45th Annual Meeting of the Mississippi Chapter of the American Fisheries Society

February 20-22, 2019

Jackson, MS

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Program at a Glance

Date and Time	Event	Location
Wednesday, Feb 20th		
2:30-5:00 PM	Registration	Museum - Theater Hallway
3:00-5:00 PM	Presentations	Museum - Theater
5:30-7:00 PM	Check-in and Registration	Cabot Lodge - Lobby
6:00-9:00 PM	Welcome Social	Cabot Lodge - Meeting Room
Thursday, Feb 21st		
	Breakfast	On your own
7:30-10:00 AM	Registration	Museum - Theater Hallway
8:00-10:00 AM	Presentations	Museum - Theater
10:00-10:15 AM	Break	Museum - Theater Hallway
10:15-12:00 PM	Presentations	Museum - Theater
12:00-1:30 PM	Lunch	On your own
1:30-3:30 PM	Presentations	Museum - Theater
3:30-3:45 PM	Break	Museum - Theater Hallway
3:45-5:00 PM	Presentations	Museum - Theater
5:00-5:15 PM	Break	Museum - Theater Hallway
5:15-6:15 PM	Keynote Speaker	Museum - Theater
6:15-7:00 PM	Poster Session	Museum - Atrium
6:30-7:30 PM	Aquarium Tours	Museum - Atrium
7:00-9:00 PM	Banquet	Museum - Atrium
Friday, Feb 22nd		
	Breakfast	On your own
8:00-9:15 AM	Presentations	Museum - Theater
9:15-9:30 AM	Break	Museum - Theater Hallway
9:30-11:00 AM	Chapter Business Meeting	Museum - Theater
11:00 AM	Adjourn	
11:00-12:00 PM	Museum Collections Tour (optional)	Museum - Lobby

Keynote Speaker

Dr. Glenn Parsons

Dr. Glenn Parsons is Professor of Biology at the University of Mississippi, Ole Miss. Dr. Parsons received his PhD in Marine Science from the University of South Florida's School of Marine Science in 1987. He took a position as an Assistant Professor of Biology at Ole Miss in 1987 and was promoted to Associate Professor in 1993 and then Full Professor in 1999. Dr. Parsons has published over 50 research papers on topics such as shark biology, fisheries, biomechanics of fish swimming and fish physiology. He has also published a book entitled *Sharks, Skates and Rays of the Gulf of Mexico: A Field Guide*. Dr. Parsons was the 2007 recipient of a World Wildlife Fund, Smartgear Competition Award for his work with bycatch reduction in shrimp fisheries in the Gulf of Mexico. Dr. Parsons teaches undergraduate and graduate courses at Ole Miss in Freshman Biology, Fish Biology, Biological Oceanography, Ichthyology, Conservation Biology and the Physiology of Aquatic Animals. His current research interests involve the biomechanics and efficiency of fish locomotion, metabolic rate determinations, respiratory physiology, energy budgets, and growth and reproduction in sharks.

President Elect Candidates

Robert Leaf

Dr. Robert Leaf joined the University of Southern Mississippi in 2012 and has expertise in quantitative methods and computer-intensive modeling approaches. The goals of these analyses are to understand population regulation and appropriate and effective conservation and management strategies. Dr. Leaf received his PhD in Fishery and Wildlife Sciences from the Virginia Polytechnic Institute and State University in 2010, where he studied how phenology of individuals in harvested populations were altered under size-selective fishing. As a post-doctoral researcher in NOAA's "Fisheries and the Environment" program, Dr. Leaf examined how phytoplankton bloom phenology determined recruitment patterns in northeast Atlantic ground fishes. His current work involves assessment of Gulf Menhaden, Gulf of Mexico Blue Crab, and Mississippi's Red Drum, Spotted Seatrout, and Sheepshead stocks. Leaf's current research focus is concerned with understanding and modeling biological systems at the population level and is focused on understanding the fishing pressures and environmental drivers that influence sustainability of commercially harvested fishes and invertebrates. Leaf has been a national AFS member since 2005 and has served in leadership positions at the chapter and section level during this time.

President Elect Candidates

Dennis Riecke

Dennis received a BS degree in Fishery Biology and Aquatic Science from the University of Southwestern Louisiana in 1982 and a MS degree in Fisheries Management from Mississippi State University in 1985.

Dennis has worked for the Kansas Fish and Game Commission as a District Fisheries Biologist, (January 1985- April 1987), in Louisiana as an Aquaculture Research Associate (May 1987-November 1988) and for the past 30 years as a fisheries biologist and a fisheries coordinator for the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP). He current duties include serving as Environmental Coordinator, representing MDWFP on the Miss. Dept. of Environmental Quality permit board; providing fisheries technical information on farm pond and aquatic plant management; helping communities enroll existing water bodies in an urban fisheries program; and on issues concerning commercial fishing, oxbow lake/public water access, aquatic invasive species, instream flow and drafting or revising state laws and fisheries regulations.

