gear is unknown. A total of 240 nongame fishes were shot with bowfishing equipment and held in convalescent pools with control fishes to document short term mortality up to five days. Overall mortality of bowfished and control fishes was 87% and 0%, respectively. Anatomical shot locations influenced mortality, with fishes shot in critical areas (head, internal organs, or spine; 78% of total) experiencing 96% mortality, whereas fishes shot in the dorsal musculature, tail, or fins experienced 52% mortality. Some fishes shot (13.7%) were not successfully retrieved, providing insight into potential additional cryptic mortality associated with the sport. Shot fishes were generally older (mean = 19.4, range 3-54) with a higher proportion of females (62%) than control fishes (mean = 12.5, range 2-39; 37% female). Bowfished Smallmouth Buffalo were significantly longer, heavier, older, and had a higher female representation than control fish of the same species. The high mortality evidenced from this study, paired with conservation ethics, suggest that shoot and release is not a viable practice in sustainably managed bowfisheries.

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Movement of endemic Bartram's Bass and invasive Alabama Bass in Eastatoee Creek, South Carolina

Tyler Zumwalt* (Clemson University), Brandon K. Peoples, Clemson University; Troy Farmer, Clemson University; Mark C. Scott, SCDNR; Daniel Farrae, SCDNR; Kevin Kubach, SCDNR; Katherine Silliman, SCDNR

Hybridization between endemic Bartram's Bass and nonnative Alabama Bass has threatened the persistence of Bartram's Bass. However, the mechanisms and rate at which nonnative Alabama Bass genes are spread is unknown. Therefore, our objective was to quantify the movement of Bartram's Bass, Alabama Bass, and hybrids. We radio-tagged 10 Bartram's Bass, 12 Alabama Bass, and 5 hybrids, then tracked individuals from May-September of 2021. We used mixed effect models to quantify mean movement rates (meters/week) and changes in location (rkm) among each species, with temperature and discharge as interaction effects. Bartram's Bass moved the least (170 m/week; 0-390 95% CI), followed by Alabama Bass (489 m/week; 237-740 95% CI), and hybrids moved the most (763 m/week; 400-1125 95% CI). Hybrids also had the most range overlap with Bartram's Bass. Movement rates of Alabama Bass ($\beta = 0.17 \pm 0.11$, $p < 0.01$) and Bartram's Bass ($\beta = 0.03 \pm 0.01$, $p = 0.01$) increased with discharge while movement rate of hybrids decreased with temperature ($\beta = -0.29 \pm 0.08$, $p < 0.01$). Bartram's Bass also shifted upstream in response to temperature ($\beta = 0.10 \pm 0.05$, $p = 0.02$), while no factors shifted the location of Alabama Bass or hybrids. These results suggest hybrids were the primary spreaders of nonnative genes, with moderate temperatures and high discharges yielding the highest invasion risk. Additionally, existing physical barriers and habitat differences confounded invasion potential, while simultaneously limiting Bartram's Bass dispersal. Therefore, actions to prevent further nonnative gene spreading should consider these barriers and the effects of temperature and discharge on invasion potential.

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2023 SD AFS Poster Presentations

([†] Best Student Poster Candidate)

(*Presenter)

Distribution of *Procambarus pearsei* and *Procambarus braswelli* in North Carolina and the effects of *P. clarkii* invasion

Robert Adams* (Appalachian State University), S.J. Busch, E.J.Thompson, R.P Creed, and M.M Gangloff (Appalachian State University)

Procambarus pearsei and *P. braswelli* are currently considered species of concern by the NCWRC. Both crayfish species are endemic to the lower Cape Fear, Pee Dee and Waccamaw river systems in North Carolina and South Carolina. These drainages have been extensively colonized by *Procambarus clarkii*, an invasive species that escaped from aquaculture facilities, raising concerns that this cosmopolitan and large crayfish may displace smaller and more niche-limited native crayfish species. Indeed, prior to our surveys, *P. pearsei* had not been detected in North Carolina since October of 2015. Our goal is to examine whether the distribution and abundance of *P. pearsei* and *P. braswelli* are being affected by *P. clarkii* invasions. To date, we have conducted surveys at 27 historical sites and 35 new sites across the ranges of *P. pearsei* and *P. braswelli*. We detected *P. braswelli* at 4 of 12 historically occupied sites and *P. pearsei* at 2 of 15 historically-occupied sites. Future surveys will involve sampling year-round to assess the degree to which the distributions of these species have changed over time and determine how seasonality affects the detectability of native and invasive crayfishes. We will also obtain detailed demographic and reproductive-status information to assess whether life history traits may explain some of the potential for competition between native and invasive species. These data will help guide management of both native and invasive crayfishes and hopefully highlight the potential impacts of *P. clarkii* and other invasive crayfishes in this region's unique but vulnerable freshwater ecosystems.

[†]Assessing Biota and Environmental Characteristics Above and Below a Low-head Dam

Trevor Alexander* (Western Carolina University), Keith Gibbs (WCU) & Tom Martin (WCU)

Dams are a form of anthropogenic alteration to aquatic ecosystems that can affect natural conditions and influence aquatic fauna assemblages. The size and type of a dam can have different effects on the aquatic environment, such as altered flow rate, water temperatures, sediment transport, and can serve as barriers that limit fish migration or distribution of fishes, macroinvertebrates, and aquatic plant species. The focal point of this study is a low-head dam located on the Tuckasegee River in Jackson County, NC. Fish and macroinvertebrates were sampled at multiple sites above and below the dam to compare species assemblages. Macroinvertebrates were sampled with a kick net in shallow riffles and a D-frame net for timed multihabitat sampling. Backpack electrofishers were used to sample fish in available wadeable habitats. We used multivariate statistical analyses to determine the similarity of fish and macroinvertebrate assemblages among sites. Our results indicate the dam has minimal effect on aquatic habitat and aquatic macroinvertebrates. However, we found greater fish diversity below the impoundment. A one-way SIMPER shows that the Wounded darter and Banded darter were not detected above the dam but were present below the dam. Conversely, the Greenfin shiner, Brook trout, and Rosyside dace were not detected below the dam but were found above the dam. Restored

connectivity to this system may improve fish diversity above the dam. However, removing the dam may cause a temporary decrease in sensitive macroinvertebrates since the dam is withholding sediment. Substrate composition may change temporarily below the dam until the finer substrate is transported downstream. Overall, this study provides several years of baseline that can be referenced if the dam is removed.

Investigating centennial genetic changes at an epicenter of marine biodiversity through short-read genome assemblies

Jemelyn Grace Baldisimo* (Old Dominion University), Eric Garcia (Old Dominion University), Abner Bucol (Silliman University), Rene Clark (Rutgers University), Brendan Reid (Rutgers University), Roy Roberts (Texas A&M University-Corpus Christi), John Whalen (Old Dominion University), Chris Bird (Texas A&M University-Corpus Christi)

The Philippines is an epicenter of marine biodiversity, having more species per unit area than anywhere else in the world. However, it is also known to be heavily impacted by anthropogenic stressors. The NSF-funded Philippines PIRE Project aims to uncover changes in genetic diversity of marine fish populations due to habitat degradation, overfishing, and other anthropogenic activities. Since we have access to specimens collected in the Philippines from 1907 to 1910 by the USS Albatross through the Smithsonian National Museum, we can study temporal changes in genetic diversity for over 100 years. Appropriate extraction methods, DNA repair protocols, library variations, and sequencing methods were tested to develop a pipeline to genotype a few species with up to 40,000 loci across historical and contemporary samples. In this study, we focus on comparing the performance by four commonly used tools (ABySS, HipMer, SOAPdenovo, and SPAdes) for assembling short reads from six species that had historical and contemporary samples. Results showed that the four assemblers produce high quality assemblies, but SPAdes consistently yielded high quality metrics, produced more contigs and assembled larger contigs. Successful genome assembly from short reads represents a new paradigm for studying non-model fisheries and organisms. Our findings can aid molecular biologists studying non-model organism with limited computational resources, which can help drastically increase genetic knowledge on systems they study.

