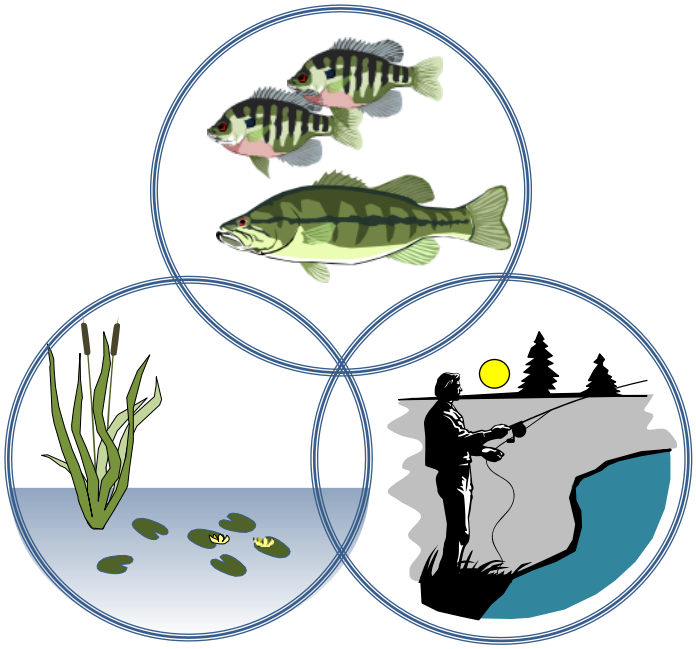
2014 Joint Annual Meeting of the **Mississippi** and **Tennessee** Chapters of the American Fisheries Society

Pickwick Landing State Park
Counce, TN



18-20 March 2014

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The organizers from the Tennessee and Mississippi Chapters would like to recognize the following groups for financial support of the meeting.

College of Forest Resources, Department of Wildlife, Fisheries & Aquaculture, Mississippi State University	College of Forest Resources Forest and Wildlife Research Center
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We also thank the Mississippi Department of Wildlife, Fisheries & Parks for the in-kind donation of printing these programs.

Program at a Glance

Date/Time	Event	Location
Tuesday, March 18		
4:00 - 7:00 PM	Check-in and Registration	Lobby
7:00 - 11:00 PM	Welcome Social	Conference Room
Wednesday, March 19		
6:00 - 7:45 AM	Breakfast (on your own)	Restaurant
7:45 - 10 AM	Registration	Lobby
8:00 - 8:30 AM	Introduction and Welcome	Conference Room
8:30- 10:00 AM	Presentations	Conference Room
10:00 - 10:30 AM	Break	Conference Room
10:30 - 11:45 AM	Presentations	Conference Room
11:45 - 1:00 PM	Lunch (on your own)	Restaurant
1:15 - 3:00 PM	Presentations	Conference Room
3:00 - 3:30 PM	Break	Conference Room
3:30 - 4:45 PM	Presentations	Conference Room
6:00 - 11:00 PM	Banquet	Conference Room
Thursday, March 20		
6:00 - 7:45 AM	Breakfast (on your own)	Restaurant
8:00 - 8:15 AM	Morning announcements	Conference Room
8:15 - 10:00 AM	Presentations	Conference Room
10:00 - 10:30 AM	Break	Conference Room
10:30 - 11:45 AM	Presentations	Conference Room
11:45 - 1:00 PM	Lunch (on your own)	Restaurant
1:00 - 3:00 PM	Presentations	Conference Room
3:00 -3:30 PM	Break	Lobby
3:30 -6:00 PM	Chapter Business Meetings	Conference Rooms (Divided)

Banquet Speaker: Steve Moore

Steve Moore received his B.S. degree from Western Carolina University in 1976. Steve received his Master degree in Science at Tennessee Tech University in 1979. He began his career as a bioscience tech at the Uplands Field Research Lab directly out of graduate school, and in January 1982, Steve took a job as a Fish Biologist with the Florida Game and Freshwater Fish Commission. In September 1985, Steve became a fishery biologist for Great Smoky Mountains National Park (GRSM). In June 2000, Steve became a supervisory fishery biologist for GRSM where he stayed until his retirement date of January 10, 2014. His career spanned nearly 30 years with the National Park Service in this role.

During Steve's tenure at GRSM, he has supervised nearly 200 seasonal NPS fish technicians, Student Conservation Association interns, Friends/TU interns and graduate students. Steve led efforts to restore over 27 miles of stream within GRSM for native southern Appalachian brook trout, as well as an additional 13 miles and two lakes for various other species, including bull trout in Crater Lake National Park and Bonneville cutthroat trout in Great Basin National Park. Steve has coordinated a long term water quality program within GRSM since 1993, which is providing the data researchers need for modeling inputs to determine total maximum daily loads, critical loads, and other data essential to protect and preserve the fauna of GRSM for future generations. Further, he has consulted on native fish restoration projects at Rangell St. Elias, Rocky Mountain, Olympic, Yellowstone, and Great Sand Dunes National Parks. In total, he has worked with more than 50 non-government organizations, state and federal agencies and private groups on fisheries projects throughout the country totaling more than $2 million dollars in direct and in-kind donations and volunteer time.

Steve has been a life member of the American Fisheries Society since 1993 and served as the TN AFS President from 1992-1993. Steve has also played a big role in the International Wild Trout Symposium for over twenty years. Steve has authored or coauthored over 40 peer reviewed publications during his tenure in the fields of fisheries management, fishing regulations, native fish restoration, ichthyology, water quality changes due to acid deposition, critical load monitoring, biotic effects due to acid deposition, soil chemistry, brook trout genetics and threatened and endangered fish ecology.

Presentation Schedule

Students competing for the best student presentation are designated with superscript numerals for Mississippi[1] and Tennessee[2].

Date/Time	Title	First author
Wednesday, March 19		
8:00 - 8:30 AM	**Welcome**	
8:30 - 9:00 AM	Habitat conservation update from the Southeast Aquatic Resource Partnership (SARP)	Scott Robinson
9:00 - 9:15 AM	Occurrence of tarpon, *Megalops atlanticus*, leptocephali in Mississippi coastal waters	Patrick Graham
9:15 - 9:30 AM	Anthropogenic induced decline and restoration of Tennessee's mussel fauna	Don Hubbs
9:30 - 9:45 AM	Investigation of movement patterns of lake sturgeon in the Upper Tennessee River: (Gaining a better understanding of population demographics through tagging)	Jason Henegar
9:45 - 10:00 AM	Stocking Florida largemouth bass, *M.s. floridanus*, to enhance the quality of a largemouth bass fishery in Chickamauga Reservoir	Mike Jolley
10:00 - 10:30 AM	**Break**	
10:30 - 10:45 AM	Otoliths of rare or uncommon fishes in Gulf Coast Research Laboratory samples	Gary Gray
10:45 - 11:00 AM	Hydroacoustics survey of fish distribution at a power plant heated	Mark Bevelhimer
11:00 - 11:15 AM	Radio tracking crappies in Sardis and Enid Reservoirs	Glenn Parsons
11:15 - 11:30 AM	Using recirculation aquaculture for reintroduction of native species at the Tennessee Aquarium Conservation Institute	Kathlina Alford

11:30 - 11:45 AM	The secondary stress response of the Atlantic stingray to prolonged air exposure	Faith Lambert[1]
11:45 - 1:00 PM	**Lunch (on your own)**	**Restaurant**
1:15 - 1:30 PM	Summary of MDWFP pallid sturgeon sampling in the Lower Mississippi River, 2010-2013	Nathan Aycock
1:30 - 1:45 PM	Using floating streambed wetlands to reduce eutrophication and improve habitat	Clint Lloyd
1:45 - 2:00 PM	Growth and condition of black crappies, *Pomoxis nigromaculatus*, in two West Tennessee small impoundments	Chris Bailey[2]
2:00 - 2:15 PM	Proceed with caution when implementing a mixed receiver model passive acoustic array design	Jennifer Green[1]
2:15 - 2:30 PM	Assessing the accuracy of length based mortality estimates	Jason Bies[1]
2:30 - 2:45 PM	Age and growth of the finetooth shark, *Carcharhinus isodon*, in the northern Gulf of Mexico	Jeremy Higgs[1]
2:45 - 3:00 PM	Physiological responses of juvenile paddlefish, *Polyodon spathula*, to acute and chronic hypoxia	Daniel Aboagye[1]
3:00 - 3:30 PM	**Break**	
3:30 - 3:45 PM	Assessment of Mississippi's red drum (*Sciaenops ocellatus*) fishery	Robert Leaf
3:45 - 4:00 PM	Stocking efficacy and catch-and-release mortality of Sauger in the Cumberland River in Tennessee	Grant Scholten[2]
4:00 - 4:15 PM	Abundance and distribution of sharks within the Mississippi Sound: summary of a decade long gillnet resource survey, 2004-2013	Sarah Ashworth
4:15 - 4:30 PM	Temperature selection of fishes near a power plant thermal plume	Justin Spaulding[2]

4:30 - 4:45 PM	Impacts of off-road vehicles (ORV) on biological assemblages and habitat in the Comite River, Louisiana	Brian Alford
6:00 - 11:00 PM	**Banquet**	**Conference Room**