He has coauthored two manuscripts, authored a proceedings article and a workshop article and coauthored the third (1997), fourth (2010) and fifth (2015) editions of *Managing Mississippi Ponds and Small Lakes: A Landowner's Guide*. He has had over 30 popular articles about fisheries published in hunting and fishing magazines and newspapers and has had 8 photographs published in books and brochures.

He has been a Certified Fisheries Professional since 1996 and a Certified Public Manager since 2011.

He served as Secretary-Treasurer of the Mississippi Chapter AFS (1997-1999) and the SDAFS Warmwater Streams Committee (2000-2005). From 2003-2014 and 2017-present he served as Chairman of the SDAFS Resolutions Committee and on the AFS Resolutions Committee (2003-2014). From 2009-2014, he served as Chairman of the AFS Resolutions Committee (2003-2014).

He served as Vice-President, President-Elect, President and Past President (2013-2017) of the Southern Division AFS.

Presentation Schedule

Students competing for the best student presentation are designated with an asterisk (*).

All moderators for this conference are students. Moderating gives students greater familiarity with conference structure, an informal opportunity to speak in the scientific setting, and promotes familiarity with colleagues and potential employers.

Wednesday February 20th		
Time	**Title**	**Presenter**
3:00 PM	**WELCOME**	**Nathan Aycock**
Moderator	**Bradley Richardson**	
3:15 PM	State management of Red Snapper in Mississippi, current results of the programs Tails n' Scales and the charter vessel reef fish observer program.	Megan Fleming
3:30 PM	Results from acoustic monitoring of Red Drum in the Biloxi Bay	Wade Hardy
3:45 PM	An introduction to the Mississippi Department of Marine Resources operated Lyman Fish Hatchery focused on marine aquaculture and coastal restoration.	Michael Lee
4:00 PM	Largemouth bass growth in the Pascagoula Marsh post-Katrina	Samantha Stelmack
4:15 PM	Collaborative agency efforts to contain and eradicate giant salvinia, *Salvinia molesta*, in the Pelahatchie Bay of Ross Barnett Reservoir.	Ryan Jones
4:30 PM	Underwater Acoustics and USACE Activities: Measurement Methods, Data Analysis, and Risk Management	Alan Katzenmeyer
4:45 PM	Using USACE motor vessels to monitor fish movements in the Mississippi River: tracking high-profile species using acoustic telemetry	Todd Slack

6:00 PM	**SOCIAL AT CABOT LODGE**	

Thursday, February 21st		
Time	**Title**	**Presenter**
7:50 AM	**ANNOUNCEMENTS**	**Nathan Aycock**
Moderator	**Caleb Aldridge**	
8:00 AM	Monitoring Southern Flounder (*Paralichthys lethostigma*) in the Mississippi Sound using Fyke Nets.	Joshua Waters
8:15 AM	Applying a network based approach to understanding Gulf Sturgeon Pascagoula River	Michael Andres

	estuary use	
8:30 AM	Evaluating enhancement strategies for Spotted Seatrout (*Cynoscion nebulosus*) in the north-central Gulf of Mexico	Nathaniel Jermain*
8:45 AM	Delineating isoscapes of selected fish species in the Northern Gulf of Mexico	Branden Kohler*
9:00 AM	DNA barcoding leads to higher resolution of Red Snapper diet in the northern GOM	Laura Moncrief
9:15 AM	An initial life history assessment of recreationally landed Swordfish, *Xiphias gladius*, in the northern Gulf of Mexico	Anna Millender*
9:30 AM	Evidence for Microplastic Ingestion by Juvenile Fishes Associated with *Sargassum* Habitats in the Gulf of Mexico	Olivia Lestrade*
9:45 AM	Diet observations of recreationally landed Swordfish, *Xiphias gladius*, in the north central Gulf of Mexico	Jeremy Higgs
10:00 AM	**BREAK**	
Moderator	**Olivia Lestrade**	
10:15 AM	Comparison of Benthic Fish Assemblages along Revetted and Natural Banks in the Lower Mississippi River: A 30-year Perspective	Jack Killgore
10:30 AM	Gulf Killifish reproductive output in commercial-scale recirculating aquaculture systems at different broodstock densities and spawning substrate surface areas	Brittany Chessar*
10:45 AM	Effects of temperature on resting aerobic metabolic rate in adult Largemouth Bass	Brandon Gerhart*
11:00 AM	Evaluating the effect of simulated spring duration on white crappie (*Pomoxis annularis)* spawning success	Christian Shirley
11:15 AM	Segmentation of Mississippi's natural and artificial lakes	Steve Miranda
11:30 AM	Ontogeny of Southern Brook Lamprey, *Ichthyomyzon gagei*, with emphasis on abundance, distribution, and morphology in a small watershed	Bayley Wilmoth*
11:45 AM	Freshwater mussels (Unionidae) of Bayou Bartholomew, Louisiana and Arkansas, with comments on historical changes at a single mussel bed from 1991 to present	Steven George
12:00 PM	**LUNCH**	
Moderator	**Bayley Wilmoth**	
1:30 PM	An overview of passive integrated transponder (PIT) tag feasibility and a new monitoring technique for Frecklebelly Madtom, *Noturus munitus*	Richard Campbell*
1:45 PM	Effect of incubation temperature on the hatching success and survival of channel x blue hybrid catfish	Nagaraj Chataknodi