Alligator Gar Research in Pensacola Bay

Calvin Beech* (Florida Fish and Wildlife Conservation Commission), Amanda Mattair (Florida Fish and Wildlife Conservation Commission), Mathew Wegener (Florida Fish and Wildlife Conservation Commission)

Alligator Gar *Atractosteus spatula* are large riverine fish that can grow to around 150kg and range across the southeastern U.S. In Florida, Alligator Gar are only found within Gulf Coastal rivers west of the Apalachicola River and are considered rare. Alligator Gar populations throughout their range have historically been declining or absent since the mid 1900's. Recognizing this decline and the need for conservation, Florida Fish and Wildlife (FWC) closed harvest of Alligator Gar in Florida waters in 2006 to anyone without a special permit. Abundance estimates are needed to determine if the harvest closure is necessary. A population estimate conducted on the Escambia River in 2014-2015, indicated additional research was needed throughout the range of Alligator Gar in Florida. To determine if harvest closures are necessary, additional abundance estimates are needed. While few individuals have been caught in the Pensacola Bay system since 2016 (N<10), recent genetic and telemetry data suggest that the

Escambia River could be the source population for all of Pensacola Bay. The objectives of this study were to (1) use telemetry to determine movement of tagged fish in Pensacola Bay and (2) locate when and where Alligator Gar aggregate in Escambia Bay for future population estimates. Research from this study will help inform managers better understand Alligator Gar population dynamics across their Florida range.

[†]Fishing Preferences of Urban Anglers in the Metro-area of Richmond, Virginia

Sophie Bels* (Christopher Newport University), Rene X. Valdez (Virginia Department of Wildlife Resources), Mallory G. White (Virginia Department of Wildlife Resources), Clint Morgeson (Virginia Department of Wildlife Resources)

The Virginia Department of Wildlife Resources is interested in recruiting and retaining diverse anglers across the state. Urban areas in Virginia have both high numbers of current and potential anglers. To better understand current urban anglers and expand strategies for engaging this group, we developed an in-person survey to measure angler preferences for urban fishing sites, fishing satisfaction, and fishing experience. Using a roving-roving creel design, we surveyed 9 fishing sites in Henrico County and the City of Richmond in June and July 2022. We conducted 152 in-person surveys over seven weeks. Results indicate that fishing effort and catch was higher on weekdays compared to weekends, urban anglers may be less experienced than average, and are more likely to fish without a target species. Our results also show that urban sites selected by anglers are perceived as relaxing and convenient to travel to. We compare results of this project to results of a recent statewide angler survey to highlight the unique aspects of urban anglers in the Richmond area. We also present management recommendations for improving survey efforts of urban anglers and communication and outreach efforts to engage with urban anglers.

[†]Reproduction and diet of the Harlequin Darter in the Neches River basin of Texas

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

Harlequin Darter *Etheostoma histrio* is widely distributed within the Mississippi River basin and gulf slope drainages of central and southeastern USA. Previous studies in more northern extents of their range report a short reproductive season (two months, February and March), life span of four or more years, and food items consisting of benthic invertebrates. The purpose of this study is to quantify monthly reproduction and diets of the Harlequin Darters taken from lower latitudes (lower Neches River of Texas) with the expectation of a longer spawning season. Harlequin Darters were taken starting in February 2022 and will be taken through February 2023. Reproduction (e.g., gonadosomatic index, ovarian stage, oocyte counts), diets, growth, and age will be described and then compared to previous reports for the purpose of exploring how life histories might change at different latitudes.

Spatial and temporal variation in food affects habitat choice in competing brook trout

Eliza Brooks* (Randolph-Macon College), Charles Gowan (Randolph-Macon College)

Brook trout (*Salvelinus fontinalis*) search for optimal foraging locations in streams while competing in local dominance hierarchies, with higher-ranking individuals gaining access to locations with more food. This process occurs within a single pool, but field observations show that fish periodically move among pools over the summer. We hypothesized that the cause of these movements is temporal variability in

food abundance, with fish deciding to move when food availability within a pool declines relative to that in other pools. We used an artificial stream with three fish to represent a natural habitat in which food levels vary among pools and change over time. Our prediction was that fish would distribute themselves in the stream according to food level and position in the dominance hierarchy and that fish would change pools when food levels in each pool were manipulated. The data showed that dominant fish did spend most time in the best pool and would switch pools when food levels were changed. However, subordinate fish did not distribute themselves as predicted and all fish frequently moved among pools regardless of food level. These results indicate that fish do not distribute themselves strictly according to food level and position in the dominance hierarchy, and that all fish periodically search among pools, perhaps to update their knowledge of conditions throughout the stream. Understanding drivers of fish movement is important in conservation because decisions made by individual fish about where to forage ultimately determine total fish abundance in the stream.

[†]Developing a joint species, spatially dependent physiologically guided abundance model to improve predictions under future climate change scenarios

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Climate change is a significant global threat to poikilotherms, with increases in temperature having the potential to alter the abundance and distributions of species across the biosphere. Predicting the response of poikilotherms to increases in temperatures, therefore, is a global conservation priority and one that often relies upon the use of correlative niche models. However, the use of these models to extrapolate abundance/distributions under future temperature conditions assumes that observed temperature-abundance relationships are valid under future temperatures - temperatures that often exceed the range of observed temperature data. We recently developed a novel physiologically guided abundance (PGA) model that relaxes this assumption by integrating data on a species' thermal preference and tolerance (e.g., thermal optimum and critical thermal maximum) into a single species correlative niche model. The fusion of lab-derived thermal performance curves effectively constrains predictions under future climates based on species-specific physiology and has been shown to produce more realistic predictions under increasing temperature scenarios. Here, we expand upon this model to account for species and spatial dependencies. We first show the validity of our newly developed joint species, spatial PGA model (jsPGA) through a simulation study. Finally, we present a case study that uses fish community data from >1,000 freshwater lakes across Minnesota. We show the utility of using the jsPGA to predict the abundance and distribution of six different species of fish that vary in their thermal tolerance under future climate change scenarios.

Examining home range trends of reef fish on North Carolina artificial reefs

Reese Dorroh* (North Carolina State University), Jeffrey Buckel, Ryan Tharp (North Carolina State University)

Artificial reefs are man-made structures that can be used to supplement or enhance natural habitats. Despite their increasing use, little work has been done examining how different species use different artificial structures or the area surrounding them. A better understanding of how fishes utilize the area around artificial structures can help managers make more informed decisions in the future. During the summer of 2021, we tagged five recreationally important species on two different artificial reef complexes off the coast of North Carolina: black sea bass (*Centropristis striata*), gag grouper (*Mycteroperca mircrolepis*), almaco jack (*Seriola rivoliana*), red snapper (*Lutjanus campechanus*), and greater amberjack (*Seriola dumerili*). Fishes were measured and tagged, and their fine-scale movements were tracked using a VEMCO Positioning System (VPS) for ~100 days. The results were used to calculate home ranges, with which two gamma generalized linear models were run using the log link function with total length (TL) and species as the predictors and home range (HR) as the response. Model results indicated a significant positive relationship between species and home range size, while controlling for the effects of total length. When examining total length alone, there was a marginally significant positive relationship with home range size. Black sea bass had the smallest home ranges, gag and red snapper had moderate home ranges, and jacks had the largest home ranges. Larger fish tended to have larger home ranges. Our results suggest that home range size does vary by species and total length.

