Georgia Chapter of the American Fisheries Society

2018 Annual Meeting

January 23 – 25, 2018
Unicoi State Park and Lodge
Helen, GA

2017 GA-AFS Annual Meeting Program

Tuesday, January 23, 2018

10:00 - 12:00	Registration	
12:30 -12:40	Welcome/Opening Comments	Peter Sakaris
12:40 - 1:00	State of the State (Freshwater)	Matt Thomas
1:00 - 1:20	State of the State (Marine)	Patrick Geer
1:20 – 1:25	Session 1: Student Presentations	
1:25 – 1:40	Importance-Satisfaction Perceptions of Georgia Trout Anglers	Hailey Yondo
1:40 – 1:55	Economic Value of Recreational Fishing on Walter F. George Reservoir (aka Lake Eufaula), Alabama and Georgia	Jeremy Plauger
1:55 – 2:10	Monitoring the Dispersal, Behavior, and Fate of Stocked Rainbow Trout *Oncorhynchus mykiss* in an Alabama Tailwater	Sarah Walsh
2:10 – 2:25	**BREAK**	
2:25 – 2:30	Session 1: (continued)	
2:30 – 2:45	Investigating Potential Cyanotoxin Exposure in Georgia Fishes	Alex Pelletier
2:45 – 3:00	Nitrate Acute Toxicity and Effects on Metamorphosis in Freshwater Mussels	Adrian Parr Moore
3:00 - 3:15	Assessing the Toxicity of a Novel Cyanobacteria on Native Macrophytes and Through a Trophic Transfer Study via Water Snakes	Melissa Martin
3:15 – 3:30	Genetic Investigations of Novel Toxic Epiphytic Cyanobacteria	Mandy Howard
3:30 – 3:45	Environmental Estrogenicity of Water and Sediment within an Agricultural Watershed: Relationship with the Incidence of Testicular Oocytes	Matthew Urich
3:45 – 4:00	**BREAK**	
4:00 - 4:05	Session 1: (continued)	
4:05 - 4:20	Bioassessments Techniques for Benthic Macroinvertebrate in the Savannah and Ogeechee River	Kelsey Laymon
4:20 – 4:35	Spatial Ecology of Shoal Bass in Two Chattahoochee River Tributaries	Amy Cottrell
4:35 – 4:50	How Consistent are Coastal Plain Stream-fish Assemblages Over Time?	Rebecca Scott
4:50 – 5:05	Analysis of Creek Chub Life History Strategies in High- and Low-impact Urban Streams	Ashley Fredricks
5:15 – 6:15	**BUSINESS MEETING**	
7:30 – 11:00	**POSTER SESSION AND SOCIAL**	

Tuesday, January 23, 2018	
Poster Session	
--Professional--	
Validation of Estimated Sicklefin Redhorse Growth from Pectoral Fin Rays Using Observed Growth Rates from Recaptured Individuals	Johnathan Davis
--Student--	
Biomonitoring of Ogeechee River Invertebrate Assemblages: Patterns of Community Structure	Julien Buchbinder
Effect of Septic Systems on Nitrogen and Phosphorus Loading in Chatuge Reservoir	Caroline Cox
Comparison of Spotted Bass Populations Among Three North Georgia Reservoirs	Sarah Gossett
Nesting Microhabitat Use of Bartram's Bass in the Upper Savannah River Basin	Emily Judson
Effect of MS-222 Dosages on Sedation and Recovery Time of Two Non-game Fishes	Elizabeth Lowe
Changes in Trophic Linkages due to Anthropogenic Disturbances in Florida's Coastal Lakes	Steven Nanez
Parasite Diversity of Invasive Blue Catfish, *Ictalurus furcatus*, in the Satilla River	Adriana Perrucci

Wednesday, January 24, 2018		
7:30 – 8:15	**Fellowship of Christian Conservationists**	
8:30 - 8:35	Session 2: Student Presentations	
8:35 – 8:50	Evaluating the VI Alpha Tagging Method for Marking Redbreast Sunfish	Daniel Malcom
8:50 – 9:05	Using Cohort Age Analysis to Understand Spawning Patterns in Atlantic Sturgeon	Adam Fox
9:05 – 9:20	Annual Recruitment and Habitat Use of Juvenile Gulf Sturgeon in the Apalachicola River, FL	Nathaniel Hancock
9:20 – 9:35	Annual Mortality of Atlantic Tripletail in Coastal Georgia and Florida: Implications for Managing the Recreational Fishery	Alexander Cummins
9:35 – 9:50	Techniques to Improve Production of Off-bottom Cultured Oysters	Shannon Kirk
9:50 – 10:05	**BREAK**	
10:05 - 10:10	Session 3: Professional Presentations (Marine)	
10:10 – 10:25	Georgia's Coastal Lagoons: Source or Sink?	Ryan Harrell
10:25 – 10:40	Adult Red Drum and Shark Longline Survey	Donna McDowell
10:40 – 10:55	Georgia's Coastal Telemetry Array and Its Contribution to Cobia Management	Chris Kalinowsky
10:55 - 11:05	Update and Assessment of Georgia's Horseshoe Crab Abundance Index	Lindsey Aubart
11:05 -11:20	South Atlantic Fishery Management Council's Citizen Science Program	Bryan Fluech
11:20 - 1:00	**LUNCH (On Your Own)**	
1:00 - 1:05	Session 4: Recent advances in fish production and Georgia fish stocking programs (Symposia)	
1:05 – 1:20	Georgia's Walleye Program	Anthony Rabern and Clint Peacock
1:20 – 1:35	Aflatoxins in Feed Stored at Bobby N. Setzer State Fish Hatchery	Adam Moticak
1:35 – 1:50	Smallmouth Bass Production in Georgia: The First Steps	Clint Peacock
1:50 – 2:05	Intensive Pond-based Production Systems for Aquaculture	Luke Roy
2:05 – 2:20	Overview of the Georgia Trout Stocking Program	John Lee Thomson
2:20 – 2:35	**BREAK**	
2:35 – 3:30	**Career Panel – Entering and Advancing in the Fisheries Workforce**	

Wednesday, January 24, 2018		
3:30 – 3:35	Session 5: Professional Presentations (Freshwater)	
3:35 – 3:50	40 Years of Black Bass Tournaments in Georgia	Clint Peacock
3:50 - 4:05	The Changing Face of Energy: What Does it Mean for Fisheries in Georgia?	Patrick O'Rouke
4:05 – 4:20	Development of an Interjurisdictional, Rangewide Management Plan for Shoal Bass	Steve Sammons
4:20 - 4:35	Largemouth Bass (*Micropterus salmoides*) Enhancement Stocking in West Point Lake, Georgia	Brent Hess
4:35 – 4:50	Improving aquatic connectivity at White Dam on the Middle Oconee River – A collaborative approach	Jay Shelton
6:00 - 8:00	**BANQUET AND ANNUAL RAFFLE**	
8:00 – 11:00	**SOCIAL IN DOGWOOD ROOM**	

Thursday, January 25, 2018		
9:00 - 9:05	Session 5: continued	
9:05 – 9:20	Adventures in Course-Embedded Undergraduate Research (CUREs): an investigation of a non-native blue catfish population in the Satilla River, Georgia	Peter Sakaris
9:20 – 9:35	Incorporating Fishing and Fisheries Conservation into the Curriculum through STEM Education and Service Project-based Learning	Marion Baker
9:35 – 9:50	Seasonal Food Habits of Introduced Blue Catfish in Lake Oconee, Georgia	Cecil Jennings
9:50 – 10:05	Proposed Standard Weight (Ws) Equation and Standard Length Categories for Shoal Bass *Micropterus cataractae*	Tim Bonvechio
10:05 – 10:20	Conservation Genetics of Roanoke Bass, a Declining Sportfish of Eastern North America	James Roberts
10:20 – 10:35	Genetic Relationships Among Georgia Black Bass	Bryant Bowen
10:35 – 10:45	**CLOSING COMMENTS**	
ADJOURN		

ORAL PRESENTATION ABSTRACTS

Session 1: Student Presentations

Importance-Satisfaction Perceptions of Georgia Trout Anglers

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Fishery managers often rely on imperfect information about angler preferences when designing and implementing management strategies. In response, we gathered data via a 2017 mail survey administered to 4,000 Georgia trout license holders. Recipients were asked to evaluate the importance of multiple salient catch and non-catch attributes as well as their satisfaction with the performance of those same attributes. For instance, the amount of fish caught might be extremely important to some anglers while others may consider proximity to angling opportunities to be more important. Summarized responses are presented through an importance-satisfaction analysis (ISA), which can be used to identify discrepancies between what stakeholders deem important and their satisfaction with the performance of those attributes. To capture variation in trout angler preferences, survey responses were grouped by level of angler specialization, which is commonly used to observe diversity among participants. Angler specialization grouping was conducted using K-means cluster analysis with a three-cluster solution. Segmenting anglers by specialization allows multiple ISAs to be conducted with ANOVAs detecting potential differences among groups. Results of the ANOVAs indicate specialization groups differed in the importance of 10 of the 17 trout fishing attributes. Satisfaction with the performance of the attributes differed between the groups on 5 of the attributes. Average responses for importance and satisfaction were highest for the most specialized group and lowest for the least specialized group, indicating the most specialized group placed more importance on and were more satisfied with the attributes on average. Only 3 of the 17 trout fishing attributes fell in the same ISA quadrant across the three specialization groups. Identifying the heterogeneity in the importance and satisfaction placed on various attributes of trout angling can lead to a better understanding of angler needs and desires, which can be of great use to managers during the decision-making process.