Thursday, March 20

8:00 - 8:15 AM	**Morning announcements**	
8:15 - 8:30 AM	Current status of Cumberland arrow darter (*Etheostoma sagitta*) in Tennessee	Bart Carter
8:30 - 8:45 AM	Co-culture of channel catfish with hybrid catfish facilitates 'herd effect' to improve production performance	Nagaraj Chatakondi
8:45 - 9:00 AM	Northern Gulf of Mexico whale shark research program: what we have learned about whale shark aggregations in the northern Gulf of Mexico	Eric Hoffmayer
9:00 - 9:15 AM	High definition stream surveys: Fish habitat at the riverscape scale	James Parham
9:15 - 9:30 AM	Current brook trout distribution in Tennessee	Jim Habera
9:30 - 9:45 AM	Population characteristics of flathead catfish in the Lower Tennessee-Tombigbee Waterway	Tyler Stubbs
9:45 - 10:00 AM	Reproduction of the blacknose shark, *Carcharhinus acronotus*, in the northern Gulf of Mexico	Jill Hendon
10:00 - 10:30 AM	**Break**	**Conference Room**
10:30 - 10:45 AM	Development of crappie (*Pomoxis* spp.) reproduction methods in closed aquaculture systems	Charile Culpepper[1]
10:45 - 11:00 AM	Hands-on fish management: Using manual removal to restructure a crowded Largemouth Bass population in Puerto Rico	Cynthia Fox[1]
11:00 - 11:15 AM	Impact of EPA's new 316 (b) regulations on aquatic resources and fishery professionals	Fred Heitman

11:15 - 11:30 AM	Investigating fish-biofilm relationships using exclusion cages: a design comparison	Natalie Knorp[2]
11:30 - 11:45 AM	Examination at the ichthyoplankton community assemblage of the Loop Current and Sargassum habitats in the Gulf of Mexico	Stephanie Taylor[1]
11:45 - 1:00 PM	**Lunch (on your own)**	**Restaurant**
1:00 - 1:15 PM	How do fins heal? Effects of different pectoral fin sampling techniques	Peter Allen
1:15 - 1:30 PM	Cumulative stress effects on growth, physiology and fillet quality in channel catfish	Mike Ciaramella[1]
1:30 - 1:45 PM	Ontogeny of the cortisol stress response in channel catfish (Ictalurus punctatus)	Brian Peterson
1:45 - 2:00 PM	Stocking Addictions in North America in the 21st Century	Phil Bettoli
2:00 - 2:15 PM	Consumptive effects of fish predators drive composition of emerging dragonfly assemblages in structured and unstructured habitats	Natalie Knorp[2]
2:15 - 2:30 PM	Changes in osmoregulatory ability of juvenile Gulf killifish *Fundulus grandis*	Shane Ramee[1]
2:30 - 2:45 PM	Spatial Distribution of Threats to Paddlefish Populations across the Southeastern United States	Brenda M. Pracheil
3:00 -3:30 PM	**Break**	**Lobby**
3:30 -6:00 PM	**Chapter Business Meetings**	**Conference Rooms (Divided)**

Poster Submissions

Students competing for the best student presentation are designated with superscript numerals for Mississippi[1] and Tennessee[2].

Poster Number	Poster Title	First author
1	Muskellunge management in Tennessee: History and recent research	Justin Spaulding[2]
2	Assessment of native brook trout propagation for restoring Tennessee populations	Thomas Johnson[2]
3	The paddlefish fishery in Mississippi, 2007-2013	Garry Lucas

Session Moderators

All moderators in this conference are students from Mississippi and Tennessee. The objective was to give the students greater opportunity for public speaking and improve face recognition with potential employers.

Session	Moderator	Affiliation
Wednesday, March 19		
8:30 - 10:00 AM	Jason Bies	Mississippi State University
10:30 - 11:45 AM	Travis Johnson	Tennessee Technological University
1:15 - 3:00 PM	Stephanie Taylor	The University of Southern Mississippi
3:30 - 4:45 PM	Natalie Knorp	Tennessee Technological University
Thursday, March 20		
8:15 - 10:00 AM	Clint Lloyd	Mississippi State University
10:30 - 11:45 AM	Jennifer Green	The University of Southern Mississippi
1:00 - 3:00 PM	Cynthia Fox	Mississippi State University

Abstracts

Abstracts are listed in alphabetical order. Presenting author is underlined.

Physiological responses of juvenile paddlefish, *Polyodon spathula,* to acute and chronic hypoxia

Aboagye, Daniel[1], and Peter Allen[1]

[1] *Mississippi State University, Dept. of Wildlife, Fisheries and Aquaculture, Mississippi State, MS 39762 USA*

The American paddlefish (*Polyodon spathula*) is a declining, primitive, migratory fish, and an important aquaculture species. Hypoxia is a potential problem in managed culture conditions, and is an increasing problem in the natural habitats that the paddlefish has historically inhabited, including the Mississippi River system and nearby drainage systems. However, the effects of hypoxia on paddlefish are not well understood. Therefore, in order to understand the respiratory physiology of paddlefish, the effects of acute and chronic hypoxia were measured in juvenile paddlefish (~150 g) acclimated to 25°C and exposed to normoxia (≥ 148 mmHg), acute and chronic hypoxia (59-74 mmHg). Blood pH, PO_2 and hematological parameters, including oxygen transport (hemoglobin, hematocrit), ionic (chloride, osmolality), and metabolic (glucose, lactate) variables were measured immediately following a 0.5, 2, 24, 48 h exposure to hypoxic water. Blood pH and PO_2 decreased whiles hemoglobin, glucose and lactate concentrations increased significantly when paddlefish were exposed to both acute and chronic hypoxia. The results further indicates that juvenile paddlefish are relatively sensitive to both acute and chronic hypoxia, and require a dissolved oxygen concentration ≥ 5 mg/L to maintain basal aerobic metabolism and > 2.0 mg/L to survive under hypoxia.

Impacts of off-road vehicles (ORV) on biological assemblages and habitat in the Comite River, Louisiana

Alford, Brian[1], Isis Longo[2], Michael Kaller[3]

[1]*University of Tennessee, Department of Forestry, Wildlife, and Fisheries, Knoxville, TN 37996*

[2]*Louisiana Department of Wildlife and Fisheries, Fisheries Management Section, Baton Rouge, LA 70808*

[3]*Louisiana State University Agricultural Center, School of Renewable Natural Resources, Baton Rouge, LA 70803*

The Comite River is a coastal plain tributary of the Lake Pontchartrain Basin in southeastern Louisiana and is registered with the State as a Scenic and Historic Stream, giving it some protective status. The Louisiana Department of Wildlife and Fisheries (LDWF) manages the Scenic Streams program and, in October 2013, took steps to ban off-road vehicles (ORV) in all Scenic Stream beds (channel bottom between the banks at low water mark). The Comite River was cited as an example of a stream that has been incurring heavy amounts of ORV traffic during warm, low water periods (May-October) for the purposes of recreational riding. However, the Louisiana Wildlife and Fisheries Commission requested to see data that supported the stance taken by LDWF that ORV riding had a negative impact on the ecological integrity of the Comite River. We present data collected during 2009-2013 from unimpacted sites, low impact, medium impact, and high impact sites during warm months that suggest ORV riding degrades the ecological integrity of this system. Data were collected on the presence/absence and relative abundance of benthic macroinvertebrates (including unionid mussels and crayfishes) and fishes. Reach lengths (40 x wetted width) were delineated and 30 seine hauls were taken to sample fishes, ten hand grabs were collected at each site (leaf litter, woody debris, and rootwads) then put in plastic bags on ice, and mussel surveys were conducted at 1 m wide intervals along both banks and at mid-channel. Instream habitat data were also collected at these sites using standard U.S. EPA Environmental Monitoring and Assessment Protocols (EMAP) for low-gradient, glide-pool streams. Although stream dwelling crayfish were found at unimpacted sites (*Orconectes palmeri palmeri*), none were collected at the remaining impacted sites. Greater numbers of pollution-tolerant invertebrate taxa were found at sites with increased ORV impact. For fishes, 18 species were found at unimpacted sites, 14 at medium impact sites, 8 at low impact sites, and only 4 at high impact sites. The high impact sites contained no predators, including Spotted bass (*Micropterus punctulatus*), which is the dominant predator at other less impacted sites. Only 4 species of mussel were found at unimpacted sites, 1 at a medium impact site, and 0 at high impact sites. Habitat trends included a decline in rapid habitat assessment scores (RHA) from unimpacted to impacted sites, lower dissolved oxygen, lesser overhanging vegetation cover, lower large woody debris volume, and increases in human debris.

Using recirculation aquaculture for reintroduction of native species at the Tennessee Aquarium Conservation Institute

Alford, Kathlina[1], Thom Demas[2], and Anna George[1]

[1] *Tennessee Aquarium Conservation Institute, 201 Chestnut Street, Chattanooga, TN 37401*

[2] *Tennessee Aquarium, One Broad Street, Chattanooga, TN 37402*

Since 2010, the Tennessee Aquarium Conservation Institute (TNACI) has been using recirculation aquaculture techniques for the grow-out of Lake Sturgeon, *Acipenser fulvescens*, as a partner in the Tennessee Lake Sturgeon Restoration Working Group. In 2012, TNACI began using similar systems and techniques to propagate Southern Appalachian Brook Trout, *Salvelinus fontinalis*, as a potential tool for reintroduction. Lake Sturgeon systems consist of two 130" (330.2 cm) long troughs, one 96" (243.8 cm) long trough, two 300 gal. (1135.6 L) sumps, one 800 gal. (3028.3 L) water tower, a bead filter, a fluidized bed filter, a felt mechanical filter and an 80 watt high output UV sterilizer. The total system volume is 1,600 gal. (6056.7 L) and each system is capable of housing 1,000 juvenile Lake Sturgeon as they grow from 0.5"-6" (1.3-15.2 cm) over a 5-6 month time period. Brook Trout systems consist of two 43" (109.2 cm) diameter round tanks, one 108" (274.3 cm) long trough, one 33" (83.8 cm) square sump, a fluidized bed filter and a felt mechanical filter. Additionally, a 2 hp chiller unit is used to cool the water for each system. During the 2012-2013 growing season, water temperature followed natural stream conditions and ranged from 45°F (7.2°C) to 67°F (19.4°C). Since October 2013, water has been kept at a constant 50°F (10.0°C). Broodstock are held in the two round tanks while the trough is used to house hatching jars for eggs, 2 gal. (7.6 L) screened tanks for the sac fry and free swimming juveniles, and larger juveniles that are loose in the trough. The total system volume is 300 gal. (1135.6 L). Recirculation aquaculture offers many benefits for conservation programs including the ability to manipulate temperature, dose medications, and keep individual populations separated to avoid cross-contamination of genes or parasites.