Development of the Blue Ridge Snorkel Trail in North Carolina

Luke Etchison* (NC Wildlife Resources Commission), Andrea Leslie (NC Wildlife Resources Commission)

The Blue Ridge Snorkel Trail (BRST) is an innovative education project that will link together a set of publicly accessible river sites where people can safely snorkel to experience the underwater world of streams and rivers of western North Carolina. Phase I of the snorkel trail involves establishing a set of ten pilot sites, in ten different counties. Each site would be identified with an educational sign, which provides safety information, a description of notable species at the site, and a map of the snorkel trail which will note the location of all snorkel sites across western NC. Additional information on the fishes that can be found at each site will be provided in a link to the North Carolina Fishes website. The BRST is set to break ground in Spring 2023.

Making sausage with countless cooks; combining genetic and acoustic telemetry data from many collaborators to understand coastwide migration patterns of Atlantic Sturgeon

Dewayne Fox* (Delaware State University), Matthew Breece (University of Delaware), David Kazyak (USGS), Matthew Balazik (USACE), Hal Brundage (Environmental Research and Consulting Inc.), Keith Dunton (Monmouth University), Adam Fox (University of Georgia), Mike Frisk (Stony Brook University), Christian Hager (Chesapeake Scientific), Danielle Haulsee (Hubbs Seaworld Research Institute), Amanda Higgs (Cornell University), Eric Hilton (Virginia Institute of Marine Sciences), Joe Iafrates (US Navy), Robin Johnson (USGS), Jason Kahn (NMFS), Micah Kieffer (USGS), Michael Loeffler (North Carolina Division of Marine Fisheries), Barbara Lubinski (USGS), Pat McGrath (Virginia Institute of Marine Sciences), Mike O'Brien (University of Maryland), Ian Park (Delaware Division of Fish and Wildlife), Bill Post (South Carolina Department of Natural Resources), Eric Reyier (NASA), Tom Savoy (Department of Energy and

Environmental Protection), Dave Secor (University of Maryland), James Sulikowski (Arizona State University), Carter Watterson (US Navy), Shannon White (USGS), Gayle Zydlewski (University of Maine)

Following decades of intensive conservation efforts, many US Atlantic Sturgeon distinct population segments remain critically imperiled. Still experiencing the negative impacts brought on by historic overharvest and habitat loss, Atlantic Sturgeon are also being exposed to threats including marine construction, vessel strikes, and fisheries bycatch. Due to species' long lifespan and the tendency for adults and sub-adults to engage in coast-wide migrations, these threats are often realized over vast temporal and spatial scales that are difficult to monitor and even more difficult to mitigate. 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 private, academic, state, and federal institutions have been independently conducting regional studies of Atlantic Sturgeon migration, integration of these efforts is needed to gain a more comprehensive understanding of continental scale habitat use. Working collaboratively with 14 institutions, we have compiled telemetry data (n= 32 million detections) and genotypes for 2650 telemetered Atlantic Sturgeon. We are using this dataset to characterize the migrations and habitat use of Atlantic Sturgeon across broad spatial scales. Genetic assignment tests will provide insight into when and where specific population segments occur, and in turn where they are exposed to threats, thereby improving our ability to mitigate potential damage. Results from this study will be used to identify important critical habitat areas and improve our ability to protect Atlantic Sturgeon during vulnerable life stages.

Effectiveness of Reduced Representation Sequencing on Century-Old Ethanol-Preserved Museum Fishes

Eric Garcia* (Old Dominion University), Martin French (Texas A&M University-Corpus Christi), Chris Bird (Texas A&M University-Corpus Christi)

Museum specimens have a largely underutilized potential to allow biologists to study rare, ancient, or extinct organisms using genomic methods. However, museum samples often have degraded and fragmented DNA making it more difficult to sequence. Reduced representation sequencing has proven to be affordable and effective for population genomic applications but is sensitive to the degradation inherent with museum samples. Here, sequence quality and error rates were compared between reduced representation libraries constructed from century-old, ethanol-preserved museum and contemporary samples for two fishes (*Atherinomorus duodecimalis* and *Siganus spinus*). Museum specimens had a larger proportion of reads filtered due to low base call quality and adapter sequences, while having a lower proportion of targeted reads. Museum specimens exhibited equal or higher error rates in the synthetic adapter sections of reads, suggesting that contaminants retained in museum DNA extracts altered DNA polymerase specificity or nucleotides directly. Museum specimens exhibited substantially elevated error rates in the first two natural nucleotides (last two positions of the SbfI restriction site, 7 & 8), and a model assuming an error at position 7 results in a random nucleotide in 8 fit the data well. The base call error patterns were consistent with chemical contaminants in museum samples reducing restriction enzyme specificity. Overall, sequencing of degraded museum specimens is possible, but all else being equal, it can result in more errors and lower depth of coverage per locus than for contemporary samples. Consequently, more DNA per museum library needs to be processed to achieve reliable results.

†Taxonomic Standing and Genetic Surveillance of *Cambarus jezerinaci* in Kentucky

Cassidy Gebhardt* (West Liberty University), Nicole Garrison and Zachary Loughman (West Liberty University)

Cambarus jezerinaci, is a small, cold stream-dwelling crayfish found in Southeastern Kentucky which may or may not be a member of a species complex. Previous research completed in 2008 compared the Cytochrome Oxidase I (COI) gene between *C. jezerinaci* and a closely related species, *Cambarus parvoculus*. This work identified a third genetically distinct lineage most similar to *C. jezerinaci* that occurred in both the Cumberland and Kentucky River watersheds in Kentucky. In 2022, surveys were completed throughout the proposed range of *C. jezerinaci* in Kentucky, with a special emphasis focused on surveying the Kentucky River watershed. Initial morphology identifications indicated that specimens collected are of the unique lineage, not of nominate *C. jezerinaci*. Determination of the taxonomic standing of *C. (cf.) jezerinaci* in the Kentucky River is important for the conservation of these animals and helps broaden our understanding of what it means to be a species. Continuing to perform research to genetically identify cryptic species allows for a better understanding of biodiversity on our planet and the process of speciation itself. Given the rapidly changing climate, it is imperative to catalog the true diversity of our freshwater streams and develop conservation action plans for endemic species such as *C. jezerinaci*.

Hatchery capacity needed to support Atlantic surfclam fishery enhancement

Caela Gilsinan* (William and Mary - Virginia Institute of Marine Science), Dr's. Andrew Scheld and Sarah Borsetti (William and Mary - Virginia Institute of Marine Science), Dr. Daphne Munroe (Rutgers the State University of New Jersey, Haskin Shellfish Research Laboratory)

High demand for renewable energy has stimulated offshore wind farms' development along the east coast of the United States, with over two million acres currently leased for development. It is expected that access to important Atlantic surfclam fishing grounds will be limited or lost due to the overlap with wind lease areas. This study explores the economic viability of large-scale hatchery production to offset additional costs, reduced revenues, and potential job losses associated with the displacement of the fishing fleet. Reports and primary literature were used to understand growth and survival of Atlantic surfclams in hatchery and nursery settings. This information was used to calculate the scale of hatchery efforts needed to support one million bushels of fishery-sized clams (>120mm). Data on labor, energy, construction, and material inputs and costs for hatchery and nursery production were gathered by analyzing literature and meeting with hatchery managers, researchers, and others knowledgeable about shellfish hatchery production. A techno-economic cost model and Monte Carlo analyses were employed to explore average costs and their variability. This study suggests that 374 million to 2.1 billion Atlantic surfclams are needed at the end of the hatchery stage to produce one million bushels of market-sized product. Total production costs range from $3.7M to $15.1M, including $2.9M - $13.3M in hatchery costs and $800K-$1.9M in nursery costs. Under current market conditions, where Atlantic surfclams regularly sell for $14-$17/bushel, this analysis suggests that hatchery production could be a viable fishery enhancement method for offsetting losses associated with offshore wind development.