Economic Value of Recreational Fishing on Walter F. George Reservoir (aka Lake Eufaula), Alabama and Georgia

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Completed in 1963, Walter F. George Reservoir (aka Lake Eufaula) is located approximately 137 km between Columbus and Fort Gaines, Georgia. The reservoir supports many sport fisheries and has a national reputation for its Largemouth Bass fishery. Although a very popular reservoir, the annual economic impact from anglers is virtually unknown. An economic creel survey took place January 1 through December 31, 2017 in the area between Walter F. George Dam to the Georgia State Road 39 Bridge, approximately 14375 ha. The reservoir was divided into four sections with 3-5 subsections within each unit. A stratified, non-uniform probability sampling design was used for this survey to select time of day and section of reservoir to sample. A roving creel survey, instantaneous counts, aerial counts of boats, and follow-up telephone surveys were all conducted to meet the goals of this project. Sampling periods consisted of five consecutive days and two periods were conducted each month. Each 5-day period consisted of two weekend days and three weekdays, with three aerial boat counts of the entire reservoir conducted during the period. Anglers contacted on the water were asked standard creel survey questions regarding their experience and catch that day, along with second questions about their expenditures. Other detailed questions were asked based on individual expenses during follow up interviews. These expenditures will be divided into the larger towns and counties where their money was spent (Eufaula and Abbeville, Alabama; Georgetown and Ft. Gaines, Georgia) and other regions from out of town anglers. Data from phone surveys will be combined with those from the roving creel survey, instantaneous counts, and aerial surveys, to estimate the complete economic impacts of angling on Lake Eufaula to surrounding communities and both states.

Monitoring the Dispersal, Behavior, and Fate of Stocked Rainbow Trout Oncorhynchus mykiss in an Alabama Tailwater

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Hypolimnetic discharge from reservoirs in the southern United States provide cold enough water temperatures (< 20^{o} C) to support successful Rainbow Trout fisheries in regions where they otherwise could not exist. These tailwater trout fisheries remain widely popular for recreational anglers and are of major socioeconomic significance. The objective of our research is to describe post-stocking dispersal, behavior, and fate of Rainbow Trout cohorts stocked in the Sipsey Fork tailwater below Lewis Smith Dam in Northern Alabama. In a recent creel survey, only 4 to 23% of the trout stocked each month were harvested indicating that the ultimate fate of the majority of stocked Rainbow Trout is unknown. In spring, summer, and fall 2017, we tagged and manually tracked cohorts of Rainbow Trout to document movement patterns and determine approximate longevity in the fishery. Tagged trout were tracked twice a week for the first four weeks post-stocking, once a week during the next four weeks, and then biweekly for the next two months. We calculated Rainbow Trout dispersal, range, and fate using ArcView. Knowledge regarding the dispersal and fate of stocked Rainbow Trout in this system will allow more efficient management of the fishery, leading to increased recruitment, retention and satisfaction of anglers that utilize this resource.

Investigating Potential Cyanotoxin Exposure in Georgia Fishes

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A toxin produced by the recently-described cyanobacter *Aetokthonos hydrillicola* (Ah) has killed more than 170 Bald Eagles (*Haliaeetus leucocephalus*) and thousands of American Coots (*Fulica americana*) across the southeast since 1998. Waterfowl such as coots are particularly susceptible to Ah toxin because they forage heavily on Hydrilla, the main host plant for Ah. Although many fish species also forage on Hydrilla within Ah-contaminated reservoirs and may therefore be exposed to Ah toxin, the occurrence and effects of Ah toxin on wild fish populations currently remains uninvestigated. Here I present preliminary findings of potential Ah toxin exposure in wild fishes from Clarks Hill Reservoir (CHR) near Augusta, Georgia. Because Ah toxin is known to impair motor coordination, we quantified swimming performance of sunfishes (*Lepomis sp.*) from CHR from two sites containing Ah-contaminated Hydrilla and from two sites containing no Hydrilla. Control swimming trials conducted in early autumn (prior to Ah toxin production) found no differences in swimming performance among the four sites. On the contrary, experimental swimming trials conducted in late autumn (after Ah toxin production) showed that sunfishes from Hydrilla-free sites swam on average twice as quickly as sunfishes from Hydrilla sites. These preliminary findings highlight the need to further investigate the potential effects of Ah toxin in fishes from CHR and other Ah-contaminated reservoirs in Georgia.

Nitrate Acute Toxicity and Effects on Metamorphosis in Freshwater Mussels

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Nutrient pollution, specifically nitrate, has become one of the most prevalent causes of water quality degradation globally, with increasing anthropogenic input from suburban and agricultural runoff, municipal wastewater, and industrial waste. Water quality and contaminants have been identified as major challenges for freshwater mussel populations, many of which are highly imperiled globally. The potential effects of nitrate to freshwater mussels are largely unknown, particularly during the parasitic stage of the complex freshwater mussel lifecycle. Therefore, we investigated the effects of nitrate on freshwater mussel larvae (glochidia) viability, attachment success on host fish, and metamorphosis success to the juvenile stage. First, we exposed Fatmucket (*Lampsilis siliquoidea*) and Wavy-rayed Lampmussel (*Lampsilis fasciola*) glochidia to environmentally relevant nitrate concentrations (0, 11, or 56 mg NO3-N/L) for 24 hours before inoculation on their primary host, largemouth bass (*Micropterus salmoides*). Additionally, we exposed brooding female Fatmucket to a range of nitrate concentrations (0, 11, 56 mg NO3-N/L) for 25 days and monitored the same suite of endpoints to determine the effects of nitrate when glochidia are exposed during brooding in the marsupial gills. These results can be incorporated into a stage-based population model for prediction of the effects of nitrate pollution on freshwater mussel populations. Additionally, we will present 24-hr EC50s for glochidia viability for 4 species of freshwater mussels, including common and imperiled species. This will allow us to compare the sensitivity of more common species to that of imperiled species. Results of these studies are important for improving characterization of the hazards of nitrate pollution to aquatic life and this work will better define the role of water quality in assessing habitat suitability for mussel conservation efforts.

Assessing the Toxicity of a Novel Cyanobacteria on Native Macrophytes and Through a Trophic Transfer Study via Water Snakes

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Vacuolar myelinopathy (VM) is a neurological disease likely caused by an unknown cyanotoxin. The toxin is biosynthesized by the cyanobacterium, *Aetokthonos hydrillicola* (Ah), growing on submerged aquatic plants. VM affected animals develop brain lesions and can exhibit neurological signs of exposure. Most succumb to the disease. Intoxication occurs when a primary consumer ingests the Ah plant material or if ingestion happens via trophic transfer of a secondary consumer. The goals of this study were to: (1) identify, through a trophic transfer feeding trial, additional susceptible taxa affected by VM and (2) analyze the toxicity of native macrophyte material through an invertebrate bioassay.

Two species of water snakes whose range overlaps with VM infected reservoirs/lakes and whose diet consists of animals that are likely to feed on hydrilla were wild-caught for this study. They were then randomly selected to either a control or treatment group and fed, ad libitum, fish for 93 days. All fish were fed, ad libitum, either toxic or non-toxic *H. verticillata*. Three sets of behavior tests including tongue flicking, righting response, and swimming agility were conducted to capture neurological signs of disease. Brain tissues were analyzed. Treated snakes developed vacuoles indicative of VM in the olfactory and spinal cord regions.

For the other aspect of the study, native macrophytes, that have the potential of aggressively spreading throughout various aquatic locations, and non-native macrophytes will be collected. Sampling will take place in a known VM reservoir/lake. A subset of leaves and stems will be randomly selected and screened for Ah colonies. If Ah is found, its density will be quantified. The remaining plant material will be dried and biomass calculated. A solvent extraction process will be conducted on the dried material. Extracted material will be tested on the water flea, *Ceriodaphnia dubia*, to identify its sensitivity to Ah.