How do fins heal? Effects of different pectoral fin sampling techniques

Allen, Peter J.[1], Erin Brinkman[2], Rob DeVries[1], Heather Stewart[1], Daniel Aboagye[1], Shane Ramee[1], Michael Ciaramella[1], Lora Petrie-Hanson[3]

[1]*Dept. of Wildlife, Fisheries and Aquaculture, College of Forest Resources, Mississippi State University, Box 9690, Mississippi State, MS 39762*

[2]*Dept. of Clinical Sciences, College of Veterinary Medicine, Mississippi State University, Box 6100, Mississippi State, MS 39762*

[3]*Dept. of Basic Sciences, College of Veterinary Medicine, Mississippi State University, Box 6100, Mississippi State, MS 39762*

Field sampling techniques may cause damage to fins either directly by tissue removal for ageing or genetic purposes or indirectly during capture and handling. To assess how fins heal following different sampling techniques, three different pectoral fin spine/ray treatments were applied (n=8-9 fish/trt): entire leading fin ray removed, a 1-2 cm portion removed near the point of articulation or a 1-2 cm portion removed from a secondary fin ray. All fish were given an injection of an oxytetracycline-based antibiotic into the dorsal musculature following fin treatments, except for an additional group (n=8) that had the entire fin spine removed to assess effects on healing. Following fin section removal, fish from different treatments were mixed equally between three large (4,000-L) recirculating systems, and fin ray healing and mortality were monitored over a 9-month period. In addition, blood samples were collected at 4 months to assess immune system impact, and radiographs were taken at 4 and 8 months to assess the degree of bone/calcified structure healing. Survival was high in all treatments, and healing progressed differently depending on the treatment, with the slowest healing observed in fish with the entire fin spine removed. Results will be discussed in the context of fish health and management.

Abundance and distribution of sharks within the Mississippi Sound: summary of a decade long gillnet resource survey, 2004-2013

Ashworth, Sarah L.[1], J.M. Hendon[1], E.R. Hoffmayer[2]

[1]*Center for Fisheries Research and Development, Gulf Coast Research Laboratory, The University of Southern Mississippi, 703 East Beach Drive, Ocean Springs, 39564*

[2]*National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, 3209 Frederic Street, Pascagoula, MS 3958*

In 2004, a fisheries independent gillnet survey was initiated to monitor coastal shark populations in the Mississippi Sound. Sampling occurred monthly (March - October) at sites throughout the Mississippi Sound using a 183 x 3 m gillnet with six 30.5 m panels of varying mesh sizes ranging from 8.9 to 20.3 cm stretch mesh. Through 2013, this project comprises 10 years of data and represents 369 gillnet stations, 1,016 hours of fishing effort and a catch of 4,309 sharks. Sharks were caught at 74% of the stations. Nine shark species were encountered with Atlantic sharpnose (*Rhizoprionodon terraenovae*, n = 2,361), finetooth (*Carcharhinus isodon*, n = 689), blacktip (*C. limbatus*, n = 677), and bonnethead (*Sphyrna tiburo*, n = 231) being the most abundant, representing 93% of the sharks caught. Other species encountered in lower numbers included bull (*C. leucas*), spinner (*C. brevipinna*), scalloped hammerhead (*S. lewini*), great hammerhead (*S. mokarran*), and blacknose (*C. acronotus*). Sharks were found throughout the Mississippi Sound with the majority (80%) being immature. Of the six geographic regions sampled (Petit Bois/ Sand Island, Horn Island, Round Island, Ship islands, Cat Island, and Inshore), Petit Bois/Sand and Round Island had the highest mean catch per unit effort (CPUE) at 6.29 ± 0.96 and 6.07 ± 0.9 sharks net hour^{-1}, respectively, while the Inshore region had the lowest CPUE at 0.86 ± 0.38 sharks net hour^{-1}. Multiple logistic and linear regressions were used to determine the influence of geographic and environmental variables on the distribution of the sharks in the region.

Summary of MDWFP pallid sturgeon sampling in the Lower Mississippi River, 2010-2013

Aycock, Nathan, Jerry Brown, Darrin Hardesty, Don Henke, Ryan Jones, Chad Washington

Mississippi Department of Wildlife, Fisheries, and Parks, Jackson, Mississippi, 39211

MDWFP has been sampling sturgeon on two stretches of the Lower Mississippi River since 2010 in coordination with the US Fish and Wildlife Service and Mississippi State University. Our objectives were to collect fish for a *Scaphirhynchus* identification study and for sonic tag implantation. A total of 367 trotlines were fished near Tunica, MS, (RM 684-690) from 2010-2013, and 219 trotlines were fished near Vicksburg, MS, (RM 429-443) from 2011-2013. In all, 2,565 shovelnose sturgeon, 110 pallid sturgeon, and 55 morphologically intermediate sturgeon have been captured. Shovelnose sturgeon were the most abundant species collected at each site, and pallid sturgeon were the fourth most abundant species collected. Pallid sturgeon catch rates have been similar each year and similar at both sites (mean CPUE = 0.19 fish per line). Abundance, catch rates, mean lengths, and pallid to shovelnose ratios were similar to those found in previous studies in the Lower Mississippi River. Recapture data has documented some long range movements by sturgeon both upstream and downstream.

Growth and condition of black crappies, *Pomoxis nigromaculatus*, in two West Tennessee small impoundments

Bailey, Chris T[1]. and B. A. Ray[1]

[1]The University of Tennessee, Martin, TN 38237

Black crappies (*Pomoxis nigromaculatus*) were sampled from Brown's Creek Lake and Maple Creek Lake, both of which are small impoundments in west Tennessee that are geographically close (16 km apart) and have similar depths, watersheds and fish communities. Both lakes are managed with the statewide 254-mm minimum length limit for crappies. We assessed population characteristics of crappies in each lake and considered whether the current length limit was suitable for these lakes. Crappies were collected in May and June 2012 by angling and length, weight, and age data were used to determine condition (Wr) and growth rates of captured fish. Age was back-calculated using polished whole-otoliths. Growth of crappies was faster in Maple Creek Lake than Brown's Creek Lake (GLM; *P*-value = 0.04); however, both lakes were found to have slow growing crappie populations. There was no difference in size structure between the two crappie populations, and both lakes were dominated by preferred-size (250 – 300 mm) crappies. No crappies > 280-mm was captured in either lake. Condition of quality-size (200 – 250 mm) crappies was greater in Maple Creek Lake (Wr = 91) than in Brown's Creek Lake (Wr = 85). There was no difference in condition of preferred-size crappies between lakes. Based on condition and growth rates, size structure of crappies in these impoundments may benefit from reduction of the 254-mm minimum length limit.

Stocking Addictions in North America in the 21st Century

Bettoli, Phillip W.[1]

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

The Wild, Wild, West era of exotic species stockings, translocations, and supplemental stockings in North America has come and gone, but stocking programs to meet various demands in inland waters are here to stay. Ill-fated and poorly-conceived stocking programs abound, but many stocking programs are easily defended. For instance, the ability of aging reservoirs to support self-sustaining populations of native species (e.g., walleyes *Sander vitreus*) often declines over time. If proper consideration is given to potential downstream impacts and genetic conservation concerns are addressed, stocking programs that maintain those sport fisheries pose minimal risk and pay rich dividends to society. Stocking protocols have long been available and the science of assessing stocking programs has matured, but biologists face an overarching problem: the angling public and their elected representatives are often addicted to stocking. Unlike some forms of addiction, the costs (e.g., ecological impacts) of a potentially harmful stocking program are not borne directly (or immediately) by the individual. As with some addictions, a stocking addiction often leads to craving more (i.e., more hatchery fish; more waters stocked more often). In practice, it is often difficult to reign in the unbridled enthusiasm of many stakeholders (and some biologists) for stocking programs, even when good alternatives exist. Education and public outreach will be the key to aligning angler expectations with biological realities and ecosystem health. Given the vast scale of inland stocking programs in North America, we have our work cut out for us in the 21st century.

Hydroacoustics survey of fish distribution at a power plant heated discharge

Bevelhimer, Mark[1] and Constantin Scherelis[2]

[1]*Oak Ridge National Laboratory, Oak Ridge, TN 37831*

[2]*The University of Tennessee, Knoxville, TN 37996*

Observations of fish presence in the vicinity of thermal plumes during seasonal thermal extremes often contradict predictions based on laboratory derived thermal tolerance criteria. Quantifying actual exposure in the field will provide a more realistic basis for developing avoidance and upper incipient lethal temperature criteria. The study objective was to document the distribution of fish in the vicinity of the thermal discharge at TVA's Cumberland City Fossil Plant using a boat-mounted hydroacoustics (i.e., split-beam sonar) system. Hydroacoustic surveys will be conducted on several occasions in 2012 and 2013 with an emphasis on mid-summer when both ambient and plume temperatures are the highest. Each survey consisted of replicate hydroacoustics transects at several locations: within the thermal discharge as close to the discharge as able to safely approach with a boat; in the immediate vicinity of the main channel just upstream and downstream of the discharge; and at locations 1-2 km upstream and downstream of the discharge. Survey data were analyzed using a combination of BioSonics and Echoview software to produce a vertical and longitudinal distribution of fish by general size category throughout the survey area. These data were evaluated along with TVA's fish collection data and results from a complementary telemetry study to better estimate the abundance of various fish species within and near the thermal discharge. The results suggest that the discharge area and heated plume are utilized by fish to a larger degree than would be predicted by the thermal preference information for the local species.