	eggs	
2:00 PM	Results from a 2018 Status Survey for Frecklebelly Madtom (*Noturus munitus*) in the Pearl River Drainage	Matthew Wagner
2:15 PM	State Boundaries Draw Hard Lines in *Aeromonas hydrophila* Disease Strains of Farm-raised Channel Catfish, *Ictalurus punctatus*	Bradley Richardson*
2:30 PM	Feasibility of Low-Energy Electrical Stimuli for Spatial Exclusion of Armored Catfish	F. Michael Holliman
2:45 PM	Parasite-induced anemia and mortality in Channel and Hybrid Catfish exposed to *Bolbophorus damnificus* cercariae	Mackenzie Gunn*
3:00 PM	Investigation of seafood fraud among catfish products in the Southern US markets	Vandana Dharan*
3:15 PM	Molecular characterization of Edwardsiella ictaluri isolates and the efficacy of E. ictaluri vaccine to protect channel catfish fingerlings against the field isolates	Divya Johnson*
3:30 PM	**BREAK**	
Moderator	**Anna Millender**	
3:45 PM	Direct Description of the Stress Response of Atlantic Sharpnose Sharks, *Rhizoprionodon terraenovae*: Quantification of Adrenocorticotropic Hormone	Lauren Fuller*
4:00 PM	Getting to the Bottom of Bottom Longline Survey; Examining Yearly Trends in Species Abundance and Distribution of Elasmobranchs and Teleost	Matthew Donaldson
4:15 PM	Diet comparison of four shark species in the north central Gulf of Mexico	Beckah Campbell*
4:30 PM	Describing annual variability in the movement patterns of Bull Shark, *Carcharhinus leucas*, in St. Louis Bay and adjacent waters using passive acoustic telemetry	Christopher Lapniewski
4:45 PM	Simulating Cookiecutter Shark bites with a 3D-printed maxillary/mandibular model	Mark Grace
5:00 PM	**BREAK**	
5:15-6:15 PM	**KEYNOTE SPEAKER**	
6:15-7:00 PM	**POSTER SESSION**	
6:30-7:30 PM	**AQUARIUM TOURS**	
7:00-9:00 PM	**BANQUET**	

Friday February 22nd		
Time	**Title**	**Presenter**
7:50 AM	**ANNOUNCEMENTS**	**Nathan Aycock**
Moderator	**Nathan Aycock**	
8:00 AM	Filling in the gaps: baseline studies of Atlantic Tarpon (*Megalops atlanticus*) in Mississippi coastal waters	Patrick Graham
8:15 AM	Population Characteristics of Jumping Silver Carp, *Hypophthalmichthys molitrix*, in the Illinois River: Two Years of Tournament Data	Jay Collins
8:30 AM	Tracking Asian carp movement in the Tennessee River and Tennessee-Tombigbee Waterway	Trevor Knight
8:45 AM	The Japanese Mystery Snail (*Bellamya japonica*) in Mississippi	Jan Hoover
9:00 AM	Dealing with the Press – Being Reactive and Proactive	Dennis Reicke
9:15 AM	**BREAK**	
9:30 AM	**CHAPTER BUSINESS MEETING**	
11:00 AM	**ADJOURN**	
11:00 AM	**MUSEUM COLLECTIONS TOUR (optional)**	

Poster Presentations

Students poster abstracts are designated with an asterisk (*).

Poster #	Title	Presenter
1	Early look: Performance of machine learning to classify age from age-length	Caleb Aldridge*
2	Teaching and tagging: Expanding marine education through species investigation	Danielle Bailey
3	Tiny Fish, Big River: Occurrence of Stonecat and Freckled Madtoms in the Lower Mississippi River	Nicky Faucheux
4	Gulf of Mexico Shark Pupping and Nursery Survey: a review of the survey from 2015 to 2018 in Mississippi coastal waters	Patrick Graham
5	Otolith shape analysis for Gulf Menhaden (*Brevoortia patronus*) in the north-central Gulf of Mexico	Nathaniel Jermain*
6	Preliminary observations of adult/sub-adult Red Drum (*Sciaenops ocellatus*) abundance in coastal Mississippi waters using a long-term monitoring program	Arthur Karels
7	Differences in Habitat use Between Immature and Mature Female Red Snapper	Andrea Leontiou
8	Morphological and molecular identification of a *Posthodiplostomum* sp. associated with mortality in farmed largemouth bass *Micropterus salmoides* in the southeastern United States	Adrián López-Porras*
9	Establishing Ground Cover in Reservoir Mudflats to Foster Fish Assemblages	David Norris*
10	Spatial differences in condition impact caloric density of Gulf Menhaden (*Brevoortia patronus*) in the northern Gulf of Mexico	Kasea Price
11	Comparison of catch per unit effort (CPUE) between commercial and recreational catch of legal blue crab, *Callinectes sapidus*, in Mississippi coastal waters	Jeremy Timbs
12	Molecular, morphological, and histopathological data for the pentastome *Levisunguis subaequalis* in Western Mosquitofish *Gambusia affinis*	Ethan Woodyard*

Presentation Abstracts

Abstracts are in alphabetical order by presenting author's last name.
Presenting author is underlined.