Genetic Investigations of Novel Toxic Epiphytic Cyanobacteria

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Aetokthonos hydrillicola gen. et sp. nov. (*Ah*) is a newly described cyanobacterial species implicated in an expanding wildlife disease, vacuolar myelinopathy (VM). This species produces a toxin causing neurological impairment and mortality in avian, fish, amphibian, and reptile species in southeastern reservoirs. Initial genetic analysis of 16S rRNA gene and associated ITS region confirmed that this was a novel genus and species with uncertain family designation in the Nostacales. We initiated entire genome sequencing to inform research on the origin of *Ah* and genes controlling toxin production. Contaminating heterotrophic bacteria of the species *Sphingopyxis*, bound to filaments of *Ah* are interfering with molecular investigations. We are developing new methods to grow an axenic culture and remove contaminants from *Ah* for DNA extraction. qPCR has been utilized to monitor the effectiveness of these culturing and cleaning protocols. Future research will further investigate the DNA of *Ah* and associated epiphytic microbial community. Having an axenic culture will allow for specific gene isolation of *Ah* and facilitate investigations of the co-occurring micro-organisms. The genetic diversity of *Ah* and microbial consortium occurring in reservoirs with VM mortalities will provide valuable inference on the origin of the novel cyanobacteria and its potential for toxin production in expanding geographic invasions.

Environmental Estrogenicity of Water and Sediment within an Agricultural Watershed: Relationship with the Incidence of Testicular Oocytes

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Environmental estrogens threaten habitat quality and the integrity of freshwater fish populations by altering reproductive behavior and physiology such as induction of testicular oocytes. Municipal and industrial wastewater effluents are often the focus of efforts to characterize environmental risk associated with estrogens; however, major contributors of estrogens in many watersheds include runoff from agricultural fields, containing animal wastes applied as fertilizer. Chicken litter, often used to amend soil in pasture and row crop operations, contains high concentrations of estrogens which can run off into aquatic systems during rain events. Exposures to environmental estrogens can be enhanced in riverine systems as these rain events and chicken litter applications often coincide with spawning events and sensitive early life stages of fish, posing risk to reproduction and development. Testicular oocytes can be indicative of exposure to estrogens and may lead to population-level effects. To better understand population risks of agriculture-induced endocrine disruption, we compared seasonal trends in surface water and sediment estrogenicity, determined by an estrogen CALUX reporter gene assay, to the prevalence and severity of gonadal malformations among adult male fish from a gradient of agriculture-intensive sites within the Coosa River System (GA, USA). We discuss geospatial and temporal relationships among land use, environmental estrogenicity, gonadal malformations, and documented population declines among imperiled and sport fish species within an agriculturally-dominated basin.

Bioassessments Techniques for Benthic Macroinvertebrate in the Savannah and Ogeechee River

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Bioassessments are an essential surveillance tool for determining the health of streams and rivers. Benthic macroinvertebrates are commonly used for bioassessment in wadeable streams, however a standardized method for sampling in non-wadeable streams has not been developed for rivers in Georgia. This study was conducted to determine the effectiveness and potential biases of three bioassessment techniques. Mesh bags filled with leaves (leaf packs), Masonite boards (Hester-Dendy samplers), and mesh bags filled with woody debris (snag bags) were deployed during the fall of 2014 at three sites on the Savannah River (N=26) and three sites on the Ogeechee River (N=26). After 30 days, samplers were retrieved and colonizing macroinvertebrate assemblages were assessed for differences in: Richness (EPT Taxa, Diptera
Taxa, Trichoptera taxa), Composition (%EPT, %Trichoptera, %Chironomidae, % Diptera), Tolerance (Hilsenhoff Biotic Index), Functional Feeding Group Structure, Habit, diversity (Shannon Wiener, Simpson) and community structure. Macroinvertebrate assemblages differed significantly in Diptera abundance ($F_{10,34}=4.6248$ $P=0.0004$), Chironomidae abundance ($F_{10,34}=4.7010$ $P=0.0003$) and % burrower ($F_{10,34}=2.2688$ $P=0.0368$). Macroinvertebrate assemblages colonizing the different sampling devices also differed significantly (PERMANOVA, $F_{12,34}=1.6056$ $P=0.002$). SIMPER analysis revealed that the samplers collected similar taxa, but the number of individuals collected from a few taxa differed between sites. There were also no significant differences when the Georgia Multi-Metric Index, a common tool used in wadeable streams, was applied to site specific data suggesting that all three samplers provide efficient means for collecting macroinvertebrates for biomonitoring purposes in larger rivers. However, Hester-Dendy samplers provide a standard sampling surface for the calculation of macroinvertebrate density and biomass and are relatively easier to process than either leaf packs or snag bags. Our study provides a comparative assessment of these three passive sampling devices for the collection of macroinvertebrates in large, non-wadeable river systems in Georgia. Therefore, our results can be used to guide future management practices for the collection of macroinvertebrates for bioassessment in large rivers of the region.

Parasite Diversity of Invasive Blue Catfish, Ictalurus furcatus, in the Satilla River

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The blue catfish, *Ictalurus furcatus*, is primarily native to the Mississippi River drainage and invasive populations of this fish have been found in the Satilla River of Southeastern Georgia since 2011. This occurrence provides an opportunity to compare the parasite communities of nonindigenous populations to those found in their natural habitat. By collecting blue catfish from the Satilla River, surveying their parasites, and comparing them to what they would normally contract in the Mississippi River drainage, the parasite communities of these different locations can be better identified and understood.

Spatial Ecology of Shoal Bass in Two Chattahoochee River Tributaries

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This study aims to analyze the differences in movement patterns and habitat use of Shoal Bass in two Chattahoochee River tributaries, Flat Shoals and Mulberry Creek. These two tributaries hold two of the few remaining viable populations within their native range. Though both in the fall line region, the two study tributaries are geomorphically distinct. 20 individuals were tagged in each creek, and 20 additional males were tagged in Flat Shoals to analyze male nesting behavior. Fish were tracked each week for 18 consecutive months, with the study overlapping two spawning seasons. We are also using side-scan sonar to look at habitat associations and how use/availability changes when compared across seasons and between creeks.

How Consistent Are Coastal Plain Stream-fish Assemblages Over Time?

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We are interested in characterizing the roles played by spatial and temporal environmental variation, acting at various scales (local to landscape), in determining fish assemblage composition in wadeable Atlantic Coastal Plain (ACP) streams. To this point, we have collected fish, habitat, and water-quality data for two summers at ACP streams in the Ogeechee, Altamaha, and Savannah basins of Georgia. After the first summer of data collection, it appeared that multivariate assemblage composition was primarily influenced by local factors (woody debris, pH, depth, and water velocity), and that sites sorted into two distinct groups, characterized either by "fluvial" or "non-fluvial" fish assemblages. Based on these results, we posed the following questions: (1) Does the dichotomy of fluvial and non-fluvial faunal and environmental characteristics persist over time, or is there high inter-annual variability? (2) Are fluvial sites more stable and more similar to each other over time than non-fluvial sites, or vice versa? Based on analyses across years, both the assemblage structure and environmental regimes of these site-groups were highly persistent in time and space, despite significant inter-annual variation in regional discharge patterns. These findings suggest that the structure of ACP fish communities is primarily driven by local physical and chemical habitat conditions, which are in turn strongly controlled by local summer hydrology. Given projected hydrologic changes associated with water abstraction and climate change, these findings have broad implications for fisheries and conservation in the ACP.

Analysis of Creek Chub Life History Strategies in High- and Low-impact Urban Streams

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The creek chub is a highly resilient fish species that commonly occurs at high densities in urban systems; however, limited information exists regarding their life history characteristics. Our goal was to assess the population characteristics of the creek chub from an urban tributary of the Chattahoochee River. In Fall 2014 and Fall 2016, 76 creek chubs were collected from Rottenwood Creek for age and growth analyses. In Fall 2016, we also conducted standardized sampling of the creek chub population along two transects in Rottenwood Creek. Population densities were 2.1 creek chubs per 10 m of habitat along transect 1 and 11.0 creek chubs per 10 m along transect 2. During Fall 2016 sampling, creek chub total lengths ranged from 39 to 129 mm TL, with a strong recruitment class of age-0 fish present in the population. Creek chubs did not exhibit great longevity (max age = 4 years), with an annual survival rate of approximately 43%. Creek chubs grew to mean lengths of 90, 109, and 131 mm at ages 1, 2, and 3, respectively. In Spring 2017, a sample of creek chubs were collected from Rottenwood Creek for age and growth analyses. Fecundity and age at maturity were also examined. In Spring 2017, creek chub total lengths ranged from 33 to 136 mm TL. Ripe ovaries were observed in fish as small as 65 mm TL. Great variation was observed in egg size among individuals with a mean egg diameter ranging from 0.92 to 1.47 mm. A significant relationship was observed between fecundity and creek chub total length. Currently, we are investigating potential growth differences between sexes, and a comparison of fish growth and age structure between the Rottenwood population and a lower density population in Ivy Creek, Georgia.