Assessing the accuracy of length based mortality estimates

Bies, Jason[1], Cynthia Fox[1], and J. Wesley Neal[1]

Mississippi State University, Department of Wildlife, Fisheries, and Aquaculture, Mississippi State, MS 39762

Mortality is a fundamental determinate of population dynamics, as successful management of a fishery cannot occur without a firm understanding of the rate at which individuals are lost. Direct measures of mortality, via telemetry (fishing and natural mortality) and creel surveys (fishing mortality), provide accurate mortality estimates but are often prohibitive given the costs of both equipment and effort. Likewise, catch curves (total mortality) can be less labor intensive but require accurate age data. Indirect measures of mortality estimation are less intensive, but come with some uncertainty and assumptions. Length-based mortality estimates utilize parameters from the von Bertalanffy growth equation to convert length to age. This precludes the need for age data, which are not available for many tropical fish species due to lack of annuli formation in bony structures. In this study, we compare mortality estimates between creel surveys, sonic telemetry, and length based methods to determine the accuracy and utility of length-based methods in systems where age data are not available. The single point access of the study reservoir and associated complete census of angler effort provide a unique opportunity for comparison of methods of mortality estimation. If length-based models provide accurate mortality estimates, this technique could save time and money for fisheries managers.

Current status of Cumberland arrow darter *(Etheostoma sagitta)* in Tennessee

Carter, Bart[1], Rick Bivens[1], Carl Williams[1], and Michael Floyd[2]

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Cumberland arrow darter *(Etheostoma sagitta)* is restricted to the upper Cumberland River basin of southeastern Kentucky and eastern Tennessee. In Tennessee, it is confined to three counties (Scott, Campbell, and Claiborne) in the Cumberland Mountain ecoregion. Much of the region has been the subject of extensive surface and underground coal mining, logging, oil/gas extraction, and residential development resulting in stream degradation. In 1994 and 2002, the Tennessee Wildlife Resources Agency (TWRA) surveyed multiple streams containing Cumberland arrow darter as part of regional stream assessment activities. During these surveys, Cumberland arrow darter occurred in 32 of the streams surveyed. The objective of this study was to reassess the occurrence of the species in these streams. One pass electrofishing surveys were conducted in the 32 streams between 2011 and 2012 to evaluate the persistence of darters from previous surveys. Darters were present at 24 of the 32 (75%) streams sampled. Thirty-nine sites were surveyed among the 32 streams, with Cumberland arrow darter occurring at 28 (72%) of these sites. Based on our results, it appears that Cumberland arrow darter has remained relatively stable over the 19 year period but it may be absent from eight historical streams. Additional surveys in Scott County streams verified the persistence of Cumberland arrow darter from two streams that were not part of our original 1994 and 2002 surveys. The state-listed Cumberland arrow darter is afforded additional protection because it is sympatric with blackside dace *(Chrosomus cumberlandensis)* in numerous streams across its range. The species is currently a candidate for federal listing with a listing priority of 9.

Co-culture of channel catfish with hybrid catfish facilitates 'herd effect' to improve production performance

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Herd effect is an epidemiological phenomenon, where the presence or proximity of a certain proportion of improved (superior) individuals improve the performance of less improved (normal) individuals. Channel catfish, *Ictalurus puntatus* is the single largest aquaculture species cultured in US. However, catfish production has been declining due to inefficiencies in farming practices and influx of cheap imports. Channel catfish ♀ x blue catfish, I.*furcatus* ♂ F_1 hybrid represent a major improvement in the production efficiency due to its higher growth rate, better survival, and improved production compared to channel catfish under research and commercial conditions. We hypothesize channel catfish in the presence of hybrid catfish at optimal proportions improve the performance traits of channel catfish. To test our hypothesis, we co-cultured channel catfish and hybrid catfish in five proportions (0, 25, 50, 75 and 100%) in six replicated 80 L aquaria under controlled conditions for a 8 week growth study. The second study was repeated in 600 L tanks for 16 weeks. Production traits (growth, feed conversion, and survival) did not differ between the two genotypes at the five proportions. Fish raised in controlled aquaria were subject to disease challenge with *Edwardsiella ictaluri,* the bacterium that causes ESC disease. In this third study, percent mortality of channel catfish when co-habituated with an equal proportion of hybrid catfish was significantly ($P < 0.05$) lower compared to channel catfish co-cultured with the other four proportions of hybrid catfish. The time of the death was also delayed in channel catfish in this treatment. This improved disease protection in channel catfish may be to the attributed to the 'herd effect' phenomenon. This preliminary data suggests that co-culture of channel catfish and hybrid catfish in equal proportions may reduce the cost of raising US farm raised catfish in the catfish industry.

Cumulative stress effects on growth, physiology and fillet quality in channel catfish

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Channel catfish (*Ictalurus punctatus*) represent a significant resource in the Southern United States and are typically cultured in shallow ponds, which can result in drastic environmental changes leading to stress. In addition, sorting, grading and transport during harvest can cause further stress. The cumulative effects of such stress events are altered growth and physiology and diminished fillet quality. The occurrence of red fillets in cultured catfish has increased over the years and is speculated to be due to pre-harvest stress events. This study assessed the effects of cumulative stressors on growth, physiology and fillet quality in channel catfish. Fish were subject to a combination of environmental stressors including temperature (25°C or 33°C) and dissolved oxygen (i.e. 2mg/L or 6mg/L), followed by handling stressors including socking, sorting and transport at high densities. Dissolved oxygen showed a greater effect on growth with respect to length and weight, with increasing stress resulting in a decreased condition factor. Physiological stress response was identified with alterations in hematocrit related to oxygen level in the high temperature treatments and will be evaluated further through chemical analysis of plasma samples. Quality characteristics will be evaluated through sensory and non-sensory methods. Color data suggests that the high-oxygen high-temperature treatment could be integral to the formation of red fillets with all other treatments showing decreased redness over the course of the stress events. These data outline the effects of stress on growth and insight into potential causes of red fillets. Further evaluations of physiological and quality changes are being examined to elicit a deeper understanding of the relationship between stress and quality in channel catfish.

Development of crappie (*Pomoxis* spp.) reproduction methods in closed aquaculture systems

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Crappie (*Pomoxis* spp.) represent some of the most important regional gamefishes in the Southeast, however populations are cyclic. In order to increase population stability, spawning and culture of crappie have been conducted by the North Mississippi Fish Hatchery in Enid, MS. However, techniques have been hampered by the paucity of available information. In order to develop crappie reproduction methods in closed aquaculture systems, three objectives are proposed. The first objective is to develop a protocol for the cryopreservation and activation of black crappie sperm. Experimentation will determine the methods necessary to extend the short-term (1-3 weeks) and long-term (6 months to a year) viability of black crappie semen through the use of three different sperm extender solutions. The second objective will evaluate the viability of induced spawning methods for crappie. White crappie (*Pomoxis annularis*) females and black crappie (*Pomoxis nigromaculatus*) males will be induced to spawn in indoor-tanks using synthetic reproductive hormone (i.e., luteinizing hormone releasing hormone analogue + dopamine blocker or human chorionic gonadotropin) treatments. The third objective will be to assess the potential for out-of-season spawning in white and black crappie using photoperiod and temperature manipulation, using 3-week or 6-week seasonal photoperiod and temperature shifts from winter to summer conditions. Completion of these research objectives will improve production methods for this species, and provide a foundation for future research in closed-system, crappie aquaculture.

Hands-on fish management: Using manual removal to restructure a crowded Largemouth Bass population in Puerto Rico

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Largemouth Bass *Micropterus salmoides floridanus* were stocked in Cerrillos Reservoir in 1997. Within three years, relative weight declined from above 100 to ~80 and the population displayed characteristics of overcrowding, with much of the population composed of fish ≤ 350mm. A protected slot limit (356-508mm) was implemented in 2003 to encourage harvest of smaller bass, protect intermediate-sized bass, and allow for occasional harvest of trophy bass. However, limited effort and angler attitudes towards harvest of small bass maintained the bass crowded situation in the reservoir. Therefore, the regulation was removed early in 2011. Because overcrowding persisted, we conducted an experimental removal of fish from the crowded size classes (200-380mm) in 2012. We removed 2,333 Largemouth Bass equaling 26% of the crowded biomass and 20% of the total biomass. Preliminary data suggest Largemouth Bass condition has improved, with average relative weight increasing from 81 to 87within seven months post-removal. Population sampling in spring 2013 will confirm if the Largemouth Bass population responded to the experimental removal. Computer simulation models will be used to predict population response to various harvest strategies to determine if mechanical removals of Largemouth Bass are a viable management strategy to prevent Largemouth Bass crowding within the reservoir.