Spatial distribution and habitat associations of mussel and fish communities in the upper Guadalupe River basin (TX) during extreme drought

Zachary Hutchens* (Department of Biology, Texas State University), Timothy Bonner (Department of Biology, Texas State University)

Surface waters in upper reaches of Edwards Plateau (TX) streams are supported primarily by springs from karst aquifers. Availability of groundwater is sufficient to keep surface water flowing, in at least part of the upper reaches, during periods of drought, thereby providing refuge for numerous Edwards Plateau endemic fauna. Purposes of this study were to identify surface water availability and the existing mussel and fish communities within the upper Guadalupe River basin (TX) during a period of extreme drought in 2022. Study objectives were to quantify mussel and fish communities and their habitat associations in a river network from multiple headwater streams to their convergence in a single channel downstream. Most headwater streams maintained flowing waters during the extreme drought, whereas lower reaches of the mainstem only contained pool habitats or completely dry. Correspondingly, species richness and abundances of endemic spring-associated fishes were greatest within the headwater streams with flowing waters and become reduced or absent in pooled water in the mainstem. Other species not necessarily associated with springs systems, such as several mussel species, also were more abundant in headwater streams with flowing waters. Our findings offer insights into why mussel and fish communities are not homogenously distributed within the upper reach of the Guadalupe River basin during wet periods (e.g., source and sink dynamics) but also identify areas as drought refugia, which might be targeted for conservation action during wet and dry periods.

Artificial illumination of trawl gear components to reduce Pacific halibut bycatch in the US West Coast bottom trawl fishery

Derek Jackson* (Virginia Institute of Marine Science)

In the last decade there has been a concentrated interest in the use of artificial light serving as a bycatch reduction device for a number of different fisheries around the world. In the US west coast groundfish fishery, previous studies found success reducing Pacific halibut, *Hippoglossus stenolepis*, bycatch caught in low-rise, cutback trawls. However, since those studies were conducted, regulations have changed to allow for less species and size selective high-rise trawls in areas that were once highly restricted. The goal of this study was to investigate the efficacy of green LEDs at reducing Pacific halibut bycatch for this trawl configuration. Catch comparison analysis found that illuminated trawls caught significantly less halibut than the non-illuminated trawls albeit with reductions in the target catch as well. The results from this study further explore the potential of a low-cost device, serving as a potential BRD for the fishery.

†Feeding Habits of *Carcharhinus plumbeus*, Off of the Southeast U.S Coast From 2006-2022

Emma Jackson* (NOAA Hollings Scholar; University of South Carolina), John Carlson (National Marine Fisheries Service)

Sandbar sharks, *Carcharhinus plumbeus*, are apex predators that may structure marine communities through predation. This study describes the diet, highlighting changes in feeding habits, determining ontogenetic shifts, and comparing this contemporary study with historical studies. From North Carolina to the Gulf of Mexico (GOM), 705 shark stomachs were obtained through the NOAA Fisheries Observer Program between 2006 and 2022. Of the 705, 258 were used for diet analysis, excluding empty and those with only bait as contents. In the two regions, there were 173 females and 85 males caught with similar numbers of juvenile and mature adults but females being more prevalent in both. Diet was assessed by life-stage and quantified using five indices: percent by number, percent by weight, frequency of occurrence, the index of relative importance (IRI), and IRI expressed as a percent (%IRI) for prey categories and lower taxonomic classifications. The largest consumed prey item between age class, sex, and region were teleost followed by cephalopods according to their indices of relative importance (IRI). The survey of prey items ranks cephalopods of higher importance than previous studies. Ontogenetic shifts were not likely due to large juveniles and a lack of neonates within the region.

†Comparison of Redfin Darter (*Etheostoma whipplei*) Diets from Two Spatially-Distinct Streams in the Arkansas River Valley.

Ben Johnson* (Arkansas Tech University, Department of Biological Sciences), Ethan Dodson (Arkansas Tech University, Department of Biological Sciences), Kyler Hecke (Arkansas Tech University, Department of Biological Sciences)

Diet-data collection is increasingly difficult for darters, as most methods require the dissection of each specimen and the removal of the digestive tract, which is fatal. In result, the diets of many darter species have been relatively understudied. The Redfin Darters (*Etheostoma whipplei*) is one species where there is very little information on its diet. We wanted to use a non-lethal diet extraction method to see how the diet of this species varied between two spatially-distinct streams, Bakers Creek and Shoal Creek, tributaries of Lake Dardanelle (Arkansas River) in Arkansas. We employed two sampling gears (kick-nets and seines) to collect this species. Small-scale gastric lavage was used to extract diet data from all individuals at two different streams. All prey items were preserved and identified to the genus level (if possible). Bray-Curtis dissimilarity was used to assess the composition of prey item in fish from the two streams. A total of 176 different prey items from 17 fish (37-69 mm), covering 10 orders were extracted from Redfin Darters sampled in Bakers Creek. Diptera was the most abundant (59.1%) order for diets from Bakers Creek. Dipterans from the family Chironomidae and sub-family Tanypodinae comprised (47.2%) majority of diet items from Bakers Creek. In Shoal Creek, a total of 187 different prey items from 18 fish (32-67 mm), covering 10 orders were extracted from Redfin Darters sampled. Diptera was the most abundant (63.6%) order for diets from Shoal Creek. Dipterans from the family Chironomidae and sub-family Tanypodinae comprised (47.6%) majority of diet items from Bakers Creek. The composition of prey items from the two streams were relatively similar (Bray-Curtis distance = 0.125). Diets from both streams were comprised mostly of chironomids, suggesting that this prey item is an important part of Redfin Darter diets. This research is will aid in the understanding of darter diets. Future research will assess the seasonality of diets in Redfin Darters.

[†]Longitudinal Assessment of Fish Communities of Moro Creek, Arkansas.

Andrew Julian* (Arkansas Tech University), Dr. Kyler Hecke (ATU)

Longitudinal differences in fish communities are due various factors that shape the functional diversity for an aquatic system. However, these longitudinal relationships are seldom assessed in freshwater streams. Moro Creek, a tributary of the Ouachita River in Arkansas, is one system that has been understudied in the last ~50 years. New research is needed on this system to fully understand the variation in species occurrences throughout this watershed. We assessed the spatial relationships of fish communities on longitudinal scale in Moro Creek. Eleven sites were sampled on a longitudinal scale (4 upper reach, 4 middle reach, 3 lower reach) in the watershed. A depletion sampling approach was employed to increase detection of species. Species abundance was estimated at each of the sites. We used non-metric multidimensional scaling models (NMDS) to assess how species compositions varied across a longitudinal gradient. The three most abundant species at upper reach sites were Western Mosquitofish (250), Banded Pygmy Sunfish (87), and Flier (51). At middle reach sites, the three most abundant species were Western Mosquitofish (92), Blackspotted Topminnow (55), and Ribbon Shiner (42). At lower reach sites, the three most abundant species were Ribbon Shiner (114), Western Mosquitofish (61), and Bluegill (34). NMDS suggests that fish communities exhibit similarities relative to their position within a watershed and could be related to associated environmental and habitat parameters. This research is important for the management of fish communities in south-central plain streams. Future research should consider longitudinal relationship of fish communities on a temporal scale.