ORAL PRESENTATION ABSTRACTS

Session 2: Student Presentations

Evaluating the VI Alpha Tagging Method for Marking Redbreast Sunfish

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Forty Redbreast sunfish (*Lepomis auritus*) were collected with a backpack-electrofisher from Nickajack Creek in Cobb County, Georgia on May 26, 2017 and stocked inside a living stream (vivarium). To aid in the prevention of negative fish-on-fish interactions ("bullying"), fish were separated and stocked according to size. The fish were placed into four designated sections (Large, Medium, Small, & Control) and allowed to acclimate for two weeks prior to tagging. Visible Implant alpha-tags were injected into both cheeks of each fish except for those in the control group. Tags were checked twice (~2 week intervals) for retention until completion of the study. Unfortunately, this study was concluded prematurely (<1 month) due to the amount of mortality experienced in the sections. However, at the first tag retention inspection, all living fish retained both tags with the exception of four individuals in the small section, who only rejected one of their tags. Twenty-four days after tagging, fish were experiencing a high rate of mortality with only twenty-seven living fish remaining. At this point, all living fish retained at least one of their tags except for one fish in the small section who rejected both tags. In the fall, this technique for tagging sunfish with VI alpha tags was conducted in two urban creeks within Gwinnett County, Georgia to evaluate the effects of habitat fragmentation on the connectivity of redbreast sunfish and green sunfish populations with the additional objectives of size distribution and abundance comparisons.

Using Cohort Age Analysis to Understand Spawning Patterns in Atlantic Sturgeon

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The Atlantic Sturgeon is an anadromous fish that historically occurred from maritime Canada to northern Florida. The species experienced major population declines during the 20th century, resulting in its listing under the Endangered Species Act in 2012. Although assessment of annual spawning runs is essential to evaluating species recovery, the timing of spawning is still unknown for many populations. Several recent studies suggest that dual spawning runs may occur in at least some rivers, citing individual movements of adults and/or bimodal length distributions of river-resident juveniles within individual river systems. Unfortunately, direct evidence of dual spawning has not been obtained for any adult spawning run, and histogram-based age assignments of river-resident juveniles have not been validated. The primary objective of this study was to determine the length-at-age relationship for river-resident juvenile Atlantic Sturgeon in the Savannah, Ogeechee, and Altamaha Rivers of Georgia. During the summers of 2015-2016, we used variable mesh entanglement gears to capture 1743 juveniles >850mm (TL), and conducted age analysis on a subsample of fin rays from 158 individuals. Although length-frequency histograms of our catch showed a distinct bimodal juvenile distribution, our analysis found that all juveniles <325mm were age-0, while those >325mm were age-1. These findings indicate that only one annual spawning run occurs within Georgia and that similar analyses of juvenile length-at-age are needed to confirm dual spawning in other river populations.

Annual Recruitment and Habitat Use of Juvenile Gulf Sturgeon in the Apalachicola River, FL

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The Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) is currently listed as federally threatened because of chronic overfishing and habitat degradation that occurred throughout the 20th century. Although adult life history of Gulf Sturgeon has been well studied, little information is available regarding juvenile life stages. The objectives of this study were to estimate annual recruitment and to quantify overwinter survival and habitat use of age-1 Gulf Sturgeon in the Apalachicola River, Fl. From 2014 through 2017 we acoustically tagged at least 10 age-1 juveniles during the early spring and summer of each year. Using a passive acoustic receiver array deployed throughout the lower estuary and bay, we monitored seasonal movements and survival of the tagged fish to quantify annual survival and to identify high use habitats of the young fish. Acoustic detections obtained during the annual spring migration from the bay to the river, combined with annual recaptures of tagged juveniles, yielded an overwinter survival of 89% in 2014, 75% in 2015, and 75% in 2016. Annual mark-recapture estimates of juvenile cohorts indicated consistent but low recruitment of 46 (95% CL; 37-70), 54 (95% CL;34-119), 90 (95% CL; 73-118), 210 (95% CL;190-241), and 22(95% CL; 17-27) age-1 juveniles in each respective year. These findings suggest that population recovery is currently limited by slow recruitment to age-1, and not likely a result of poor survival of age-1 juveniles. Further studies are needed to quantify spawning success and to identify other variables affecting juvenile abundance during the first year of life.

Annual Mortality of Atlantic Tripletail in Coastal Georgia and Florida: Implications for Managing the Recreational Fishery

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The Atlantic Tripletail *Lobotes surinamensis* supports a popular recreational fishery along the Atlantic coast of Georgia and Florida; however, effective management of the fishery has been hampered by a lack of current data regarding fisheries impacts on the population. The primary objective of this study was to quantify annual mortality for the Tripletail population inhabiting the Atlantic coast of Georgia and Florida, as an important indicator of the fishery's sustainability. During the summers of 2009 through 2014, 57 Tripletail were captured via hook and line sampling in Ossabaw Sound, Georgia and tagged with acoustic transmitters. The survival and movements of tagged fish were monitored by an acoustic array consisting of 196 stationary receivers deployed throughout the coastal marine waters of Georgia and Florida. Over the 5 years of the study, we collected more than 500,000 valid detections of tagged Tripletail. Using spatial mark-recapture modeling, we estimated the mean annual apparent mortality of these fish at 63.6 % (95% CI ± 38-82%) across all study years. Although estimates of annual mortality in other Tripletail populations are not currently available, the annual mortality from this study was comparable to that of several other nearshore marine sportfishes. Our results, in conjunction with, recent studies of Tripletail reproduction, suggest that only a small percentage of females may survive long enough to reproduce. Additional studies are needed to evaluate potential fishery benefits of increasing minimum size regulations.

Techniques to Improve Production of Off-bottom Cultured Oysters

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Oyster aquaculture has the potential to be a major economic contributor in the Southeastern United States. However, suitable conditions for optimum off-bottom bivalve growth are congruent with many suspension-feeding invertebrates that can attach to gear, increasing the need for research of appropriate biofouling control methods. This project will address the efficacy of aerial drying and fouling-release coatings on the control of biofouling on floating oyster cages (OysterGro™) throughout the southeastern U.S. states. The University of Georgia Marine Extension and Georgia Sea Grant will be leading research in three Atlantic states (NC, SC, GA). Triploid Eastern oyster (*Crassostrea virginica*) seed was provided by the Lady's Island Oyster, Seabrook, SC. Oyster seed 30.9mm were stocked at density of 150/bag and deployed at all locations in mid-October 2017. Fifty percent of cages and culture bags were treated with a water-based silicone release coating (Netminder®) in September 2017 and aerial drying regimes include drying frequencies of weekly, biweekly, and every three weeks. Quarterly sampling will include measurement of shell metrics and photographic analysis of fouling. Meat yield, condition index, shell density, and quantitative analysis of fouling on the oysters will be assessed when oysters reach a shell height of 76 mm. While oysters may reach this endpoint prior to peak fouling season, we will continue the experiment to assess fouling through the summer months.

Session 3: Professional Presentations (Marine)

Georgia's Coastal Lagoons: Source or sink?

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Understanding juvenile fish habitat is a key component for the management of any fish species. Many saltwater species are dependent on coastal habitats as nursery habitats. In Georgia, a habitat potentially used by many larval and juvenile sportfish are saltwater impoundments. These impoundments are numerous along the Georgia coast and often are created by removing fill dirt to raise the elevation of the adjacent land. These impoundments may offer protection from predation as well as serve as a winter thermal refuge. From the fall of 2009 through the spring of 2013, GADNR CRD staff investigated the potential emigration of various marine fishes from 3 coastal Georgia saltwater impoundments. Multiple fish species including tropical/subtropical fishes such as Atlantic Tarpon (*Megalops atlanticus*) and Common Snook (*Centropomus undecimalis*) were marked using half duplex PIT tags. Autonomous PIT tag antenna arrays were placed at or near culvert outflows to determine if and when juvenile fish were emigrating from these protected habitats to join the adult population. Temperature data loggers were deployed to determine if these impoundments could serve as winter thermal refuges for tropical/subtropical species. Sub-adult Spot (*Leiostomus xanthurus*) were the only confirmed species emigrating from the saltwater impoundments. Many Atlantic Tarpon survived a Georgia winter with multiple surviving two. At least one Common Snook survived a Georgia winter. This is the first documented case of either Atlantic Tarpon or Common Snook overwintering in Georgia.

Adult Red Drum and Shark Longline Survey

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Georgia Department of Natural Resources' Coastal Resources Division has conducted a longline project since the fall of 2006. The project was designed to provide more detailed information on the status of the adult red drum population in the south Atlantic. Areas of sampling include inshore, nearshore, and offshore from Doboy to Cumberland Sound. Sampling occurs from May through December targeting twenty five randomly selected stations. To date, over seven thousand sharks and more than seven hundred Red Drum have been sampled. Data from this survey is used to inform the Atlantic States Marine Fisheries Commission Red Drum stock assessment and helps guide the management of Red Drum in Georgia.