Occurrence of Tarpon, *Megalops atlanticus*, leptocephali in Mississippi coastal waters

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Tarpon, *Megalops atlanticus*, are large, migratory elopomorph fish that occur in tropical, subtropical and temperature waters of the Atlantic Ocean, including the Gulf of Mexico (GOM). Based on historic accounts, adult tarpon were abundant in Mississippi coastal waters during early decades of the 20th Century and supported a vibrant recreational fishery. The population began a rapid decline in the 1950's, and, currently, adults are rarely observed in the Mississippi Sound estuary. The cause(s) of the decline is unknown, but coastal development, diminished water quality and associated habitat alteration/loss are among factors presumed linked to the phenomenon and resultant demise of the fishery. Little was known of the biology, habitats and seasonal occurrence of young tarpon in local waters prior to recent Gulf Coast Research Laboratory (GCRL) studies of juvenile tarpon from Mississippi estuarine bays and marshland tidal sloughs (2007 - 2013). Tarpon larvae (leptocephali) were rare in historic GCRL research collections (N=6, pre-metamorphic, 24.0 - 27.8 mm FL) prior to summer/fall 2013 during which GCRL directed sampling using a beam plankton trawl (BPL, 750µm mesh) pulled by hand along the shoreline at fixed stations (< 1.5m depth) during daytime resulted in an unprecedented capture of 40 pre-metamorphic larvae (20.2 - 28.7 mm FL). Leptocephali were collected July - October at surface water temperatures and salinities of 24.8 - 34.1°C and 13.4 - 28.9 ppt., respectively. The source of the leptocephali is unknown, but based on recent evidence of spawning capable tarpon from the northern GOM, it is presumed the larvae were dispersed from suspected summer spawning grounds offshore Mississippi into local estuaries. Funding from the Mississippi Department of Marine Resources in support of our recent and forthcoming tarpon research enables data collection and analysis critical to understanding tarpon life stage dynamics and habitat requirements in coastal Mississippi waters and the northern GOM.

Otoliths of rare or uncommon fishes in Gulf Coast Research Laboratory samples

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Age determination of teleost fish by otolith analysis is integral in determining the life history parameters for fish populations and essential for effective fisheries management. Publications that describe otolith collection, removal, and analytical techniques are common, and recent photographic atlases provide support for determining source species. However, due to the high diversity of species in the Gulf of Mexico, these resources often focus on species of significant commercial value and/or management interest. Routine Gulf Coast Research Laboratory (GCRL) field sampling efforts, as well as collections taken during recreational fishing venues or on commercial fisheries docks, present opportunities for otolith collection from rare or uncommon species. Photographs and general descriptions of sagittal otoliths from several of these species are presented herein. As otoliths are often found in fish stomach contents, having a resource for identifying rare/uncommon otoliths would be an invaluable tool in support of better understanding the ecology of Gulf fishes as a whole.

Proceed with caution when implementing a mixed receiver model passive acoustic array design

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Passive acoustic telemetry has become a popular and powerful tool to facilitate continuous long-term spatial and temporal monitoring of aquatic species. Receiver models vary in their ability to detect acoustic transmitters using either a mono-frequency signal-channel system (e.g. VEMCO Ltd. VR2W), or a system that is able to scan multiple frequencies across numerous channels (e.g. Sonotronics, Inc. SUR-3). Strategically positioned acoustic receiver arrays can provide insight about movement patterns and behavior of acoustically-tagged organisms; however, accurate interpretation of acoustic data requires an understanding of receiver transmitter detection probabilities. In an ongoing study monitoring acoustically-tagged Gulf-strain *Morone saxatilis* in the Biloxi River, MS, our passive array was initially comprised of VR2W and SUR-3 receivers. Given the mix of receiver types, we could not assume homogeneity of detection efficiencies between receiver models. A controlled experiment comparing receiver transmitter detection probabilities was conducted in both fresh and brackish water environments using multiple transmitter types with varying power outputs (dB) (VEMCO Ltd. V7 (136 dB), V9 (145-151 dB) and V13 (147-153 dB)). Transmitter detection efficiency significantly differed among receiver models, environment condition, and transmitter type. Differences in transmitter detection efficiency between VR2W and SUR-3 receivers in brackish conditions ranged from 4.3% to 13.0% based on transmitter type, but these differences were not significant by transmitter power outputs. In freshwater, transmitter detection efficiency was statistically different for V9 ($p=0.001$) and V13 ($p<0.0001$) transmitters, with VR2W receivers recording on average 16.7% and 12.6% more detections than SUR-3 receivers. Interestingly, V7 transmitter detection efficiency was higher, although not significant, for SUR-3 receivers than VR2Ws in both fresh and brackish water environments. Our findings emphasize the importance of accounting for inconsistencies between receiver models, environment conditions, and transmitter power outputs when interpreting passive acoustic telemetry data.

Current brook trout distribution in Tennessee

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Conservation of Tennessee's wild brook trout *Salvelinus fontinalis* is an important management goal because of their significant roles in ecological integrity, biological diversity, and sportfishing legacy. Accordingly, a new survey of all brook trout streams outside Great Smoky Mountains National Park was completed during 2011-2013 to inventory the current resource, determine changes in the downstream distributional limit of each population, and identify any associated causes. Overall, there was a net distribution loss of 6% (14.1 km) since the last survey conducted during the 1990s. The losses included 10 entire populations (12.7 km), but only two of these were replaced by nonnative rainbow trout *Oncorhynchus mykiss*. Brook trout sustained a net loss of 14.7 km (13%) in 48 streams open to nonnative salmonid invasion and with no restoration or enhancement efforts since the 1990s. However, brook trout also recolonized two streams and potentially re-established two metapopulations, while restoration/enhancement projects added 5.9 km of distribution in three streams. Three previously-undocumented brook trout populations (3.6 km) were also identified during the past decade. Currently, brook trout inhabit 228.9 km in 103 Tennessee streams, which is similar to the distribution totals for the previous survey (106 streams, 237 km). Movements of lower brook trout distributional limits in many streams are likely transitional changes ("ebb and flow") linked to a host of factors interacting at a local scale (especially stream flows). While some additional populations may be lost, particularly where habitat is marginal, Tennessee's brook trout resource appears to be more secure than it once did. Future brook trout restoration efforts should consider the Nolichucky watershed, which currently has no native southern Appalachian brook trout populations, and the Watauga watershed, which lost 20 km (20%) of its brook trout distribution since the 1990s.

Impact of EPA's new 316 (b) regulations on aquatic resources and fishery professionals

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EPA has promulgated new 316(b) regulations in an effort to reduce the impact of once through cooling water on aquatic resources. Fishery professionals now will be drawn into discussions of whether or not certain engineering controls are sufficient to meet regulatory requirements for reducing impingement and entrainment mortality, as well as the impact on threatened and endangered species. Understanding how implementation of the new 316(b) rules will affect aquatic resources will become part of the fisheries management biologist job responsibilities. Here we attempt to explain how fishery managers may be involved in this process.

Reproduction of the blacknose shark, *Carcharhinus acronotus*, in the northern Gulf of Mexico

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The blacknose shark, *Carcharhinus acronotus*, is a small coastal shark commonly encountered in the northern Gulf of Mexico. Reproductive analyses of this species conducted off the east coast of the United States and in the eastern Gulf of Mexico have shown variations in reproductive traits; however, the studies did not use standardized protocols, which make direct comparisons difficult. During the current study blacknose sharks were sampled from the entire northern Gulf of Mexico and examined to provide a more comprehensive estimate of the reproductive parameters associated with this population. Six hundred and seven blacknose sharks were captured by gillnet or long line in the northern Gulf from 2008 - 2013 (males: n = 347, 350 to 1076 mm fork length (FL); females: n = 260, 342 to 1120 mm FL). The size at 50 % maturity was 800 and 822 mm FL for males and females, respectively. Male gonadosomatic index (*I*G) and testis length and width reached maximum levels in May suggesting a peak in sperm production. Female *I*G and maximum follicle diameters were highest in June, indicating ovulation occurred near this time. Embryos ranged in size from 42.1 mm stretched total length (STL) in August, to 467 mm STL in May, with an average brood size of 3.6 and a 1:0.95 female to male ratio. These data indicate a mating period in July/August, and parturition occurring in May/June, yielding an 11 month gestation period. The majority of the individuals in this population exhibited annual reproductive periodicity.

Investigation of movement patterns of lake sturgeon in the Upper Tennessee River: (Gaining a better understanding of population demographics through tagging)

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The lake sturgeon reintroduction program is an interagency cooperative project initiated in 2000, with releases of juveniles and fingerlings from wild broodstock Since that time, over 140,000 fish have been stocked. Recent monitoring, captures, and angler reports indicate these sturgeon are surviving, growing, and dispersing throughout the accessible mainstem Tennessee River and large tributaries. We established an array of acoustic monitoring receivers in the upper Tennessee River and large tributaries to study the movement patterns of resident lake sturgeon. In August 2013, we deployed, mapped, and range tested acoustic monitoring receivers at select locations around known concentrations of lake sturgeon, at locks/dams, and along tributary streams in eastern Tennessee. In November 2013, we surgically implanted resident lake sturgeon (n=42) of hatchery origin with coded acoustic tags. Acoustic coded tags have a battery life expectancy of 5-6 years. Acoustic monitoring receivers will be checked and data offloaded regularly in order to map the gross movement patterns of lake sturgeon Additional data will be gathered with a mobile acoustic receiver from a roving boat. We are eager to identify the daily, seasonal, and annual movement patterns of individual sturgeons in the upper Tennessee River. Because the earliest stocked fish are approaching reproductive age/size classes, we anticipate upstream spawning movements and to observe associated behaviors.

Age and growth of the finetooth shark, *Carcharhinus isodon*, in the northern Gulf of Mexico

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Finetooth shark, *Carcharhinus isodon*, age and growth studies have been conducted in the western North Atlantic Ocean and a discrete area in the eastern Gulf of Mexico (GOM). Variability in the resulting age estimates was evident between the two geographic locations. The goal of this study was to collect finetooth from a wider geographic region in the northern GOM to provide a better representation of the population for age and growth estimates. Sharks were collected monthly from 2011-2013, by gillnet and longline in coastal waters from Louisiana to the Florida panhandle. Four hundred and fifty-four specimens were collected (males: n = 148, 397 - 1119 mm FL; females: n = 306, 420 - 1384 mm FL) and vertebrae were removed from each individual and prepared for analysis. Two independent readers, with no prior knowledge of specimen size, date of capture, or previous counts, were used to count growth bands. A three-parameter von Bertalanffy growth curve (VBGF) was fit to the length at age data. Estimated ages ranged from 0.0 to 6.5 and 0.0 to 9.4 years for male and females, respectively. The length and age at which 50% of the population was mature was 959 mm FL and 3.2 years for males and 1034 mm FL and 3.9 years for females. Theoretical maximum size (L_{inf}) and growth constant (k) estimates were 1144 and 1277 mm FL and 0.40 and 0.31 for males and females, respectively. All reported values are comparable to those found by the previous study on finetooth from the eastern Gulf of Mexico. As the VBGF estimates generated in the current study are from a wider geographical area and are based on a larger sample size, we feel that these estimates are more representative of the northern Gulf region as a whole.