Michael Andres, Michael.Andres@usm.edu, (228) 872-4275

Applying a network based approach to understanding Gulf Sturgeon Pascagoula River estuary use

Michael J. Andres[1], Mark S. Peterson[1], Paul O. Grammer[2], and W. Todd Slack[3]

The University of Southern Mississippi, [1]Division of Coastal Sciences and [2]Center for Fisheries Research & Development, Ocean Springs, MS 39564

[3]US Army Engineer Research and Development Center, Environmental Laboratory EEA, Vicksburg, MS 39180

Gulf Sturgeon, *Acipenser oxyrinchus desotoi*, are restricted to seven drainages ranging from the Pearl River, LA, to the Suwanee River, FL. Throughout the fall and early spring months Gulf Sturgeon leave these rivers to forage in coastal habitats ranging from the estuaries associated with each drainage (primarily juveniles and sub-adults) to the open beachfronts (adults) along the northern Gulf of Mexico (GOM). Previous research on estuarine occupancy for Pascagoula River Gulf Sturgeon demonstrated the western Pascagoula River distributary is occupied more than the eastern distributary. Network-based analyses are becoming more common in fixed acoustic telemetry studies because receivers can be treated as nodes and the movement steps between them as edges. Network-based analyses can provide additional metrics that partially help overcome issues of spatial autocorrelation and can provide finer-scale spatial use patterns associated with specific habitat types. To this end, we analyzed acoustic telemetry data collected for Gulf Sturgeon from 2010-2013 in the Pascagoula River estuary by applying the node level network metrics of degree, node strength, eigenvector centrality, and betweenness centrality to address fine-scale seasonal and ontogenetic spatial use patterns. Regardless of size class (juvenile, subadult, or adult) or season, nodes with the lowest network metrics (bottom 50%) were associated with the eastern estuarine distributary or were peripheral nodes to the far west of the array. For all size classes, nodes with the highest metrics were associated with presumed migratory routes, not associated with the maintenance dredged channels in the eastern distributary. Juveniles, further had high metrics associated with nodes in shallow water (1–2 m) nearest the primary migratory route. Our approach indicated that regardless of size class and season, certain nodes were repeatedly selected over the three year study period by Gulf Sturgeon that can prove useful when making future restoration or conservation decisions for this population.

Beckah A. Campbell, Student Paper

Diet comparison of four shark species in the north central Gulf of Mexico

Beckah A. Campbell[1, 2], Jeremy M. Higgs[2], Jill M. Hendon[2], Eric R. Hoffmayer[3]

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

[3]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, 3209 Frederic Street, Pascagoula, MS 39567

Quantifying the feeding ecology of marine predators is essential for understanding their trophic interactions and potential regulatory effects in marine ecosystems. This study describes the diet of four coastal shark species in the north central Gulf of Mexico (ncGOM) collected from 2003 – 2018. Atlantic Sharpnose (*Rhizoprionodon terraenovae,* n = 1,389), Finetooth (*Carcharhinus isodon,* n = 431), Blacktip (*Carcharhinus limbatus,* n = 572), and Bonnethead (*Sphyrna tiburo,* n = 119) sharks were collected from fisheries independent sampling conducted by the Shark Research Program at the University of Southern Mississippi's Center for Fisheries Research and Development. Stomach contents were found in 18% of Finetooth (n = 79), 22% of Blacktip (n = 128), 32% of Atlantic Sharpnose (n = 444) sharks, and 81% of Bonnetheads (n = 96). Prey items were enumerated, weighed, and identified to the lowest taxonomic level and were quantified using five indices: percent number (%N), percent weight (%W), percent frequency of occurrence (%O), index of relative importance (IRI), and percent index of relative importance (%IRI). Overall, the primary prey group for Atlantic Sharpnose, Blacktip, and Finetooth sharks were teleost fishes, specifically, the Atlantic Croaker, *Micropogonias undulatus,* (26% IRI) for Atlantic Sharpnose sharks, and the Gulf Menhaden, *Brevoortia patronus,* for Blacktip (36% IRI) and Finetooth (91% IRI) sharks. Bonnethead sharks preyed predominantly on crustaceans, with the primary prey item being the Blue Crab, *Callinectus sapidus* (88% IRI). The Shannon-Weiner Index was used to define the species diversity of each shark diet. Overall, Atlantic Sharpnose had the most diverse diet, foraging on a wide range of cephalopods and crustaceans, as well as, teleost fishes, with a Shannon-Weiner Index of 3.15. Results for Blacktips (2.17), Bonnetheads (1.82), and Finetooth (1.26) sharks indicated that diet was not as diverse as Atlantic Sharpnose. It is likely that the specialized feeding strategies found in these four species allows them to co-exist in the ncGOM. Results from the current study will help further the knowledge of predator prey relationships in the ncGOM.