Georgia's Coastal Telemetry Array and Its Contribution To Cobia Management

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Established in 2013, Georgia's Coastal Telemetry Array is a series of individual acoustic receivers that continuously listen for coded ultrasonic transmitters attached to or implanted in marine animals. Originally, the array was designed to capture and describe the movements of Atlantic Sturgeon in coastal waters. In its current configuration, there are three series of eight receivers placed off the St. Simons shipping channel. These arrays offer tracking coverage from approximately one to fifteen miles offshore. Data from the receivers are downloaded and shared with cooperating researchers. In addition to displaying the movements of Atlantic Sturgeon the array has proven valuable for capturing the movements of many other species. Because of this ecological benefit the project has received supplemental funding by the Georgia Natural Resources Foundation which has allowed Coastal Resources Division to continue to maintain the large-scale telemetry array. Data from this array has the potential to impact the regional management of a multitude of highly migratory species; one such example is Cobia. Recent changes in Cobia management have resulted in harvest closures for recreational fishermen because the stock was split into two regions and regulated by a landings quota. Questions have arisen over the validity of this two-stock hypothesis. Data from Georgia's coastal receiver array will be used in conjunction with data provided by other researchers in South Carolina and Florida to help determine whether this two-stock approach is the best strategy for the management of Cobia along the US Atlantic Coast.

Update and assessment of Georgia's horseshoe crab abundance index.

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Horseshoe crabs are a unique contributor to the estuarine environment in Georgia and along the entire eastern seaboard. These crabs provide food for migratory birds, bait for fishermen and are collected for the biomedical industry. Currently they are managed by the Atlantic States Marine Fisheries Commission utilizing a stock assessment from 2013 and a new assessment is expected in 2018. Updates to the assessment will include a new index of abundance for each state. This assessment took a regional approach and horseshoe crabs in the Southeast showed an increasing trend. Since 1999, no commercial fishing for horseshoe crabs has occurred in Georgia, therefore indices for Georgia can only be developed from state independent surveys. Georgia's Department of Natural Resources will use data collected onboard the R/V Anna on the Ecological Monitoring Trawl Survey. The survey span covers 36 stations, in six of the major estuaries across the Georgia coast, covering a large spatial distribution of river, sound and offshore fixed stations. Data on horseshoe crabs has been collected from 1999 - 2016 and will provide information to determine an index of abundance using a geometric mean of catch per tow. Conclusions on the overall health of the horseshoe crab population may not be determined, however insight on changes to the Georgia population may appear from the updated index.

South Atlantic Fishery Management Council's Citizen Science Program

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The South Atlantic Fishery Management Council manages federal fisheries along the eastern U.S. from North Carolina to the Florida Keys. Management encompasses a wide range of habitats and species including 70 fish species managed through seven fishery management plans, along with plans addressing habitat, sargassum, and corals. The South Atlantic Council has grappled for years with the challenge of providing timely and robust science to support decision-making despite limited resources and a complex and diverse ecosystem. These data shortcomings and the resulting scientific uncertainties complicate management and often lead to fishermen offering their expertise and vessels to collect samples and record observational data to help "fill the gaps". Recognizing the desire of fishermen to get involved and the data needs for the region, the South Atlantic Council is developing a comprehensive fishery citizen science program. Citizen science can engage multiple fishery stakeholders (fishermen/scientists/managers) in collecting valuable data that can decrease scientific and management uncertainty and help managers make more informed policy decisions. To help build an initial program infrastructure, the Council has established a Citizen Science Advisory Pool and action teams focused on communications, outreach and education; data management, finance, projects and topics management and volunteers. Action teams consist of various stakeholders representing fishermen, state and federal resource management agencies, researchers, Sea Grant agents, and non-for-profit organizations. This presentation will provide an overview of the Council's Citizen Science Program as well as discuss how fishermen, researchers and resource managers can enhance existing data collection, research and monitoring efforts through this new initiative.

Session 4: Recent Advances in Fish Production and Georgia Fish Stocking Programs (Symposia)

Georgia's Walleye Program

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Georgia's walleye hatchery and stocking program dates back to 1960. Due to limited success, the program was discontinued after 1968. With the rapid spread of illegally-stocked blueback herring in many north Georgia reservoirs in the late-1990s, a renewed interest in stocking walleye for predatory control of herring was born and in 2002, the Georgia walleye hatchery and stocking program was resurrected. Through trial and error with stocking rates and fertilization regimes, hatchery success improved over time to the extent most north Georgia reservoirs are now stocked with walleye fingerlings. A growing walleye angler base and a new walleye state record are testimonies of the success of Georgia's walleye stocking program.

Aflatoxins in Feed Stored at Bobby N. Setzer State Fish Hatchery

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Bobby N. Setzer is the largest Trout hatchery operated by the North Carolina Wildlife Resources Commission. Three species of trout produced at the facility amount to 65-75% of total annual trout production within the state. Historic chronic mortality associated with Rainbow Trout production lead to increased antibiotic use, poor utilization of rearing space, inefficient feed usage, and overall loss of fish due to poor fish health. Research was conducted to determine why mortality was only occurring in rainbow trout and what was causing the mortality. Various fish health labs were used to identify presence or absence of bacteria in rainbow trout during high mortality events and to provide recommendation for antibiotic treatment. Treatments were conducted but infections would return within two weeks after treatment and would continue throughout the production cycle. Due to the reoccurring mortality in rainbow trout staff then sent off samples, utilizing brook trout and brown trout as controls, to be analyzed histologically. Results showed major abnormalities in the livers of rainbow trout and high levels of vacuolizations and inclusions in hepatocytes indicating contaminants in our water or fish feed. Staff then researched possible contaminants in feed which led to the possibility of aflatoxicosis. Staff collected samples from feed and other locations and sent off for analysis for presence of aflatoxins and if present at what levels. Results determined the presence of aflatoxins in all sampled feed and areas above trout rearing guidelines. Past research studies indicate that rainbow trout are most susceptible to aflatoxins and levels as low as 0.4 ppb/day in feed can lead to suppressed immune systems. Hatchery staff, with advice from other professionals, came up with plans to clean feed storage areas and equipment on a regular schedule. Also, staff planned to provide a better environment for storage to decrease the possibility of Aspergillus growth. Results have shown a decrease in rainbow trout mortality by 50-60% which is directly correlated with a healthy immune system.

Smallmouth Bass Production in Georgia: The First Steps

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Smallmouth bass (*Micropterus dolomieu*) are a black bass species native to the Tennessee River watershed, which includes parts of extreme northern Georgia. As with other black bass species, they are frequently targeted by recreational anglers. Smallmouth bass in Georgia have had difficulty competing with the introduced spotted bass (*Micropterus punctulatus*). These two factors have presented a need and the public support for smallmouth bass conservation work. Due to the possibility of hybridization between smallmouth bass and spotted bass, any broodfish collected from the wild need to be genetically evaluated. Once wild broodfish arrive at the hatchery and are shown to be genetically pure smallmouth bass, they are held in a concrete raceway where they will eventually spawn. Hatchery conditions (temperature and lights) are controlled throughout the year to simulate changes in the seasons. Spawning substrate is a mat of Spawntex with rocks adhered in the center. Spawned Eggs are treated daily with 100 ppm of 35% Perox-Aid to limit fungus growth. Hatched fry are either stocked into a pond or held inside and fed artemia nauplii. In 2017 two different diets were used in producing phase II smallmouth bass. Fish in a pond were given live forage (fathead minnow and gambusia) while fish inside the hatchery were fed a commercial pellet diet (Rangen Soft & Moist). Pond produced fish grew from fry to 96.6mm average total length in roughly 4 months. In the same time period, pellet reared fish grew from 51mm average to total length to 127.4mm. All fingerlings were stocked into Lake Blue Ridge to support the struggling smallmouth bass population.