Northern Gulf of Mexico whale shark research program: what we have learned about whale shark aggregations in the northern Gulf of Mexico

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The *Northern Gulf of Mexico Whale Shark Research Program* was initiated in 2003 to increase our knowledge of whale shark occurrence and distribution within the region. A primary component of this program is a whale shark sighting website, which accommodates reports of regional sightings by "citizen scientists." Whale sharks aggregate in areas of high prey abundance and our hope was to examine factors driving this behavior in the northern Gulf of Mexico. To date, over 600 whale shark sighting reports have been received. Reports were provided by a number of groups, including recreational anglers, divers, helicopter pilots and petroleum industry personnel and were categorized as sightings of solitary individuals, small aggregations (2-9 individuals) or large aggregations (10 or more individuals). Whale shark aggregations represented 190 (31%) of reported sightings, 47 (25%) of which were large aggregations between 10-150 individuals. All of the reported large aggregations occurred during summer, almost exclusively along the continental shelf edge, with 19 (41%) occurring at Ewing Bank off Louisiana. Directed research efforts were made to encounter aggregations to determine the size and sex of the sharks within the aggregation and to identify the primary prey source(s) by collecting plankton samples. Four aggregations were encountered and appeared to consist of largely juvenile males that were feeding on little tunny (*Euthynnus alletteratus*) eggs. The use of sightings data provided by "citizen scientists" has proven to be an inexpensive and effective technique for characterizing whale shark distribution, seasonality and aggregation locations in the northern Gulf of Mexico.

Anthropogenic induced decline and restoration of Tennessee's mussel fauna

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The State of Tennessee has historically supported ~130 of the nation's 300 native freshwater mussel species. The Tennessee and Cumberland River systems compose the Cumberlandian Region. Historically, this region supported the richest freshwater mussel (Bivalvia: Unionacea) fauna in the world with at least 107 mussel taxa in the families Unionidae and Margaritiferidae. Greater than one-third of this fauna is endemic to the region. Freshwater mussels are proportionally the most imperiled group of animals in the state of Tennessee and in the United States. Dozens of major impoundments, altered thermal, hydrologic and chemical regimes downstream from dams, episodic and chronic chemical spills, channelization, mining activities and sedimentation have contributed to the demise of this extraordinary fauna resulting in the extinction or significant decline of over 70% of the mussel species. Within Tennessee, the U.S. Fish and Wildlife Service has listed 45 mussel species as endangered under provisions of the Endangered Species Act of 1973. Fourteen species known from the region, including several endemics, are now considered to be extinct. Numbers of imperiled mussel species continue to increase as divergent forms are recognized and other taxa continue to decline. Focused research during the last two decades has developed conservation strategies aimed at reversing this downward trend. These strategies include reservoir release minimum flow and water quality improvements, development of mussel population assessment, propagation, and restoration techniques.

Assessment of native brook trout propagation for restoring Tennessee populations

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Brook trout *Salvelinus fontinalis* are the only salmonid native to Tennessee and currently only occupy 3% of their historic range. Populations have declined as a result of habitat loss and interspecific competition with introduced salmonids. Management practices typically involve translocation to restore extirpated populations. Captive propagation and stocking of fingerlings is an additional restoration tool that is being explored. During fall 2013, broodstock were collected from two streams, Sycamore Creek and Left Prong Hampton Creek, by backpack electrofishing. Broodstock collected in 2012 were held over for grow-out at two hatcheries, Tellico Trout Hatchery (TTH) and Tennessee Aquarium Conservation Institute (TNACI). All broodstock were artificially spawned using the dry method of fertilization once a week for 5 weeks. Egg and milt production, total length, weight and relative weight (W_r) were measured and compared between 2012 and 2013 broodstock for each stream. In addition, incubation period (accumulated thermal units) for eggs to eyed stage and 50% hatch of alevins was enumerated. Holdover broodstock from 2012 were larger and produced more gametes than did 2013 wild broodstock. After fertilization, eggs were distributed to three hatchery facilities each with a unique water source: surface water (TTH), municipal recirculation (TNACI) and spring water (Erwin Trout Hatchery). Hatchery methods, water chemistry and survival rate post-stocking will be compared for each hatchery to determine the best propagation protocol for this species.

Stocking Florida largemouth bass, *M.s. floridanus,* to enhance the quality of a largemouth bass fishery in Chickamauga Reservoir

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In an effort to enhance the fishing quality for largemouth bass (LMB) in Chickamauga Reservoir, the Tennessee Wildlife Resources Agency (TWRA) initiated a Florida largemouth bass, *M.s. floridanus,* (FLMB) stocking project in the year 2000. The goal was to stock Chickamauga annually, until Florida bass genes comprise at least 15% of the LMB population genome. A pre-stocking survey of LMB was conducted revealing an 8% frequency of FLMB alleles. In 2002 genetic tests revealed that only 0.8% of fish tested expressed FLMB genes. In 2004 the stocking strategy shifted from a reservoir wide approach to focusing on three embayments. Data collections conducted in 2010 showed a 33.7% influence of FLMB genes into the LMB population genome within these three embayments. Largemouth bass collected via spring electrofishing surveys from mid to lower reservoir in 2012 showed that FLMB genes were present in 45% of the LMB genome. The majority (77%) of the LMB from this 2012 survey were backcrosses. In 2013, fin clips from LMB greater than eight pounds were collected at tournaments and from individual anglers; genetic tests determined that most (75%) of these large fish were hybrids. Genetic tests conducted throughout the project have yielded few pure FLMB. Over two million FLMB fingerlings have been stocked since the project was initiated. There has been an increase in the number of trophy bass caught and historic LMB tournament weights have elevated Chickamauga Reservoir into the national spotlight making it a "hotspot" destination for bass fishermen. More studies will be conducted in the future to further evaluate distribution and effects of FLMB genes into the overall LMB population genome. This project continues to be very popular with the bass angling public and has contributed well to local economies.

Investigating fish-biofilm relationships using exclusion cages: a design comparison

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Fish influence biofilm communities directly through the consumption of algae, and indirectly through the formation chemical 'hotspots' and removal of grazing invertebrates. Removing the grazing components (i.e., invertebrates and algivorous fish) from the food web is needed to isolate the effects of fish on stream biofilms. Exclusion practices utilized to exclude fish often cannot exclude most invertebrates, but common designs used to exclude both groups inherently alter natural water movement and/or light available to algae on substrata, particularly when cages are submersed in lotic systems. We combined lab and field assessments of cage materials and structural designs to determine which model promotes the most realistic colonization by algae in the absence of fish and macroinvertebrate grazers. We compared the effects of cage materials and dimensions on water flow in a laboratory flume and light penetration using a scanning spectrophotometer. Based on results from laboratory experiments, several exclusion designs were deployed in a second order, cobble-dominated stream to assess differences in algae colonization among models. The benefits and limitations of various cage designs in the context of *in situ* experiments investigating fish-biofilm relationships will be presented.

Consumptive effects of fish predators drive composition of emerging dragonfly assemblages in structured and unstructured habitats

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Recent work suggests non-consumptive effects of predators on prey may be as or more important than consumptive effects in shaping prey communities. For organisms with complex life histories (e.g., semi-aquatic insects, anurans), predator-averse oviposition patterns or post-colonization mortality might produce correlations of predators and prey. Site-selective oviposition among dragonflies has not been well-studied, but some populations appear to be structured by predators. To determine the effects of local predators on dragonfly oviposition patterns and larval emergence, we manipulated the presence of a surface-feeding, small-bodied fish predator (eastern mosquitofish, *Gambusia holbrooki*) in structured and unstructured (submerged aquatic vegetation, *Utricularia* spp.) mesocosms. We made 381 hours of oviposition observations (n = 228 total observations) and collected and identified exuvia (n = 323 exuvia) over a full year. Ovipositing dragonflies (Family: Libellulidae) did not avoid mesocosms with fish predators regardless of structure presence. In all cases, oviposition patterns could not account for emergence patterns. No dragonflies emerged from unstructured habitats that contained mosquitofish. In sum, we found that libellulid dragonflies can be severely limited by direct consumptive effects of small-bodied fish, and we found no evidence that predator avoidance by ovipositing females affects their distribution.

The secondary stress response of the Atlantic stingray to prolonged air exposure

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Many species of elasmobranch fishes are commonly caught as bycatch in recreational and commercial fisheries. In some circumstances, captured animals may face long bouts of air exposure, resulting in physiological pressures that can either be lethal or detrimental to overall health. With the number of threatened elasmobranch species on the rise, interest in conservation efforts has increased. Understanding how elasmobranchs respond to different types of stress is an essential component of these endeavors, and additional research in this area is warranted. In this experiment we sought to characterize the stress response of the Atlantic stingray, *Dasyatis sabina*. Eleven mature male *D. sabina* were exposed to air for thirty minutes to induce primary and secondary stress responses. Blood samples were taken at 0, 15, and 30 minutes, with a recovery sample at 48 hours. During air exposure, blood lactate, PCO_2, and acidosis significantly increased, indicating a strong secondary stress response. At 48 hours these parameters were fully recovered to basal levels. Our results also include measurements of plasma osmolality, chloride, urea, and glucose in response to air exposure stress. Despite the severity of the stressor and apparent poor condition of stingrays at 30 minutes, only a single mortality was observed during the week following air exposure. The deceased individual showed signs of a compromised immune system, potentially due to long term effects of the stressor and the resulting physiological response. However, the overall high survival rate that was observed is testament to the resiliency of these animals.