U.S. inland creel programs: a review and management recommendations

Anna L. Kaz* (Louisiana State University), Stephen R. Midway (Louisiana State University)

In United States inland waters recreational anglers, rather than commercial fishers, account for the primary fishing pressure. As such, the recreational sector can be a substantial driver of fish mortality, making well-informed management imperative for the sustained viability of fish populations and the fisheries they support. Creel surveys are often the only system in place for monitoring fish mortality in inland waters, because population and stock assessments are not routinely done. Thus, creel surveys are vital for informing fishery management decisions with necessary ecological and human dimension data. Here, we use the novel CreelCat dataset, comprised of state creel surveys from over 45 participating states and territories, to characterize U.S. recreational angling at the national level. Specifically, we 1) provide a summary and scope of U.S. inland creel programs in CreelCat, 2) compare current and recommended creel programs and protocols, and 3) highlight successful creel programs and offer management suggestions along a tiered approach of input resources and output data quality. In reviewing creel data from 45 states, access and roving type surveys were the most used creel designs, and lentic habitats were the most common waterbodies creeled. Most surveys recorded catch and effort metrics, with fewer surveys recording demographic and biological information. We found regional differences in spaciotemporal data coverage, with the Midwest being particularly data-rich across time and space.

Assessing the ecological impacts of remnant hydrological modifications on the integrity of barrier island freshwater habitats

Raymond P. Kidder II* (Georgia Southern University), Dr. J. Checo Colon-Gaud (Georgia Southern Biology Department), Dr. Rachel Guy (Sapelo Island National Estuarine Research Reserve)

Estuaries and their barrier islands are crucial nursery habitats for a variety of coastal fisheries including gamefish, oysters, and shrimp. These habitats are currently at risk due to the compounding effects of climate change, sea level rise, and hydrological modification. Sapelo Island, Georgia, like most southeastern barrier islands, has a lengthy history of human habitation. Plantation-based agriculture and associated industry led to the construction of a network of ditches and canals on Sapelo in the early 1800's. Though most of the island has been left to return to its natural state, questions remain regarding the impacts of these historical hydrological modifications on the ecological integrity of the island's interior freshwater aquatic habitats. To better understand the effects of these modifications on the hydrology of Sapelo Island, we have deployed a network of four water parameter monitoring stations along Oakdale Creek, the island's longest artificial channel. This network will allow us to quantify the magnitude and frequency of intrusion events that reach the island's interior. We are assessing the impacts of these intrusion events on biotic integrity by quantifying detrital decomposition, a fundamental ecological function, using a standard leaf pack methodology. Preliminary findings showed the presence of a strong salinity gradient in the study reach with salinities ranging from 0.25 to 30 ppt. Additionally, salinity was positively related to both macroinvertebrate biomass and detrital processing rates. Updated findings will be presented including hydrological data and updated values for detrital processing rates and macroinvertebrate community descriptions.

The Distribution of Per- and Polyfluoroalkyl Substances in Northern Snakehead of the Potomac River: Implications for Potential Consumption Limits

Tabitha King* (George Mason University), T. Reid Nelson (George Mason University), Tom Huff (George Mason University)

With the US Environmental Protection Agency's recent reduction of PFAS lifetime health advisory limits to humans, it is increasingly important to understand potential PFAS exposure pathways. As of 2022, only one Potomac River tributary has been evaluated for PFAS consumption advisories in surface water and game fishes. Swimming and species-specific consumption advisories were created for the tributary. A popular game fish excluded from the study was Northern Snakehead (*Channa argus*). The present study's objective is to gather preliminary data on five Virginia Potomac River tributaries' PFAS concentrations in surface water and Northern Snakehead. Out of the 26 PFAS assessed, 18 were detected in surface water using triple quadrupole liquid chromatograph mass spectrometry. Surface water from Powells, Neabsco, Dogue, Little Hunting, and Pohick Creeks each had total PFAS concentrations of at least 54.3 parts per trillion. The concentrations of PFOA and PFOS in surface water from all five tributaries exceeded the USEPA's lifetime health advisory limits. The bioaccumulation potential and tissue distribution of PFAS in Northern Snakehead will be determined next. The bioaccumulative nature of PFAS, combined with the substantial biomass consumed by Northern Snakehead, has led to the expectation that fish consumption advisories will be needed.

Benthic tray sampling and electrofishing capture different changes in nekton assemblages as restored reef complexity changes

Sean Kinney* (Louisiana Department of Wildlife and Fisheries), Melanie Bates (School of Renewable Natural Resources, Louisiana State University Agricultural Center), Steve Midway (Department of Oceanography and Coastal Sciences, Louisiana State University), Megan La Peyre (U.S. Geological Survey, Louisiana Fish and Wildlife Cooperative Research Unit, School of Renewable Natural Resources, Louisiana State University Agricultural Center)

Different sampling gears have different selectivity that may result in varying metrics of species abundances, assemblages and diversity. Benthic habitat tray sampling and electrofishing are both commonly used to sample nekton communities in shallow water environments but have not typically been compared due to historic limitations of electrofishing in saline conditions. Oyster reefs provide hard to sample, complex habitat supporting both reef resident and reef-associated nekton, providing an opportunity to investigate selectivity of two different gear types. Using a Calcasieu Lake, Louisiana reef restoration project built over a five-year period, density of recruiting organisms was quantified as a proxy for habitat complexity, while nekton were sampled using benthic habitat trays and electrofishing. The varying ages of the reef sections provide the opportunity for a space-for-time study to examine how nekton use correlates to reef development. We hypothesized that as reefs age, they become more structurally complex, and support increasing diversity and abundance of nekton. Annual winter sampling of encrusting organisms from 2017 to 2022 indicate that older reefs support greater density of encrusting organisms, resulting in a more complex habitat structure. Spring and summer 2022 nekton sampling by tray and electrofishing resulted in similar species richness, but species assemblages differed by reef age and sample gear. Understanding how reef complexity influences nekton assemblages and how sampling gear might affect species assemblage and diversity data informs managers interested in designing better restoration projects. In addition, this project will provide information on how gear choice may impact restoration monitoring outcome data.

Application of the Microrefugia Concept to explain disjunct and peripheral mussel and fish populations near endemic-rich Edwards Plateau (central Texas)

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

Aquatic organisms generally inhabit geographic ranges that encompass favorable environmental conditions (e.g., water quality, habitat preferences) that support their life history. However, shifts in range and habitats can occur over glacial-interglacial timescales, thereby isolating a population in environments very different than most of the population. Often referred to as disjunct or peripheral populations, conservation value of disjunct or peripheral populations is debated and persisting disjunct or peripheral populations can confuse habitats needs, especially for imperiled species. In this study, we quantified contemporary mussel and fish communities of a prairie stream system (Elm Creek drainage in north-central Texas with turbid and saline surface waters) with a population of a mussel species found elsewhere only in the adjacent Edwards Plateau with clear and fresh surface waters, described the likely historical climate and hydrogeology of the prairie stream system, and argue that the mussel species persistence in the prairie stream system is consistent with the Microrefugia Concept rather than a more recent dispersion event. The intent of this case study is not to conclusively identify origin of the one mussel in a prairie stream system but to establish that the Microrefugia Concept is a viable explanation

for understanding disjunct and peripheral populations of several rare and imperiled species within the Edwards Plateau, an area with high amounts of endemic aquatic organisms.