Intensive Pond-based Production Systems for Aquaculture

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The U.S. aquaculture industry, in order to remain competitive with lower cost imports and rising production costs, needs to increase production efficiency while maintaining sustainable culture practices and acceptable risk. In the last decade a number of alternative production technologies have been tested and implemented on commercial farms within the U.S. catfish industry and more recently abroad. These production technologies include intensively aerated ponds, split-pond systems, and in-pond raceway systems. Intensively aerated ponds utilize higher levels of aeration (6-10 HP/acre) compared to traditional pond culture (2-4 HP/acre). Split-pond systems divide a traditional pond in to a fish culture section (20% of the pond area) and a waste treatment section (80% of the pond area). Water is then circulated between the fish culture and waste treatment units via various water moving devices. Intensively aerated ponds (>3,000 water acres) and split-pond systems (>3,000 water acres) have been widely adopted by the U.S. catfish industry. In-pond raceway systems use low horsepower devices for continual mixing and aeration coupled with fish confined in raceway cells accounting for about 2% of pond volume. This allows for more efficient feeding, inventory control, and management of fish health. In-pond raceway systems (>12,000 acres) are being rapidly adopted over the last four years by fish farmers in Asia that are rearing a variety of different fish species. Utilizing these alternative technologies, farmers have been able to increase production and reduce food conversion ratios relative to traditional pond production systems. U.S. catfish farmers have increased production from 6,000 – 8,000 lbs/acre in traditional ponds to 11,000 –21,000 lbs/acre using alternative pond-based production systems. The advances in intensive pond-based production systems by U.S. catfish farmers has led to commercial level testing and implementation of these alternative technologies in other sectors of the aquaculture industry. Split-pond systems have been tested on commercial farms raising baitfish, largemouth bass, and marine shrimp. Commercial in-pond raceway systems in Asia are producing more than 15 species of finfish and shrimp. These alternative production systems will be reviewed and the implications to the U.S. aquaculture industry discussed.

Overview of the Georgia Trout Stocking Program

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The Georgia Trout Stocking Program is a cooperative effort of the Georgia Department of Natural Resources (GADNR), the South Carolina Department of Natural Resources (SCDNR) and the U.S. Fish and Wildlife Service (USFWS). The Georgia Trout Stocking Program manages over 100 waterbodies in Georgia as a "put and take" fishery. The four public trout hatcheries in Georgia have an established goal to stock over 1 million catchable trout annually. Three of these hatcheries are operated by GADNR and one is operated by the USFWS. The culture of trout in Georgia has unique challenges and requires interagency cooperation between these facilities to reach this goal. Trout fishing in Georgia has a significant economic impact in the state and is estimated at 160 million dollars.

Session 5: Professional Presentations (Freshwater)

40 Years of Black Bass Tournaments in Georgia

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Black bass, especially the largemouth bass (*Micropterus salmoides*), are an extremely popular target for recreational anglers. This popularity has led to anglers forming organized clubs and tournaments. In 1978 some of these clubs began submitting creel reports from each tournament they conduct to Dr. Carl Quertermus at the University of West Georgia. The purpose of this was to help biologists manage the populations and ensure the quality of the fisheries at the various waterbodies. Over the years, the number of tournaments reported has varied widely, but it still provides a useful, continuous dataset for many waterbodies in Georgia. Typically, each years' data is summarized in an annual report which is released to the public. Working to improve the utility to biologists, the data can now be summarized by waterbody over the entire 40-year time period. While recreational angling data contains some inherent biases due to gear, technique, and angler preferences, these creel reports represent far more hours on the water then biologists can hope to spend. As a result, the data can show important trends in a population or even the appearance of an introduced species. This dataset has not yet been used to its' fullest potential. Hopefully it will continue to become more useful to the fisheries community of Georgia.

The Changing Face of Energy: What Does it Mean for Fisheries in Georgia?

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Due to a combination of technological advances, policy changes, and market forces the energy sources used to generate electricity are rapidly changing. Old issues that have faced fisheries managers for decades are being replaced by lesser-known ones. It is critical that managers understand these coming shifts, as well as the underlying mechanisms behind them.

From 2001-2016, the United States population grew by nearly 12%, while overall electric production in the United States only grew by approximately 9% due to increases in energy efficiency. Meanwhile, electric production from coal, once the dominant source of electricity, dropped by nearly 35% in the same period. Much of this generating capacity has been replaced by natural gas, which saw a 116% increase in generation since 2001. Renewable sources are growing even more rapidly, such as wind (3,267% increase since 2001) and solar, which doubled in two years from 2014-2016 and now accounts for more than 1% of the country's electric generation. Trends in Georgia over this period are very similar to national averages, and present new opportunities and challenges.

Each of these generation sources has common impacts to natural resources that are often well known to most fisheries managers. However, the challenges that come from new technologies on the grid can actually change the impacts of all generation sources. For instance, the presence of significant renewables with inherent sporadic outages can cause other generation sources (e.g. hydro) to be used for short, unplanned durations to maintain grid stability. Additionally, the need for energy storage as renewable generation assets increase in scale may lead to new development in technologies such as pumped-storage hydroelectric facilities. If managers have a holistic understanding of the interplay between all of these energy sources, they will be best equipped to conserve the resources they are tasked with managing.

Development of an Interjurisdictional, Rangewide Management Plan for Shoal Bass

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In 2010, biologists from agencies across the southeastern U.S. collaborated to produce the Native Black Bass Initiative (NBBI), which became a new Keystone Initiative under the auspices of the National Fish and Wildlife Foundation (NFWF). As part of the NBBI Business Plan, management plans were expected to be developed for conservation of each species. The Shoal Bass plan was initiated in 2015 with grants from Georgia Power Company and NFWF. It includes an overview of the biology and ecology of Shoal Bass and identification of data gaps, followed by management plan specifics. Shoal Bass occur over a vast scale (drainage area approximately 53,000 km2 across three states) and range of physiographic regions. Thus, the plan was organized into six management zones based upon differences in geology, geomorphology, land-use activities, and expected threats and hindrances to conservation. Threats and potential conservation partners were identified in each management zone. Within each management zone, sub-basins were identified where Shoal Bass currently exist or been reduced/ extirpated. Within each sub-basin, we assessed current status of the species and listed potential conservation actions based upon best available knowledge of the threats in each basin. Implementation strategies and prioritization of conservation actions are still being developed.

Largemouth Bass (*Micropterus salmoides*) Enhancement Stocking in West Point Lake, Georgia

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Historically, West Point Lake is known for having a trophy largemouth bass fishery. However, in recent years, a decrease in water productivity and the introduction of the non-native spotted bass in the late 1980s has caused a shift in the black bass population from predominantly largemouth bass to spotted bass. Also, many anglers perceive that heavy tournament and recreational fishing pressure have a negative effect on the largemouth bass population. For these reasons, the Fisheries Management Section of the Georgia Department of Natural Resources initiated a five-year enhancement stocking program of largemouth bass into West Point Lake. Stocking benefits may include an increase in angling catch rates, improvement in the size structure, shift black bass composition back towards more largemouth bass, and reduce social concerns about the lack of largemouth bass. Several stocking strategies were used to improve poststocking survival. In general, larger fish are more likely to survive. Therefore, four (of five) state-hatcheries, that are located at lower latitudes where water temperature warms earlier than in West Point Lake, were used to culture the largemouth bass to help enhance the size advantage of the hatchery-fish. The average hatchery-fish stock size varied from fry to 139.4 mm TL with an effort to stock fish with superior size to the resident spotted bass. Also, seven different stocking locations were used to reduce predation and competition. After two years of the stocking program, 669,515 largemouth bass have been stocked with a poststocking survival rate of 85% based on a 48-hour cage study. Long-term stocking success may include an increase percentage of largemouth bass in the black bass population back to at least 40%. And, the detection of at least a 15% contribution of the hatchery-fish genomes to the subsequent generations of the adult largemouth bass population (≥ Age 3).

Improving aquatic connectivity at White Dam on the Middle Oconee River – A collaborative approach

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White Dam is a historic stone and masonry structure which spans the Middle Oconee River just upstream from its confluence with the North Oconee River south of Athens, GA. Records of the structure are scarce, but hydropower generation and transmission is thought to have begun at the site in the late 1800s or early 1900s in support of a textile mill known first as the Georgia Factory and later as the Athens Manufacturing Company (Mooney, 2012). The entire property is now owned by the University of Georgia, and is managed as a working forest by the Warnell School of Forestry and Natural Resources (WSFNR). The dam has not been operational for decades but has been identified as a potential impediment to native fish movement and aquatic connectivity (Georgia Department of Natural Resources et al. 2013). While removal projects for obsolete dams with the objectives of restoring aquatic connectivity are gaining momentum nationally, they are relatively new in Georgia. We believe our application to be the first submitted to the U.S. Army Corps of Engineers Savannah District for consideration under Section 404 of the Clean Water Act under conditions of Nationwide Permit 27 (Aquatic Habitat Restoration, Enhancement, and Establishment Activities). We will outline the process and provide an update on recent developments including the status of existing conditions analysis, preconstruction sampling/monitoring, constructions plans, an assessment of cultural resources.