Assessment of Mississippi's red drum (*Sciaenops ocellatus*) fishery

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Although the commercial fishery for red drum has been closed in federal waters since 1987, it is regulated by a quota in Mississippi's state waters and continues to be one of the major targets of the recreational fishing sector in Mississippi. In 2012, an estimated 126,667 fish ranging in size from the minimum size limit of 18" to 39" were landed in state waters. The fishery in Mississippi is currently managed using an estimate of "escapement", specifically what percent of fish "escape" fishing mortality to reach age-4, relative to an un-fished population. The target escapement rate is 40%. It is not clear whether this rule of thumb level of escapement is adequate for sustainability nor is it possible to evaluate the risks of alternative management strategies. A challenge to Mississippi's resource managers, whether they are concerned with maximizing near- and mid-term harvest or long-term sustainability of harvested stocks is to understand how management decisions impact sustainability and resilience of biological resources. The work discussed here will address the needs of Mississippi's Department of Marine Resources to better understand the dynamics of Mississippi's red drum fishery by using two modeling approaches, the first is a per-recruit model and the second a surplus production model (SPM, often called a biomass dynamics) model. I will review the preliminary results of these models and also discuss the data needs and refinements that must be made in order to evaluate the current and proposed size and bag limits and determine the fishery and stock status of the red drum fishery.

Using floating streambed wetlands to reduce eutrophication and improve habitat

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Eutrophication is a major concern for both inland and coastal water bodies. Excessive nutrients, particularly nitrogen and phosphorous, enter aquatic systems by way of point and nonpoint sources. Traditional remediation efforts to lessen nutrient loading, such as buffer zones and retention ponds, focus on reducing the delivery of nutrients from their sources. As human populations grow and agriculture intensifies, these efforts to reduce nutrient input alone may be insufficient. However, new technology allows the potential to remediate nutrients within aquatic systems and prevent downstream transport. The floating streambed wetland (FSW) is a hydroponic system that, when fully vegetated, is essentially a wetland that floats on the surface of the water. These devices actively circulate water, bringing nutrients to the vegetation and periphyton growing in the FSW matrix, which remove the nutrients from the water for assimilation. Manufacturer data suggest this design is highly effective in nutrient remediation, prevents the formation of an oxycline and thermocline, and increases available habitat for aquatic organisms. These claims have not yet been independently or scientifically evaluated. This research proposes to evaluate the efficacy of the FSW for reducing nutrient concentrations, for improving water quality, and for increasing fish habitat and production using replicated experimental design. The first objective is to evaluate nutrient sequestration, water quality improvement, and fish production in ponds with FSW systems compared to controls. The second objective will determine optimal areal coverage of FSW to maximize physicochemical and biological effects. The third objective will be to create and test models that predict FSW efficacy in larger systems. Results from this research will have tremendous potential in water quality management and reduction of anthropogenic degradation of aquatic habitats.

The paddlefish fishery in Mississippi, 2007-2013

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The Wildlife Commission closed the state to commercial harvest of paddlefish in May 2007, then re-opened the fishery to residents in December 2008 with regulations that make the Mississippi commercial Paddlefish fishery one of the most tightly regulated fisheries, anywhere. Special permits are needed to harvest Paddlefish for roe and all harvested paddlefish have to be tagged and the harvest reported within 24 hours. Harvest is regulated by restricting the number of harvesters, imposing a 37 inch (EFL) minimum length limit, establishing refuges within open rivers, and limiting the length of seasons. Three persons participated in the fishery for the 2008-2009 and 2009-2010 seasons. During the first season only border waters with Arkansas were open; 55 Paddlefish were caught with 26 harvested that had 73 lbs. of eggs (raw wt.). The next year paddlefish were harvested from border waters with AR and the Sunflower River. 1,163 Paddlefish were caught; 175 were harvested with 602.14 lbs. of caviar processed**.** The 2010-2011 season was exceptional as 8 persons were permitted to harvest paddlefish from 5 zones - AR border waters, Sunflower River, Coldwater River, Bear Creek, and Moon Lake. That season there were 11,810 captures, with a harvest of 2,405 Paddlefish that produced 11,186 pounds of caviar; over half of the caviar produced was from fish harvested on Moon Lake. There were 1,574 Paddlefish harvested during the 2011-2012 season, and 851 during the 2012-2013 season: Caviar production was 4,532 pounds and 3,504 pounds, respectively. Of the 19,924 captures from the 2010-2011, 2011-2012 and 2012-2013 seasons 2,716 of those released Paddlefish were thought to have eggs. Although harvesters appear to have been efficient in cropping large Paddlefish from the open portion of the Sunflower River, the harvesters can still encounter as many as 80 paddlefish in a day of fishing.

High definition stream surveys: Fish habitat at the riverscape scale

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As fisheries professionals, we develop models representing stream and water quality conditions as the basis for response to many management issues. However, most of these models are based on point samples or descriptions of short (several 100m) sections of stream or rivers. By using a new multi-attribute stream survey technique that integrates GPS, video, depth, water chemistry, and side-scan sensors, it is now feasible to survey many miles of stream (10 to 15 miles typically) in a single day with data collected approximately every meter. This new surveying approach can rapidly and cost-effectively transform the data-poor stream reaches into multi-attribute, high-resolution maps of the stream, stream channel, and water quality conditions. This output allows resource managers to move from statistical assumptions about the "average condition" of a stream based on a few small samples to a census of conditions with highly accurate, site-specific data available. All of the data collected is georeferenced and can be classified in GIS software to support multiple management objectives. As an example of the application potential of the multi-attribute stream survey technique, a number of recent studies in which we have been involved are highlighted. These projects address issues associated with classifying stream bank erosion susceptibility, monitoring the effects of dam removal, and determining habitat loss for endangered species. These case studies show the range of data collected and its utility in GIS mapping, hydrologic modeling, habitat identification, and overall stream health applications

Radio tracking crappies in Sardis and Enid Reservoirs

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Using radio telemetry, white, *Pomoxis annularis* and black, *P. nigromaculatus* crappies were tracked between January and May to encompass the spawning period. In Sardis Reservoir, tracking was conducted during 2010 and 2011 and in Enid Reservoir during 2012 and 2013. Advanced telemetry systems radio transmitter tags were used on all fish and, in 2013, Lotek archival tags were attached to fish. Fish locations were determined using an omni-directional antenna and receiver, by slowly motoring across the reservoir in a consistent search pattern to cover as much of the reservoir as possible. When a signal was detected the location of the fish was pinpointed by finding the location that maximized signal strength. Water temperature, depth, and GPS location was recorded at each site. Over the entirety of the project, we tagged 135 fish with radio transmitters, attached archival tags to 10 fish, spent 147 days tracking, and located fish on 848 occasions. Crappies were found to be far more active than anticipated, frequently covering almost the entire length of the reservoir in a few days. Movement was more restricted during the spawn and, in some cases, crappie were observed to move far up into creeks and rivers. Returns of archival tags provided detailed information regarding depth and temperature of individual fish over extended time periods.

Ontogeny of the cortisol stress response in channel catfish (*Ictalurus punctatus*)

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Cortisol is a glucocorticoid hormone which is an endocrine signaling molecule in all vertebrates and acts through intracellular glucocorticoid receptors (GR). Cortisol affects many biological functions including immunity, stress, growth, ion homeostasis, and reproduction. The objective of this study was to investigate the ontogeny of the cortisol stress response in channel catfish (*Ictalurus punctatus*) at several early life stages. Resting and stress-induced cortisol levels and two GR (GR-1 and GR-2) were measured. Resting cortisol levels in newly fertilized eggs averaged 2.4 ± 0.2 ng/egg and decreased to 0.4 ± .01 ng/egg by day 5. Cortisol levels in newly fertilized eggs subjected to an acute stress (lowered oxygen from 6 ppm to 2 ppm) averaged 2.3 ± 0.1 ng/egg and decreased to 0.3 ± .03 ng/egg by day 5. At hatching, resting cortisol levels were 2.4 ± 0.1 ng/0.1g tissue while levels increased to 8.3 ± 0.2 ng/0.1g tissue in fry subjected to an acute stress ($P < 0.05$). Four days post-hatch, resting cortisol levels were 8.3 ± 0.1 ng/0.1g tissue while levels increased to 14.9 ± 0.4 ng/0.1g tissue in fry subjected to an acute stress ($P < 0.01$). There was no significant difference between GR-1 and GR-2 mRNA in stressed and unstressed embryos. Four days post-hatch, GR-1 mRNA increased 2-fold while GR-2 mRNA increased 3-fold in fry that were subjected to low oxygen ($P < 0.05$). These results indicate that cortisol biosynthesis, integration and maturation of the hypothalamic-pituitary-interrenal (HPI) axis can be observed in channel catfish at hatching. Maternal cortisol may be responsible for levels of cortisol detected at fertilization and throughout embryonic development.

Spatial Distribution of Threats to Paddlefish Populations across the Southeastern United States

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Paddlefish are among the most mobile freshwater fishes in North America, capable of movements exceeding 1,500 km. However, this mobility combined with declines throughout many parts of their range presents a unique set of challenges for fisheries conservation and management. A key component for creating proactive and resilient management of this species is understanding the spatial distribution both of paddlefish populations and current and future threats to these populations. In this talk, I will describe the spatial distribution of current and future threats to paddlefish across the Southeastern United States focusing specifically on the impact of current and future hydropower. I will also use this talk to highlight areas where greater research is needed.