Richard L. Campbell, rlc599@msstate.edu, (662)-419-5408, Student Paper

An overview of passive integrated transponder (PIT) tag feasibility and a new monitoring technique for Frecklebelly Madtom, *Noturus munitus*

Richard L. Campbell[1], Michael E. Colvin[1], David A. Schumann[1], Matthew D. Wagner[2], and Daniel E. Schwarz[3]

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

[2]Mississippi Museum of Natural Science, 2148 Riverside Drive, Jackson, MS 39202

[3]United States Fish and Wildlife Service, Private John Allen National Fish Hatchery, 111 Elizabeth Street, Tupelo, MS 38802

Effective monitoring of at-risk or declining species is fundamental to inform conservation and monitor the effectiveness of management efforts. More than half (58%) of madtom species (*Noturus* spp.) are considered imperiled, and consequently, these fishes are regularly targeted during sampling conducted by management agencies. The effectiveness of these sampling efforts has been questioned, due to the cryptic and suspected nocturnal behaviors of madtoms. We evaluated the suitability of small (8.4 x 1.4 mm), surgically implanted passive integrated transponder (PIT) tags for ecological studies of patterned madtoms using Freckelbelly Madtom, *Noturus munitus* (experiment 1). Using novel, PIT tag transmitting artificial cover units, we also describe an efficient method to index madtom abundance and develop new understanding of madtom behavior (experiment 2). The influence of surgically implanted PIT tags on madtom survival (range: 45 – 110 mm) was minor (94% ± 4% survival) relative to control groups (97% ± 3% survival) and all tagged individuals retained the PIT tag throughout the 21-day trial. Inflammation near the surgical wound was rare and all incisions were completely healed within 14 days of the procedure. The second experiment assessed the suitability of PIT tag enhanced artificial cover units to index captive madtom populations of varying densities (n = 2, 10, 20, 30). The integrated PIT tag method detected a higher proportion of individuals at all densities (mean: 0.37 ± 0.05) than traditional count methods (0.08 ± 0.03) and provided a precise index of relative abundance ($F_{1, 29}$ = 16.3, P < 0.01, R^2 = 0.36). However, time-to-detection was relatively slow (χ^2 = 9.7, df = 3, P = 0.02) for low density groups and the gear was seemingly saturated at high densities. Managers can expect to detect ~50% of released conservation populations by deploying similar units for approximately 60 hours regardless of density.

Nagaraj Chatakondi, nagaraj.chatakondi@ars.usda.gov, (662) 686-3566

Effect of incubation temperature on the hatching success and survival of channel x blue hybrid catfish eggs

Nagaraj G. Chatakondi

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Channel x Blue hybrid catfish are increasingly raised in commercial catfish production ponds because of their superior performance compared to commonly raised channel catfish. Hybrid catfish fry are produced by hormone-induced spawning protocols in catfish hatcheries; however, hatchery production of hybrid catfish fry is inconsistent and often variable limiting the efficiency of hatchery production. Incubation temperature is one environmental variable that exerts multiple effects on the early life stages of hybrid catfish embryo by affecting hatching, developmental stage, and survival rate of fry. Optimal temperature conditions during egg development can increase hatching success and survival of progeny relative to those developed under less optimal conditions

Effects of female channel catfish and incubation temperature on hatching success, latency and survival were assessed in a hatching trial. Stripped eggs from hormone-induced channel catfish females were fertilized with pooled blue catfish sperm and incubated at 75, 80, 85 and 90 ^{0}F hatchery water. Incubation temperature and latency (h) to hatch from fertilized egg to hatch were inversely related. However, higher incubation temperature did not affect the hatching success (P=0.54) but reduced percent survival (P=0.01) at 5-day old fish.

Results of the study suggest incubating hybrid catfish eggs from 80-85 F improves hatching success and survival with a reasonable latency period to improve efficiency of hatchery production of hybrid catfish.