Adventures in Course-Embedded Undergraduate Research (CUREs): an investigation of a non-native blue catfish population in the Satilla River, Georgia

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A course-embedded undergraduate research experience (CURE) was incorporated in the curriculum of Ichthyology at Georgia Gwinnett College (GGC) in Fall 2017. Students were directed to investigate the age, growth, and food habits of the non-native blue catfish, *Ictalurus furcatus*, in the Satilla River, Georgia, and to assess the potential impact of the blue catfish on native fauna in the system. The blue catfish was first documented in the Satilla River in 2011, and Georgia-DNR biologists are concerned that this species may expand and become increasingly invasive over time. A sample of 228 blue catfish was collected by GA-DNR Biologists from the Satilla River, and was delivered to the laboratory at the School of Science and Technology at GGC. Ichthyology students weighed (g) and measured (mm TL) all blue catfish, extracted lapillar otoliths from each fish, and collected stomach contents for later analyses. Students were trained in otolith processing, age estimation, and gut content identification. Our results revealed a very young population (ages 1-3) with the potential for substantial growth in the near future. Blue catfish exhibited rapid body growth, with mean total lengths of 216 mm, 275 mm, and 345 mm at ages 1, 2 and 3. Blue catfish were highly opportunistic, likely adapting their diets to what was available. Blue catfish collected at a more inland location possessed a mixed diet of insects (36%, frequency of occurrence), mussels (22%), crustaceans (18%), and fishes (17%). However, at a location farther downstream with brackish water, crustaceans (i.e., grass shrimp, 78%) dominated their diets, followed by fish (11%). Mussels were not identified in blue catfish diets at the downstream location. We hope that this information assists GA-DNR biologists in the management of this growing population. In addition, we strongly recommend that CURE's be integrated in the lab experiences of ecology and fisheries related courses.

Incorporating Fishing and Fisheries Conservation into the Curriculum through STEM Education and Service Project-based Learning

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The Go Fish Education Center (GFEC) is an attraction equipped with freshwater aquariums, exhibits, simulators, a fish hatchery, and a stocked pond for fishing. It is open to the general public and has also become a popular destination for school groups visiting on field trips. Students' experience the center through guided tours and educational programs aligned to state educational standards and are now taught how to fish as well. Our field trips and public programs educate youth about fish habitat, life cycles, adaptations, food webs, aquatic conservation, and more. In 2015, a new youth STEM education program was implemented at GFEC. Elementary students engage and participate in service project-based learning opportunities centered on fish and fisheries conservation. Over the course of a school year, students learn about the science and technology used to conserve and manage fish populations. Using this knowledge, along with math and the engineering design process, students design and build something that will improve fishing opportunities and/or conserve fish populations. These hands-on service projects have included aquaponics design, pond management, creating bog gardens, and building fish attractors. Last year, 125 fourth-graders learned about native freshwater fish, their habitats, fishing and fish attractors. In an effort to improve fish habitat and angling opportunities, students worked together to design and build 75 fish attractors, using mostly recycled materials, which were placed at Flat Creek and Ocmulgee Public Fishing Areas.

Seasonal Food Habits of Introduced Blue Catfish in Lake Oconee, Georgia

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Blue catfish (*Ictalurus furcatus*) are native to the Coosa River drainage in northwest Georgia, but have been widely introduced outside of this range, including Lake Oconee, a7677-ha impoundment on the Oconee River in central Georgia. Blue catfish abundance and growth rates have increased dramatically since their introduction in Lake Oconee, but their food habits are unknown. Therefore, food habits of blue catfish in the upper and lower regions of this impoundment were determined by examining the stomachs of 808 specimens the reservoir's upper and lower regions across all seasons from summer 2012 to summer 2013. Diet was summarized using the Relative Importance of specific prey by weight. In the upper region of the reservoir, Asian clams (*Corbicula fluminea*) were the dominant prey item during the summer (75.7%), fall (66.4%), and winter (37.6%); whereas, crappie (*Pomoxis* spp.) were the dominant prey item in the spring (38.7%). Asian clams also were the dominant prey items in the lower region during the fall (68.4%) and winter (33.9%), and spring (36.4%). Blue catfish seemed to feed opportunistically on seasonally abundant prey items in both the upper riverine and lower lacustrine portions of the reservoir. Of the many sportfishes in the reservoir, only crappie was an important prey item in the upper region during the spring. Our results do not support concerns that blue catfish are an apex predator that would decimate the sportfish assemblage in the recently colonized reservoir.

Proposed Standard Weight (Ws) Equation and Standard Length Categories for Shoal Bass *Micropterus cataractae*

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Standard weight equations have been proposed for a variety of fishes including many of the black basses (*Micropterus)*. We plan to develop a standard weight (Ws) equation for the Shoal Bass *M. cataractae* using the traditional RLP technique and the newer EmP method. To date, length and weight data for over 9,000 Shoal Bass have been obtained. These fish were collected from 1978 to 2017 by various agencies and universities from all known populations within its relatively narrow geographic range of Alabama, Florida and Georgia. All available data will be used to develop the equations, unless hybridization issues are a concern such as with the Big Creek Shoal Bass population on the Chattahoochee River below Morgan Falls Dam. Also, to assess fish population size structure, five standard length categories (stock, quality, preferred, memorable, trophy) will be suggested based on the longest fish measured in the dataset (590 mm TL) or the reported world record (610 mm TL) for this species. Threats to the conservation of this rare black bass include urbanization, land-use changes, dams, and most notably the introduction of several non-native congeneric species. Thus, the development of a Ws equation and standard length categories will aid biologists in evaluating and monitoring Shoal bass populations as part of continuing conservation efforts.

Conservation genetics of Roanoke bass, a declining sportfish of eastern North America

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Roanoke bass (RNB) are endemic to the Roanoke, Chowan, Tar, and Neuse river basins of Virginia and North Carolina, where they support localized but popular fisheries. Previous studies by us and others suggest that RNB populations are at risk of extirpation due to various stressors, including competition and hybridization with invasive Rock bass, habitat degradation associated with anthropogenic land-use, and habitat loss and fragmentation due to river impoundment. To inform restoration of the species, we conducted the first range-wide conservation genetic study of RNB, seeking to estimate (1) historical and contemporary genetic relationships among populations, (2) the spatial extent of contemporary dispersal and population structure, (3) genetic diversity and effective population size, and (4) influences of natural and anthropogenic habitat boundaries and watershed land-use on population structure and genetic diversity. We sampled DNA from RNB in 15 streams distributed throughout the species' range, analyzing samples for genetic variation at 19 microsatellite DNA markers and the cytochrome B mitochondrial DNA gene. Based on microsatellites, most streams contained separate, genetically distinguishable populations, with high connectivity among sites within streams but, due to habitat boundaries and barriers, no contemporary dispersal between streams. However, mitochondrial divergence within and among basins was weak, suggesting historically higher range-wide gene flow. Most populations had relatively small effective population sizes (Ne < 200) and exhibited evidence of past population bottlenecks. Indices of genetic diversity were positively correlated with patch size and negatively correlated with the percentages of developed and agricultural land-use in watersheds, suggesting that habitat loss, degradation, and fragmentation may act in concert to reduce RNB population viability. Mitigating these risks likely will require a combination of strategies, including sediment abatement, prevention of further encroachment by invasive species, and restoring connectivity through barrier removal and/or fish translocations.

Genetic Relationships Among Georgia Black Bass

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Black bass are the most sought-after sport fishes in the country. Many state fisheries agencies, including Georgia, consider black bass management a high priority. Largemouth bass hybrids are the most common native black bass found throughout Georgia's waterbodies. Anglers in the state spend more days fishing for largemouth bass than any other freshwater species, and Georgia consistently produces some of the heaviest largemouth bass in the country. A 17.6-pound largemouth bass was caught in 2015 from Georgia waters that weighed more than the current state records of 46 other states. Using allozymes, Phillip et. al 1983 described an intergrade zone between two subspecies; Florida bass *Micropterus floridanus* and largemouth bass *M. salmoides*, in Georgia waters where many of these large bass are produced. In this study, we are using single nucleotide polymorphisms (SNP's) 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. 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.

POSTER PRESENTATION ABSTRACTS

Professional

Validation of Estimated Sicklefin Redhorse Growth from Pectoral Fin Rays Using Observed Growth Rates from Recaptured Individuals

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The sicklefin redhorse (SFR) *Moxostoma* sp. is endemic to the upper Tennessee River watershed in western North Carolina and north Georgia. It is considered state-endangered in north Georgia with a single population existing in Brasstown Creek, a tributary to the Hiwassee River watershed. Previous study of this population determined age structure and growth rates using sectioned pectoral fin rays. However, age validation was not conducted, and the accuracy of estimated growth rates was not assessed. SFR were captured in April from 2014 to 2017 using seines and a modified fyke net. Captured individuals were tagged with passive integrated transponder (PIT) tags, measured to total length (mm) and released. Sixteen SFR were recaptured in either April 2016 or April 2017, with one individual being recaptured twice. A von Bertalanffy growth model (VBG) was developed from pectoral fin rays and compared to a length-increment version of the VBG from mark-recapture data. Comparisons of growth rates from pectoral fin ray and mark-recapture methods were evaluated based upon the VBG-predicted age for recaptured lengths and the apparent age from the length-increment model for recaptured lengths. Little difference in growth was demonstrated between estimated growth from fin rays and observed growth from recaptured SFR. The estimated growth from recaptured fish was slightly lower with the widest differences (~1 year) at younger ages (12 – 15 years). Similarity between observed growth and predicted growth suggests that the use of pectoral fin rays, a method that is not lethal, provides an accurate assessment of SFR growth. Accurate estimation of ages and growth will allow for estimation of other population characteristics and for additional population modeling with this species. Further sampling will occur to increase the number of recaptured SFR to strengthen this analysis.