Removal of Northern Snakehead from Conowingo Dam Fish Lifts in Upper Chesapeake Bay

Joseph Love* (Maryland Department of Natural Resources)

Aquatic invasive species present diverse challenges as fishery managers seek to prevent expansion of established populations and mitigate negative impacts. Unfortunately, invasive Northern Snakehead (*Channa argus*) increased its range between 2010 and 2020 and established populations from the lower to the upper Chesapeake Bay watershed. Expansion slowed at the head of Chesapeake Bay because of Conowingo Dam in Susquehanna River, which drains New York, Pennsylvania, and Maryland. Fish lifts of the dam operate between April and June to facilitate upstream passage of anadromous fishes; in 2017, they also began passing Northern Snakehead. To reduce upstream spread of snakeheads and enable passage of anadromous fishes, a partnership was established among Exelon Corporation, J.J. McDonnell and Company, U.S. Fish and Wildlife Service, and Maryland Department of Natural Resources to remove snakeheads from the fish lifts. Since 2020, 1,827 Northern Snakeheads (466 mm - 771 mm Total Length) were removed and were either dissected (N = 158) or processed by J.J. McDonnell for food pantries. The majority of dissected snakeheads were females (59%) with between 26,397 ova and 213,180 ova, depending on female size. Work is on-going to measure ova diameters and determine if multiple sizes of ova exist within a single ovary. Few of these individuals had discernable gut contents, though six had eaten American Eel (*Anguilla rostrata*). Removing female snakeheads during their upstream spawning migration focuses control efforts during a period of heightened vulnerability and helps reduce spawning stock in the fight to prevent expansion and negative impacts.

"Home is where you make it" Exploring genetic variation in populations of the red claw crayfish (*Cherax quadricarinatus*) introduced to the island of Puerto Rico

Nicholas A. Macias* (Georgia Southern University), Dr. Checo Colon-Gaud (Georgia Southern University), Dr. J. Scott Harrison (Georgia Southern Univ0.ersity)

Crayfish introductions have been widely recognized as a threat to native diversity and ecosystem function. Introduction events involve a few founding individuals which could limit genetic diversity and establishment potential. We present here a case study which documents genetic variation of *Cherax quadricarinatus* (Red Claw) introduced to the island of Puerto Rico. Red Claw were sampled from six reservoirs (Loiza, Cidra, Carite, Guajataca, El Guineo, Dos Bocas) throughout the island, as well as an aquaculture facility (Caribe Fisheries) located in the Southwest. Seven microsatellite loci were used to assess genetic variation between populations. Allelic diversity was observed to be highest in Caribe and lowest in Cidra. AMOVA supported significant variation within total individuals (50%; $p<0.001$). Pairwise Fst was lowest between Cidra and Guajataca (Fst = 0.007), and the number of migrants per generation (Nm) was highest between these two populations (Nm = 36.167). The approaches presented here can be utilized to assess introduction success of Red Claw populations recently documented in southeastern states of the US.

Seasonal movements of a native species, Bowfin (*Amia calva*), and an invasive species, the Northern Snakehead (*Channa argus*) in the Piankatank River, Virginia.

Patrick McGrath* (Virginia Institute of Marine Science), Eric Hilton

Bowfin, *Amia calva*, are a native, carnivorous fish inhabiting freshwater systems throughout eastern North America. Although Bowfin are one of the top predators in these systems, little research has been conducted on its seasonal movements. Northern Snakehead, *Channa argus*, are native to eastern Asia but have been introduced throughout the world, and was first documented in the Piankatank River, Virginia, in 2013. The Northern Snakehead is also a top predator, overlapping the ecological niche of Bowfin. In this study, 14 Bowfin and 8 Northern Snakeheads were acoustically tagged to compare their spatial overlap and seasonal movements. In the winter, both species inhabited the same deep (3-4 m) portion of the river. In March, almost every bowfin moved upstream 9.5-25.8 km, presumably to spawn. The movement upstream correlated with a rain event that significantly increased water levels allowing access above beaver dams and other obstructions. Northern Snakeheads during this time did not have a directed upstream movement, instead moved rapidly upstream and downstream 0-6.5 km. During April and May, 7 tagged bowfin returned to the original tagging area. The other half remained upstream during the summer, likely confined in sections of the river due to low water levels restricting movements. This past fall an additional 4 Northern Snakeheads and 1 Bowfin were tagged, as well as 5 more receivers put in service to increase coverage of upstream habitat. The results of this study will contribute to the understanding of how native and invasive species that occupy similar niches interact spatially.

[t]Rare and Endangered Species Habitat Modeling in the Upper Little Tennessee River Basin

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The Southeastern United States is known for rich levels of aquatic diversity, especially within its fish and mussel species. Decreases in diversity have been associated with the degradation and fragmentation of aquatic habitats essential to these diverse communities of aquatic organisms. Quantification and characterization of habitat use of imperiled fish and mussels are vital to fully understanding these species, with the hopes of preserving and possibly reintroducing them into their historic range where suitable habitat possibly still exists. Throughout this study, we identified, assessed, and compiled habitat availability in sites across the Little Tennessee River Basin upstream of Fontana Reservoir. We used geospatial and multivariate statistical analyses to develop habitat models for species of greatest conservation need to identify potential reintroduction sites. These models have been developed for several fish species such as Stonecat (*Noturus flavus*), Spotfin Chub (*Erimonax monachus*), and the undescribed Sicklefin Redhorse (*Moxostoma* sp.). Mussels of interest include the Tennessee Clubshell (*Pleurobema oviforme*), Appalachian Elktoe (*Alasmidonta raveneliana*), and Slippershell (*Alasmidonta viridis*). Analysis of Similarity resulted in significant differences between mainstem sites above and below impoundments and tributary sites. The SIMPER function identified sand, silt, and woody debris percentages as being influential to differences among sites. These characteristics could prove to be limiting habitat factors for translocating some species. This information can be used by management organizations to further support the conservation needs of these species.

[†]Conservation and taxonomic assessment of an undescribed crayfish species complex in coastal Virginia.

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Creaserinus fodiens (Cottle 1863), commonly known as the digger crayfish, is a primary burrowing species that inhabits complex burrows in wetlands, seasonal pools, wooded floodplains, and roadside ditches. Historically*, C. fodiens* has been found from Ontario, Canada following the United States down to Texas and across four Atlantic slope states including Virginia, Maryland, North Carolina, and South Carolina. The Atlantic slope clades are geographically isolated from other *C. fodiens* populations by the continental shelf on the East coast, the Blue Ridge Mountains, and the Appalachian mountain range. Despite having a large geographical range, little research has been done on the Atlantic slope clades of *Creaserinus* spp. Recent genetic sequencing from the mitochondrial COI, 12s, and nuclear 28s genes have suggested that the Virginia population of *C. fodiens* could be described as multiple different species, suggesting a species complex. Additional morphological and genetic data from gill samples will lead to a better understanding of where the separation in classification lies among the Virginia population. A conservation and taxonomic assessment will contribute to our understanding of global crayfish biodiversity and provide important biological insight to the management and conservation of these species.