Brittany Chesser, bc1826@msstate.edu, (302) 542- 2563, Student Paper

Gulf Killifish reproductive output in commercial-scale recirculating aquaculture systems at different broodstock densities and spawning substrate surface areas

Brittany Chesser and Peter J. Allen

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

Gulf Killifish, *Fundulus grandis*, are a popular baitfish for recreational fisheries and candidates for commercial-scale culture; however, relatively low fecundity presents a production challenge. To advance techniques to maximize egg output, the effects of broodstock density and surface area of spawning mats were evaluated for egg output in commercial-scale recirculating aquaculture systems. An initial study was conducted where broodstock were stocked at two densities (45 fish/m^3, 90 fish/m^3) with eggs collected three times per week for 8 weeks. Broodstock held at 45 fish/m^3 produced more eggs/female/d than broodstock held at 90 fish/m^3; but there was no difference between eggs/collection or total egg production. Therefore, reproductive output may be limited by another factor, such as available spawning substrate. A second study was conducted where broodstock were stocked at a density of 100 fish/m^3 in all tanks with 11,800 cm^2 (1 tier), 23,600 cm^2 (2 tier), or 35,400 cm^2 (3 tier) surface area of spawning mats for 8 weeks. Reproductive output did not vary between treatments with eggs/female/d, eggs /collection, or total eggs collected leading to the conclusion that increasing surface area of spawning material does not increase egg production. Interestingly, there were differences in average eggs per tier level per collection within the 2 tier and 3 tier treatments, with the first tier levels having the highest average number of eggs and the lowest tier levels having the lowest average number of eggs. These studies indicate increasing broodstock density or surface area of spawning substrate does not increase reproductive output in Gulf Killifish broodstock in RAS. Based on these findings, a stocking density of 45 fish/m^3 and a spawning mat surface area of 11,800 cm^2 is recommended for commercial-scale RAS, due to similar egg production compared to higher stocking density and spawning mat surface area.

Jay Collins, Jay.A.Collins@usace.army.mil, (601) 634-5214

Population Characteristics of Jumping Silver Carp, *Hypophthalmichthys molitrix*, in the Illinois River: Two Years of Tournament Data

Jan Jeffrey Hoover, Jay. A. Collins, Bradley R. Lewis, Steven G. George, W. Todd Slack

US Army Engineer Research and Development Center, Vicksburg, MS 39180

Silver Carp are harvested mid-air, during their leaps from the water, by contestants in boats at an annual 2-day summer tournament in Bath Illinois on a side-channel of the Illinois River. In 2017 and 2018, we sub-sampled and processed tournament catch to describe population characteristics of jumping carp. During both years, fish were moderate in size (600-1000 mm TL) and weight (2.0-8.3 kg), but advanced in age (4-11 years); modal age was 8 in 2017 and 9 in 2018. During both years females predominated (~ 3.0 F: 1.0 M), the majority of which were gravid with large egg masses (GSI = 15-29%) containing hundreds of thousands of eggs (~ 0.25-0.75 M). Our data on gender and age differ somewhat from state electrofishing data for nearby areas in which fish were younger (1-9 years), with modal age of 3 in 2017 and 5 at 2018, and in which females were typically outnumbered by males, although skewed sex ratios were sometimes observed and females predominated in backwaters (Levi Solomon and Kevin Irons, Illinois Department of Natural Resources, pers. comm.). Our data demonstrate three advantages of collecting demographic data from jumping fish: 1) cost-effectiveness (particularly at tournaments and similar events); 2) supplemental comparisons to data obtained from traditional sampling techniques and from other areas; 3) evaluation of establishment risks associated with airborne dispersal of carp.

Vandana Dharan, vd302@msstate.edu, (662) 588-0420, Student Paper

Investigation of seafood fraud among catfish products in the Southern US markets

Vandana Dharan[1], Ganesh Kumar[1], Lester Khoo[1], and Suja Aarattuthodiyil[1]

[1]Thad Cochran National Warmwater Aquaculture Center, Mississippi State University, Stoneville, MS 38776

Seafood fraud is a major concern in the supply chain with species substitution and Country Of Origin (COO) non-compliances seen very commonly among products. The Federal Food, Drug, and Cosmetic Act limits the sale of only Ictalurids (*Ictalurus furcatus* and *I. punctatus*) under the name 'catfish', but catfish belonging to the family Pangassidae (Swai, Basa, Tra, Pangasius) are largely imported to U.S. markets and substituted for the high quality U.S. farm raised catfish products. Siluriformes being one of the largest order comprises around 3000 species which are distributed worldwide. This species richness increases the potential for species substitution. The Country of Origin Marketing 2011 require all the products sold in U.S. market should be labelled accurately with Country of Origin and Method of Production. The present study will investigate the level of species substitution and mislabeling in U. S. farm raised catfish in the southern states, mostly Mississippi, Arkansa, Alabama, Texas, and Tennesse. Catfish samples will be collected from different supermarkets, restaurants, fish markets and chain retail stores and molecularly analyzed for the species by real time-PCR using commercially available Instant catfish assay kits.