Changes in osmoregulatory ability of juvenile Gulf killifish *Fundulus grandis*

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Gulf killifish *Fundulus grandis* are a euryhaline fish species native to coastal estuaries of the Gulf of Mexico. This species is a popular baitfish and could help diversify aquaculture production in the southeastern US. In order to assess whether inland culture is feasible, this research has focused on the challenges posed by low salinity culture and the physiological changes that affect killifish performance in hypo-osmotic conditions. In an initial experiment, embryo and larval survival were measured for air incubated eggs and larvae up to 2 weeks post-hatch in either 0ppt, 7ppt, or a sequential combination of these salinities. Survival and growth of both the embryos and larvae were higher in 7ppt conditions than freshwater conditions, leading to the hypothesis that Gulf killifish hypo-osmotic tolerance may improve at a later age. In the second experiment, killifish were challenged with low salinity treatments of 0, 2.5, 5, and 7.5ppt at 2, 7, and 12 weeks post-hatch for four weeks to determine growth, survival, gill Na^+, K^+-ATPase activity, and whole body ion content. Gill Na^+, K^+-ATPase and whole body ion samples were taken at 0, 2, 14, and 28 days post-transfer for each age group. Preliminary results indicate Gulf killifish at 2 weeks post-hatch grew and survived as well at 2.5 ppt as at higher salinities but growth was reduced in freshwater. At 7 and 12 weeks post-hatch, freshwater survival and growth rates were comparable to other salinity treatments. These results suggest low salinity levels are feasible for killifish culture, and stocking of freshwater ponds will be more successful after 7 weeks post-hatch.

Habitat conservation update from the Southeast Aquatic Resource Partnership (SARP)

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The Southeast Aquatic Resource Partnership (SARP), as part of the National Fish Habitat Action Plan, works to develop regional priorities for fish and aquatic habitat conservation and facilitate local projects that address the regional priorities. SARP and its partners and member agencies have developed and are developing decision support tools and habitat assessments to provide managers better information regarding the state of aquatic habitats in the region and support more targeted and focused conservation of those habitats. Products include an assessment of land use in riparian areas, an aquatic habitat connectivity assessment and a dam removal workshop, an assessment of estuary habitat conditions in the Gulf of Mexico and an alligator gar habitat suitability map. This presentation will provide an overview of selected recent activities and products of SARP and its members and recent developments in habitat conservation in the states of Mississippi and Tennessee and throughout the southeast region. We will also discuss on-the-ground habitat conservation projects in these states, and future opportunities for potential funding of aquatic habitat conservation projects.

Stocking efficacy and catch-and-release mortality of Sauger in the Cumberland River in Tennessee

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Abstract: Sauger *Sander canadense* in the tailwaters of several Tennessee impoundments represent the largest percid fisheries in the southeast USA. However, declining Sauger populations have been evident since historical spawning migrations were blocked by dams. The Tennessee Wildlife Resources Agency annually stocks Sauger to augment recruitment, but little is known about the success of the stocking program in the Cumberland River. Because Saugers are seasonally very vulnerable to anglers in tailwaters, it is important to evaluate the population-level effects of catch-and-release (CR) mortality. The objectives of this research are to (1) assess the efficacy of the Sauger stocking program and (2) estimate CR mortality. Fin clips were collected from Sauger broodstock in 2012 and 2013 and their progeny were stocked into Old Hickory Lake. Sauger were subsequently captured using gillnets and fin clips were collected from all age-1 fish for genetic analysis of microsatellite loci to identify their natal origin (i.e., hatchery or wild). To estimate the instantaneous mortality rate associated with CR fishing, Saugers implanted with radio transmitters are also tagged with an external high-reward ($100) tag. Tag-return data on telemetered individuals will allow the estimation of exploitation, release rates, and instantaneous rate of CR mortality.

Temperature selection of fishes near a power plant thermal plume

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Laboratory-derived thermal preferences of fishes frequently dictate power plant discharge protocols. To better understand thermal tolerances and develop more accurate criteria, especially during the summer months, 47 fish were tagged with temperature-sensing ultrasonic transmitters and monitored with continuous telemetry to record thermoregulatory behavior in and around the heated discharge at the Tennessee Valley Authority's Cumberland Steam Plant on the Cumberland River. An array of submersible ultrasonic receivers (SURs) during the summer of 2013 in the vicinity of the discharge logged thousands of observations on the temperatures used by several species, including Channel Catfish *Ictalurus punctatus*, Smallmouth Buffalo *Ictiobus bubalus,* and Largemouth Bass *Micropterus salmoides*. Tagged fish spent at least some time in the thermal plume, though each species used the heated discharge differently. Largemouth Bass were frequently detected in the SUR array but only occasionally used the plume. Smallmouth Buffalo were often in the array but rarely used the plume if mainstem river temperatures exceeded 26°C. Channel Catfish were rarely observed in the array, but used the plume frequently when in the array. Channel Catfish were observed in temperatures as high as 35°C.

Muskellunge management in Tennessee: History and recent research

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Native Muskellunge *Esox masquinongy* in Tennessee were nearly extirpated in the 1970s due to habitat loss, principally from coal mining. Muskellunge were introduced into the Caney Fork River system in 1976 to hedge against the loss of native Muskellunge elsewhere in Tennessee. Advanced fingerlings have been stocked sporadically since then and fish longer than 1,300 mm have been caught in recent years. The post-stocking fate of two cohorts of radio-tagged advanced fingerlings was monitored in a tributary of the Caney Fork River in 2012. Mortality pooled over both cohorts was 79% after 56 d and the cohort that dispersed the farthest suffered the highest mortality. Predators of stocked fish included River Otters *Lutra canadensis* and Great Blue Herons *Ardea herodias*. Seine and electrofishing surveys of nursery habitats documented natural reproduction by Muskellunge in three of four Caney Fork River tributaries and that stocking program is now under critical review. In Melton Hill Lake, a mainstem impoundment in the headwaters of the Tennessee River system, a trophy Muskellunge fishery developed fairly quickly after a fingerling stocking program commenced in 1998. No natural reproduction has been documented and that reservoir fishery relies on an annual stocking program. Managers and angler groups are concerned that large numbers of adult Muskellunge may be overexploited when they concentrate into the thermal discharge of a steam plant in the winter. As anglers from across the country come to Tennessee for Muskellunge, managers should continue to observe the effects of increasing fishing pressure statewide.

Population characteristics of flathead catfish in the Lower Tennessee-Tombigbee Waterway

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Flathead Catfish (*Pylodictus olivaris*) were evaluated in 3 Northeast Mississippi lakes (Aberdeen, Columbus, and Aliceville) along the lower Tennessee-Tombigbee Waterway to provide baseline information on population characteristics. Specifically, we were interested in gathering information on fish condition, relative abundance, growth, and size structure. This information will be used to help guide future Flathead Catfish management in Mississippi, as little is known about our current populations. Fish were sampled during the late summer (July-August) from 2011-2013 using low-frequency pulsed DC electrofishing operated in low range (170-340 V) at 15-30 pps, and percent range was manually adjusted to achieve between 1-2 A output. All fish were measured for total length (mm) and weight (g). Age and growth determination was gained by extracting a pectoral spine, and sectioning through the articulating process using a low-sped isomet saw for all fish ≥ 250mm TL. Based on our results, all three lakes appear to be very similar to each other, and other lakes in the Southeast. Time to reach quality length (510 mm) was nearly identical for all three lakes; however, it took Aberdeen Flathead Catfish approximately 1 year longer to reach stock size (350 mm) than it did Columbus or Aliceville. Aberdeen had the highest catch rate (19.2 fish/mile) when compared to Columbus (7.54 fish/mile) and Aliceville (8.67 fish/mile). All three populations appear to contain healthy Flathead Catfish populations, however, habitat continues to be the main concern for these populations as the Tenn-Tom Waterway ages and sedimentation continues.

Examination at the ichthyoplankton community assemblage of the Loop Current and *Sargassum* habitats in the Gulf of Mexico

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Ichthyoplankton in the Gulf of Mexico (GOM) aggregate in two different habitats that serve to provide refuge and concentrate prey in an otherwise oligotrophic environment: the Loop Current (LC) a mesoscale oceanographic feature characterized by subtle gradients in salinity, temperature, chlorophyll *a* and *Sargassum* comprised of floating masses of the pelagic macroalgae *Sargassum spp.* The objectives of this study were to characterize the density and community composition of ichthyoplankton within these habitats. We defined three LC zones that were sampled along transects (n=10) perpendicular to the current flow: "outside, "transition", and "inside". Of the 53 LC samples we caught 18,417 ichthyoplankton from 56 families. *Sargassum* was characterized by the morphology of the patch (large mats, scattered mats, patchy windrows, and windrows) and ichthyoplankton was sampled along the edge of the *Sargassum*. Of the 61 *Sargassum* samples we caught 19,237 ichthyoplankton from 72 families. We used nonmetric multidimensional scaling (NMS) to identify four unique ichthyoplankton assemblages in the LC zones: an outside assemblage that occur in GOM waters, two transition assemblages that reside in the current and the frontal boundary, and an inside assemblage that occurs in water originating from the Caribbean. Using analysis of similarity (ANOSIM) we found significant differences between some pairwise assemblages and using similarity percentages (SIMPER) identified differences as a result of relative differences in density of Scombridae, Carangidae, and Istiophoridae. We conclude that the significant zonal differences in ichthyoplankton composition in the LC are result of subtle environmental gradients in salinity and temperature. We found significant assemblage differences in ichthyoplankton composition in Sargassum habitats using ANOSIM, resulting from temporal recruitment patterns, detected by SIMPER that were the result of differences in density of Exocoetidae and Carangidae.