A New Open Textbook for Nonmajors: Fish, Fishing, and Conservation

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Few opportunities exist for college students who are not fisheries majors to learn about fish, and issues surrounding fishing and conservation. Fish, Fishing, and Conservation (forthcoming 2023) was written for a broad audience of undergraduate students. All fifteen chapters were developed after consultation and review by experts and students to ensure that material is current and presented in ways that are compatible with student learning preferences. This book will be released in multiple formats with a Creative Commons (CC BY) copyright license that permits no-cost access, re-use, re-purposing, adaptation, and redistribution by others. Consequently, this information is readily accessible to teach undergraduate students and flexible for use by other instructors.

The book places substantial attention on overfishing and loss of biodiversity as pressing problems facing society. The book examines solutions implemented in for a variety of cases. People, places, and approaches to fishing are as varied as the diverse fish fauna that exists on the planet. Therefore, responsible fisheries practices should recognize the rights of all people to decide how to manage and conserve fish, their habitats, and how they are utilized. Incorporating findings from studies of fish conservation and management along with approaches to ethical reasoning aids students who will play key roles in resolving future issues of fish conservation and welfare. The book examines the roles of gender, conservation organizations, recreational fishing, and fisheries governance and highlights

modern principles of conservation and management as they play out in fish controversies around the globe.

The project was funded in part by VIVA (Virginia's academic library consortium). It is developed in collaboration with the University Libraries at Virginia Tech's Open Education Initiative, and Virginia Tech Publishing.

Molecular identification of freshwater mussel glochidia from naturally parasitized fish in a small stream community

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North America hosts the largest number of freshwater mussel species globally, with the majority currently listed as endangered, threatened, or under special concern. Many mussel species utilize fish hosts to complete juvenile metamorphosis, making them especially vulnerable to environmental perturbations like fish invasions or host declines. Host identification mostly occurs in a laboratory setting, and few studies have focused on fish host use in the wild. This seeks to investigate wild fish community host usage in a small South Carolina stream. Fish were collected bi-weekly from January through May 2022. The gills and fins from ~900 total fish of 14 species were inspected for glochidia under a microscope, and the pooled glochidia per individual fish were then subjected to DNA metabarcoding. Both the COI and ND1 genes were targeted with primers designed to amplify across Unionidae and Margaritiferidae mussel species. After high-throughput Illumina sequencing, sequence reads were filtered, clustered by similarity, and assigned taxonomy based on a database derived from NCBI GenBank. Using metabarcoding results, we will be investigating species richness, host specificity, and quantifying total host usage. Finally, we will quantify the phenology of host usage using environmental variables. Results from this study will help to understand the relative importance of various fish hosts for mussel populations in small tributaries and streams.

[†]Spatiotemporal variability in abundance and biomass of Mississippi River floodplain associated fish species

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Anthropogenic modifications such as levee construction and flood control structures have decoupled the floodplain from the Mississippi River and disrupted the biogeochemical cycles and trophic stability of this biologically, economically, and culturally significant habitat. Many of Louisiana's emblematic fish species rely on the timing, magnitude, and duration of the Mississippi River flood pulse to trigger key aspects of their life history. To further the conservation and management of native Louisiana fishes, a multidisciplinary and interagency approach to restoring and monitoring floodplain connectivity to the

Mississippi River is underway. The Richard K. Yancey Wildlife Management Area is 70,872 acres of floodplain habitat near the confluence of the Red River and Mississippi River. 700 acres are proposed for weir and culvert repair to retain proper water depth and improve water quality for native Louisiana fish species, with particular focus upon gars (Lepisosteidae). Our project will capitalize on the integration of high-resolution imaging sonar technology (Adaptive Resolution Imaging Sonar, ARIS 3000) which provides a non-intrusive means of recording high-quality data of nekton abundance, size, and behavior irrespective of light level or turbidity. Since summer 2021, we conducted acoustic monitoring of floodplain fish species across seasons at four sites across a latitudinal gradient of decreasing hydrologic connectivity. Our acoustic monitoring reveals the dynamic nature of the fish community and highlights an unsuspected degree of both temporal and spatial variability in abundance, biomass, and size class distribution driven by the degree of floodplain inundation. Shifts in abundance of small-bodied fish (e.g., gizzard shad, *Dorosoma cepedianum*) through time were observed, supporting the function of an inundated floodplain as an important foraging opportunity for large piscivorous fish species. Observed fluctuations in native alligator gar (*Atractosteus spatula*), longnose gar (*Lepisosteus osseus*), shortnose gar (*L. platostomus*), and spotted gar (*L. oculatus*) abundance, biomass, and size-class distribution supports the link between inundation level and available nursery habitat. We also observed invasive carp species (Cyprinidae) within the system. Our ongoing acoustic monitoring effort will continue to provide useful information on the complex interactions between floodplain associated fishes and how they utilize their habitat in relation to the inundation level and restoration effort.

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 drainage in Missouri, are currently under threat of extinction due to invasion of the woodland crayfish (*F. hylas*) from nearby drainages. Sampling of selected streams in 2008 documented reduced abundances and range reductions for both native species in reaches invaded by *F. hylas. F. quadruncus* and *F. peruncus* are in the final stages of federal listing for protection by the USFWS. However, the entire native range of the endemic crayfishes has 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 these two threatened species. We used stratified random sampling to select 96 sites across the USFR basin for a distributional survey and sampled crayfish at 71 sites in 2022. Our analyses will incorporate presence-absence data from sites sampled in 2022 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. In summer 2023, we will sample the 25 remaining sites to complete the distributional survey and conduct intensive targeted sampling to determine the leading edges of *F. hylas* invasions. Results from this study could be used to identify refugia for native species and locate barriers to further invasion.

[†]Whole genome sequencing of century-old Philippine reef fishes

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The genomes of organisms stored in museums hold a wealth of information that is challenging to access. Recent success has been reported in sequencing desiccated museum insects involved using whole genome amplification (WGA) and enzymatic repair (NEBNext FFPE Repair Mix) of DNA damage, but these techniques have not been tested on historical EtOH preserved fishes. Here, we use factorial treatment combinations to test for the effects of WGA, repair, and amount of starting DNA on whole genome sequencing of historical (1907 - 1909) and contemporary (2017) Philippine marine fishes. A total of 192 extractions were performed, 165 (76 +WGA, 89 -WGA) of which were put through each treatment combination before library prep. Contrary to expectation, WGA had a negative effect on success of libraries and repair had no consistent effect at all. A greater percentage of historical libraries treated with WGA failed than those that weren't (48% +WGA, 32% -WGA). Within the +WGA treatment group there was a much lower yield of DNA in the historical specimens compared to the contemporary. For the contemporary samples, there was a positive relationship between DNA yield and starting amount of DNA, however this was not the case in historical samples. In total we successfully sequenced 136 libraries (61 +WGA, 75 -WGA; Illumina). The success of these methods means that these museum specimens can be used to test for the effects of human activities on the evolution of fishes.

Conservation Assessment and Genetic Haplotype Mapping of the Greenbrier Cave Crayfish (*Cambarus nerterius*)

Addie Shanor* (West Liberty University), Dr. Zachary Loughman (West Liberty University), Dr. Nicole Garrison (West Liberty University)

Cambarus (*Punticambarus nerterius*), the Greenbrier cave crayfish, is West Virginia's only troglobitic crayfish. It is endemic to the Greenbrier Karst System within the Greenbrier River drainage. At its description in 1964, Horton Hobbs recorded that it inhabited only 11 caves, all but one being in Greenbrier County, West Virginia. There have been unconfirmed reports of cave-dwelling crayfish within other caves in the karst system by both cavers and biologists, although these have not all been confirmed to be *C. nerterius* as it is difficult to diagnose. Because of the stygiobitic nature of *C. nerterius*, little is known about its ecology, and it faces a unique set of threats. Surface runoff transporting contaminants and hazardous materials, agricultural waste due to livestock's use of caves as heat refuge, commercial surface activities, and invasive species are some of the most pressing threats. The last formal survey of *C. nerterius* occurred in the summers of 1988 and 1989. Since that time, zero dedicated effort has occurred for this West Virginia endemic. In this project, we will conduct a comprehensive year long life history study, confirm the presence of *C. nerterius* in caves known to or speculated to contain *C. nerterius* in the Greenbrier Karst System, and complete a genetic study to determine the interconnectedness of populations of *C. nerterius*.