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Getting to the Bottom of Bottom Longline Survey; Examining Yearly Trends in Species Abundance and Distribution of Elasmobranchs and Teleost

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Bottom longline survey data from 2007 to 2018 was collected across four regions of Mississippi and Louisiana: Mississippi Sound (MS), South of Mississippi Sound (SS), Chandeleur Sound (CS) and East of Chandeleur Sound (ECS). From 2007-2016 the survey conducted monthly sampling of three stations in each region (MS, SS, CS). Site selection was later expanded to include a fourth region (ECS), group all regions, and provided randomized stations for the entire breadth of the survey in 2016. Throughout the duration of the survey 8,770 animals were encountered, of which 81.9% were elasmobranchs and 18.1% were teleost. The Atlantic Sharpnose, *Rhizoprionodon terraenovae,* dominated overall catch (49.2%), followed by Blacktip, *Carcharhinus limbatus* (17.6%), and Bull shark, *Carcharhinus leucas* (3.7%). The Gafftopsail Catfish, *Bagre marinus*, (10.5%) was the most common teleost species caught overall, followed by Red Drum, *Sciaenops ocellatus* (5.1%), and Hardhead Catfish, *Ariopsis felis* (2.1%). Catch per unit effort (CPUE) was used as an indirect measure of abundance to examine yearly trends. In 2016, the lowest CPUE of the survey was recorded (3.72) but doubled in 2017 (7.44) and continued an upward trend in 2018 (9.56). Additionally, by examining species distribution we could infer site specific behavior. This bottom longline survey has provided insight into yearly trends in species abundance and distribution throughout Mississippi and Louisiana waters.

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State management of Red Snapper in Mississippi, current results of the programs Tails n' Scales and the charter vessel reef fish observer program.

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Red Snapper are one of the most targeted fish in the Gulf of Mexico (GOM) for their catchability and excellent table fare. Recently, decreased lengths in the federal season for Red Snapper resulted in a derby-style fishing season, thus causing difficulties in collecting accurate harvest data for the recreational sector. In 2015, the Commission on Marine Resources (CMR) adopted a regulatory modification to make it mandatory to report all recreational landings of red snapper. To ease the burden of mandatory reporting on anglers, the MDMR created the electronic reporting system Tails n' Scales. This program has been a major success in catch accuracy and data compliance and continues to improve in all areas with each Red Snapper season. Access point intercept surveys were generated and randomly selected to place MDMR personnel at sites where they would encounter recreational Red Snapper fishermen and validate their catch. For the for-hire sector, the charter vessel reef fish observer program continues to validate the catch of Mississippi's charter fleet. These programs have continued to improve on accuracy and convenience for the fishermen involved. This past year, all five of the Gulf states applied and were granted an Exempted Fishing Permit (EFP) for Red Snapper in state and federal waters for the 2018 and 2019 fishing seasons. Additionally, in 2018, Tails n' Scales was officially certified, becoming the second certified monitoring program for Red Snapper in the GOM. MDMR will continue to develop and improve the Tails n' Scales program so that Mississippi anglers are provided the maximum amount of flexibility and opportunity to harvest Red Snapper and other reef fish species from offshore Mississippi.

Lauren Fuller, lfuller@olemiss.edu, 501-541-0907, Student Paper

Direct Description of the Stress Response of Atlantic Sharpnose Sharks, *Rhizoprionodon terraenovae*: Quantification of Adrenocorticotropic Hormone

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Currently, shark stress studies focus mainly on measurement of plasma lactate and glucose as an indirect indicator of stress. The primary stress hormone of sharks, 1α-hydroxycorticosterone, is unique to elasmobranchs but a commercially available kit for this hormone does not exist. This makes it extremely expensive and time intensive to directly measure their primary stress hormone. To address this, we have measured adrenocorticotropic hormone (ACTH), the hormone responsible for stimulating the release of the primary stress hormone, to obtain a more direct estimate of stress levels. The goal of this study was to provide a description of the primary stress response of *R. terraenovae* to capture via measurement of ACTH with a commercially available kit. To do this, we followed a non-serial blood sampling protocol developed by Hoffmayer et al. (2015) in which Atlantic Sharpnose sharks (*Rhizoprionodon terraenovae*) were captured and allowed to swim freely on the line for prescribed time periods (0, 15, 30, 45 and 60 minutes). Blood samples collected after this time period were later analyzed for ACTH, lactate, and osmolality. ACTH was seen to be significantly higher at 15 minutes than baseline ($p=0.0085678$). Lactate peaked at 45 and 60 minutes ($p=0.0466536$ and $p=0.0186245$, respectively). Osmolality did not significantly change over the 60 minute time period ($F(4,19)=0.6847$, $p=0.6113$). These results indicate that ACTH peaks quickly and remains elevated while lactate takes longer to peak (45 min) but also remains elevated. Future research should investigate the effects of longer stress periods than those utilized in this study to determine how long these stress levels remain elevated.