Student

Biomonitoring of Ogeechee River Invertebrate Assemblages: Patterns of Community Structure

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Benthic invertebrates are important in river food webs, where they link between algal and detrital energy sources to insectivorous fish. In the Ogeechee, a free flowing 6th order river on Georgia's Atlantic Coastal Plain, seasonal and spatial variation plays a key role in the structuring of invertebrate communities, with implications for the fish that feed on them. Routine biomonitoring of streams and rivers to assess water quality requires collection of macroinvertebrate samples, which can be used to assess community structure. To identify patterns in structure and to assess water quality on the Ogeechee, quarterly invertebrate samples were taken from six sites along the river for three years, identified to lowest practical taxonomic level, and analyzed based on water quality indices, diversity indices and community structure. Indices of diversity and water quality were constant across sites, but diversity dropped in the winter and spring, corresponding with outbreaks of certain dominant taxa such as isopods. Community structure varied significantly by site and season. During the summer and fall, mayflies such as *Caenis* and *Tricorythodes* were common, whereas the mayfly *Baetisca* had outbreaks in the winter. Midges of the family *Chironomidae* were numerous year-round but only dominant in the summer and fall. Winter and spring samples were dominated by the isopods *Lirceus* and *Asellus*. Understanding what food resources are available at different times of year help indicate when fish are most productive and most vulnerable.

Effect of Septic Systems on Nitrogen and Phosphorus Loading in Chatuge Reservoir

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Nutrient loading through phosphorus and nitrogen results in eutrophication of aquatic systems and can result in decreased water quality, specifically from hypoxia. Chatuge Reservoir has received poor water quality ratings due to increasing eutrophication; however, recent management actions, including improving wastewater treatment and repairing failing septic systems, have been implemented to reduce nutrient loading. This study investigated nitrogen (N) and phosphorus (P) levels at nine sites in Chatuge Reservoir to assess the relationship to problem septic systems. Based upon data from 2005 – 2007, sites were chosen among priority rankings given to sub-watersheds from an analysis of septic systems within a subwatershed. Thus, three sites were monitored for each priority (High, Moderate, and Low). N and P were measured weekly from mid-September to mid-November using portable photometers. Using a Kruskal-Wallis test, mean levels of N ($P = 0.130$) and P ($P = 0.484$) were not significantly different among priority rankings with measurements having large variations at a site over the sampling period. A score was developed for each watershed based upon the number of problem septic systems, and watershed score was significantly related to N ($P = 0.024$) but not P ($P = 0.979$). Failure to detect any differences between priority watersheds could indicate the effectiveness of management actions, such as septic repair, in the watershed over the last 10 years. However, further investigation is needed to assess the relative impact of septic systems to nutrient loading in comparison to other activities in the watershed such as riparian zone removal, agriculture, and municipal waste water.

Comparison of Spotted Bass Populations Among Three North Georgia Reservoirs

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Spotted bass *Micropterus punctulatus* have been introduced into multiple reservoirs in the southeastern United States, including deep, highland reservoirs of north Georgia. In most of these reservoirs, spotted bass represent the most abundant black bass species, accounting for most angler-caught bass. However, the quality of the fishery can vary substantially among reservoirs. This study compared the spotted bass population, in terms of age structure, growth rate, mortality rate, size structure, and condition among Chatuge, Nottely, and Lanier Reservoirs. Data was collected from each reservoir during spring electrofishing surveys by Georgia DNR biologists. Otoliths were removed and sent to Young Harris College for processing and analysis. Data analysis is ongoing, and research is in progress. It is hypothesized that differences between populations might occur due to a mixed introduction of Alabama spotted bass and Kentucky spotted bass among reservoirs.

Nesting Microhabitat Use of Bartram's Bass in the Upper Savannah River Basin

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Bartram's Bass (*Micropterus sp. cf cataractae*) is an undescribed species of Shoal Bass endemic to the Savannah River basin of South Carolina and Georgia. Bartram's Bass populations are threatened by habitat alteration and hybridization with the invasive Alabama bass (*M. henshalli*), which were introduced into several Savannah River impoundments in the 1980s. Identifying the reproductive isolating mechanisms that have broken down to facilitate hybridization will be critical for conserving Bartram's Bass. In spring/summer 2017, snorkel surveys were performed in eight tributaries to the upper Savannah to quantify nesting microhabitat use of Bartram's Bass. Egg samples were collected for genetic analysis, and microhabitat parameters (depth, velocity, and substrate) were recorded at each of the 34 nests detected. Habitat transects were used to quantify available habitat. Average velocity of the 34 nests observed was 0.12 m/s, and average available velocity in the transects was 0.23 m/s ($p=0.0184$). Average depth of the nests was 0.75m, and average available depth was 0.80m ($p=0.7736$). Depth selection ranged from 0.5m to nearly 1.5m, where velocity was observed below 0.5 m/s. The preferred substrate was primarily silt (35%) and cobble (44%), with some nests composed of gravel (6%) and bedrock (15%), whereas the most available substrate observed was sand (18%), cobble (21%) and bedrock (21%) ($p<0.0001$). The preliminary results indicate that the nesting Bartram's bass are selecting more for velocity than depth and substrate, and although there is a relationship between substrate use and availability, we believe the main factor driving substrate use is velocity. Genetic analyses of eggs and individuals are underway to confirm species identity, hybrid presence, and the extent of hybridization throughout the range in the upper Savannah River basin.

Effect of MS-222 Dosages on Sedation and Recovery Time of Two Non-game Fishes

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MS-222 is a common fish anesthetic used in fisheries research and management. Although several studies have evaluated its usefulness and effects on commercial and sport fishes, few studies have assessed its effects on non-game fishes. Through a repeated measures design, this study investigated the effect of MS-222 dosage (70, 110 and 150 mg/L) on the sedation and recovery times of two common stream-dwelling fishes, banded sculpin *Cottus carolinae* and warpaint shiner *Luxilus coccogenus*. Fish (n = 30 per species) were divided into six 10-gallon holding tanks with blocking implemented by fish total length. Three trials were conducted separately for each species. Using robust ANCOVA to account for effects of fish size, no significant differences (banded sculpin: P = 0.161; warpaint shiner: P = 0.721) were detected for recovery times of both species, although sedation times differed significantly (banded sculpin: P = 0.037; warpaint shiner: P < 0.001) among dosages for both species. Among the two species, recovery times were significantly lower (P = 0.002) for banded sculpin ($\bar{x} = 180.1$ sec) than warpaint shiner ($\bar{x} = 249.5$ sec). Similarly, sedation times were significantly higher (P < 0.001) for banded sculpin ($\bar{x} = 213.8$ sec) than warpaint shiner ($\bar{x} = 104.1$ sec). Results indicate that fishes respond differently to MS-222 on a species level but that fish size might have a greater impact on fish recovery after anesthesia than dosage. Moreover, protocols for the use of MS-222 in fish anesthesia should not be generic across species but should account for size and species effects. Differences between species may be partially explained by differences in metabolic and respiration rates. Future work will expand testing to other native fishes for a more comprehensive species comparison.

Changes in Trophic Linkages due to Anthropogenic Disturbances in Florida's Coastal Lakes

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Coastal lakes in the Everglades have experienced major reductions in freshwater inflows, resulting in hypersaline conditions and eutrophication, inducing a shift from SAV to phytoplankton-dominated primary production. We examined the effects of these habitat changes on higher trophic consumers, particularly on trophic structure and individual diet variation. Fin clip samples were collected from key consumers: Tarpon (*Megalops atlanticus*), Common Snook (*Centropomus undecimalis*) and Spotted Seatrout (*Cynoscion nebulosus*) in Alligator and McCormick Creeks sub-estuaries. We expected that consumer mobility may limit the level of distinctiveness in trophic structure among systems. Consumers from the less enriched McCormick system had higher δ15N relative to the more enriched system. The relative niche position and space of species based on isotopic signatures (δ13C, δ15N) have been used to assess changes in food web structures, patterns of individual specialization, and the collapse/expansion of species interactions. The SAV-dominated McCormick Creek sub-estuary will produce greater individual diet variation than Alligator Creek sub-estuary, which primary production is dominated by phytoplankton. Also, high mobility consumers like Tarpon will have wider isotopic niche space and greater individual diet variation. This study will contribute to our understanding of how habitat transformations induced by freshwater management activities influence consumer-mediated dynamics and ecosystem functioning.