Identification of host fish species parasitized by freshwater mussels of Florida

Kallie Thornhill* (Florida Fish & Wildlife Conservation Commission- FWRI), Susan Geda (FWC), and Lauren Patterson (FWC)

Nearly all freshwater mussels within the family Unionidae have a unique life cycle requiring a host fish to complete development from a larval mussel (glochidia) to a juvenile mussel. A vital component to understanding and managing mussel populations is knowledge of their host fish requirements and reproductive timing. In Florida, there are currently 61 described species, of which nine are federally endangered, seven are federally threatened, and 13 are designated by the state fisheries agency as species of greatest conservation need. Of the 61 species, host fish requirements are unknown for 26 species. We received Federal Section 6 funds to evaluate potential host fish for 10 species of freshwater mussel: one federally endangered species (*Obovaria choctawensis*, Choctaw Bean), one federally threatened species (*Elliptio chipolaensis*, Chipola Slabshell), and eight species petitioned for federal listing (*E. ahenea*, Southern Lance; *E. arctata*, Delicate Spike; *E. fraterna*, Brother Spike; *E. monroensis*, St. Johns Elephantear; *E. purpurella*, Inflated Spike; *Strophitus radiatus*, Rayed Creekshell; *S. williamsi*, Flatwoods Creekshell; *Utterbackiana heardi*, Apalachicola Floater). To achieve our goals, we spent the last three years renovating and expanding an aquaculture setup, collecting suitable host fish and mussel broodstock, inoculating the fish with viable glochidia, and subsequently monitoring to confirm any host fish species for our target mussels. This research has increased the life history knowledge of imperiled mussel species and will help make decisions on petitioned species listings and recovery plans.

[†]Do electrofishing catch rates of Alabama Bass and Largemouth Bass differ between day and night?

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Illegal introductions of Alabama Bass into reservoirs along Atlantic Slope drainages has increased in recent years. Monitoring approaches are needed to detect Alabama Bass in recently invaded reservoirs and continued monitoring in reservoirs with established populations. However, recent observations by SCDNR biologists suggest that daytime boat electrofishing failed to detect Alabama Bass for several years after initial detection in Lake Wylie by anglers. In other reservoir systems, Alabama Bass comprise the majority of black bass in creel surveys despite continued low catches in daytime boat electrofishing surveys. Our study aimed to determine if boat electrofishing catches of Alabama Bass and native Largemouth Bass differed between day and night periods on Lake Hartwell, South Carolina. We randomly selected 8 coves along the Seneca River arm of Lake Hartwell, stratified by habitat type (coves with and without installed habitats), and randomly assigned each cove to be sampled during day or night. In each cove, we conducted four 15-minute boat electrofishing transects during fall 2021 and spring 2022. We used a mixed effect generalized linear model to test for species, time of day (day or night), and season (spring or fall) effects on catches. Catches of both species were greater at night, but the effect of time of day differed seasonally, with the greatest differences between day and night occurring during fall. Size structure of Alabama Bass also increased during night. This work highlights important elements of study design to consider in monitoring Alabama Bass populations.

Using DNA Metabarcoding to Characterize the Rufa Red Knot's (*Calidris canutus rufa*) diet at Grand Isle and the Chandeleur Islands

Wyatt Voelker* (Nicholls State University), Dr. Justine Whitaker (Nicholls State University)

In January 2021 at the Chandeleur Islands in Louisiana, we observed a Rufa Red Knot (*Calidris canutus rufa*), which has been considered a molluscivore, catch and eat a fish. The Rufa Red Knot is a shorebird with one of the longest migrations in the animal kingdom and adequate prey abundance along their migration paths is necessary for success and survival. In the early 2000s, overfishing of prey species led to Rufa Red Knot population decline leading to their listing as federally threatened in the United States and endangered in Canada. The purpose of this study was to characterize the diet of the Rufa Red Knot and compare the diets between locations. Rufa Red Knot fecal samples were collected from Grand Isle and the Chandeleur Islands. DNA was extracted, amplified, and sequenced from the scat to identify invertebrate and fish prey in separate reactions. DNA was amplified with MiFish and 18S primers, and sequenced on the Illumina® platform and assigned to the phyletic group or as close to species as possible using the BLASTn database. Having a better understanding of the Rufa Red Knot's diet gives baseline data for further research and allows management decisions to be focused on conserving benthic and fish communities for Rufa Red Knots at their various stopover and winter sites, thereby allowing a higher probability of Rufa Red Knot migration success and survival.

Juvenile Gulf Sturgeon Dynamics in the Pensacola Bay Watershed

Bradford Warland* (Florida Fish and Wildlife Conservation Commission), Kirsten Humphries, John Knight

Juvenile Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) movements and estuarine habitat use in the Yellow and Escambia rivers are currently being monitored in an ongoing 4-year project that commenced in 2020. Juvenile Gulf Sturgeon (Ages 1-5) were tagged with Vemco V7 or V9 acoustic transmitters during the spring, summer, and fall and monitored by acoustic receivers (n=~70) in the Pensacola Bay watershed. Coordinated outmigration, estuarine, and immigration movements were observed in both rivers correlated with several different environmental factors. Individuals age-1 to age-3 demonstrated high fidelity to river mouths while the age-4 and age-5 individuals traveled further into the marine system. Understanding habitat use of juvenile Gulf Sturgeon is crucial in aiding future conservation efforts for the recovery of the species.

[†]Reproductive Periodicity in a Threatened Freshwater Mussel: *Pleurobema ridellii*

Alexander Zalmat* (Texas State University), Timmothy Bonner PhD (Texas State University)

Reproductive life history data is important for understanding ecological and evolutionary dynamics, and holds implications for conservation and management strategies of imperiled species. These kinds of data are relatively lacking for freshwater mussels (Unionidae) in general, and are especially important for the management of threatened mussel species in Texas, where several threatened species are pending review for listing as endangered species. In this study, we aim to estimate the reproductive life history of two Unionid mussel species; *Pleurobema riddellii* (Louisiana pigtoe), and *Cyclonaias pustulosa* (pimpleback), in an east Texas canal system in order to address this lack of data. *P. ridellii* is an imperiled mussel species occurring in several east Texas drainages. *C. pustulosa* is a common species found throughout east Texas. Throughout the 2022 year, we collected monthly gonadal fluid samples and gill brood samples from 30 mussels of each species using a non-lethal syringe technique. Mussels were then

measured for length, and then placed back in the substrate from which they were sampled. The reproductive samples were preserved in 10% formalin and then brought back to the lab for quantification and estimation of the timing of gametogenesis and brood production. Preliminary results suggest that female gametogenesis ramps up in the spring and summer months, and then declines into the fall and winter. Brooding appears to lag slightly behind female gametogenesis. The male data suggests that spermatogenesis occurs nearly year-round. The study is ongoing, and the data being produced will help to inform management and conservation decisions in these systems.