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Freshwater mussels (Unionidae) of Bayou Bartholomew, Louisiana and Arkansas, with comments on historical changes at a single mussel bed from 1991 to present

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Bayou Bartholomew is a large tributary of the Ouachita River that drains much of southeastern Arkansas and northeastern Louisiana. During November 2017, a freshwater mussel survey was conducted in Arkansas and Louisiana portions of Bayou Bartholomew. A total of 1,168 individuals (670 live and 498 dead) representing 27 species were collected from 10 sites. Of the 27 species collected, one was federally listed threatened and four were state listed threatened or of special concern in Louisiana. Numerically dominant live mussels were: threeridge (Amblema plicata) 15%, bankclimber (Plectomerus dombeyanus) 13% and Wabash pigtoe (Fusconaia flava) 11.5%. Less abundant live mussels included: pimpleback (Cyclonaias pustulosa) 8%, mapleleaf (Quadrula quadrula) 7%, yellow sandshell (Lampilis teres) 6%, bleufer (Potamilus purpuratus) 6%, washboard (Megalonaias nervosa) 5%, pistolgrip (Tritogonia verrucosa) 5%, rock pocketbook (Arcidens confragosus) 3%, threehorn wartyback (Obliquaria reflexa) 3%, fragile shell (Leptodea fragilis) 2%, giant floater (Pyganodon grandis) 2%, wartyback (Cyclonaias nodulata) 2%, monkeyface (Theliderma metanevra) 2% and deertoe (Truncilla truncata) 2%. Rare mussel species represented by < 1.3% were: rabbitsfoot (Theliderma cylindica), butterfly (Ellipsaria lineolata), spike (Elliptio dilatata), pyramid pigtoe (Pleurobema rubrum) Louisiana fat mucket (Lampsilis hydiana), plains pocketbook (Lampsilis cardium), ebonyshell (Fusconaia ebena), Texas lilliput (Toxolasma texasensis), tapered pondhorn (Uniomerus declivus), little spectaclecase (Villosa lienosa), and Ouachita kidneyshell (Ptychobranchus occidentalis). The majority of the recent dead mussels were collected from two site in the lower reach from raccoon shell middens. Dominant recent dead mussels were rabbitsfoot (T. cylindrica) 52%, monkeyface (T. metanevra) 15% and plains pocketbook (L. cardium) 5%. When comparing our recent survey to previous historical studies, changes at one site were apparent. In 1993, more mussel species were collected including the federally listed pink mucket (Lampsilis abrupta). Rabbitsfoot (T. cylindrica) was considered rare historically, but in our survey, it was the most abundant recent dead mussel (N=258).

Brandon Gerhart, bjg287@msstate.edu, 662-325-4768, Student Paper

Effects of temperature on resting aerobic metabolic rate in adult Largemouth Bass (*Micropterus salmoides*).

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Water temperature plays an important role in regulating physiological processes in aquatic organisms. In recreationally angled fishes, an understanding of the energetic costs related to water temperature is beneficial for guiding management. Because little is known in this regard about adult black bass, the life stage typically pursued by anglers, we evaluated the effects of water temperature on resting routine aerobic metabolic rate in adult Largemouth Bass (*Micropterus salmoides*). Bass were acclimated to 18, 24, and 30°C in separate tanks for ≥ 2 weeks. Aerobic metabolism (MO_2) was measured using intermittent respirometry. Bass from the 18°C treatment exhibited the lowest aerobic metabolic rate (68.9 ± 6.5 mgO_2/kg/hr), followed by the 24°C treatment (101.3 ± 7.4 mgO_2/kg/hr) and the 30°C treatment (176.8 ± 13.4 mgO_2/kg/hr)-($P<0.05$). Furthermore, Q_{10} values were calculated and showed bass exhibited a higher temperature sensitivity over the 24°C to 30°C range (Q_{10} = 2.53) compared to the 18°C to 24°C range (Q_{10} = 1.90), indicating exacerbated aerobic demands at high temperatures. Therefore, management for adult Largemouth Bass should minimize handling and induced exercise when temperatures approach 30°C or higher

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Simulating Cookiecutter Shark bites with a 3D-printed maxillary/mandibular model

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Cookiecutter sharks (Chondrichthyes: Squaliformes: Dalatiidae) share common features for teeth and jaw structure, in particular, dignathic heterodonty (crowns for upper teeth are much more slender and shorter than the broader and longer crowns of lower teeth) and robust lower jaws (Meckel's cartilage). The teeth and jaws are well suited for the cookiecutter shark ectoparasitic feeding method that excises a nearly symmetrical oval flesh plug from a variety of prey species including marine mammals, fishes, and squids. There is considerable speculation related to the biomechanics for the cookiecutter shark bite, however, *in situ* feeding behavior has not been observed. In order to physically simulate cookiecutter shark bite configurations CT scans were conducted on two cookiecutter shark species (*Isistius brasilensis*, Cookiecutter Shark; *Isistius plutodus*, Largetooth Cookiecutter Shark). Models of the feeding mechanisms were rendered from the CT scans and 3D printed. Ballistic gelatin was then used to approximate prey flesh and cookiecutter shark bites were created from the 3D-printed teeth and jaw model. In addition to assessing various bite configurations for each species the relationship between bite volume and body volume was compared. Simulating cookiecutter shark bites advances verification that the characteristic bites on prey were made by cookiecutter sharks, therefore, there is increased validity that the occurrence of bites can be used to elucidate distributions of cookiecutter sharks and their prey.

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Filling in the gaps: baseline studies of Atlantic Tarpon (*Megalops atlanticus*) in Mississippi coastal waters

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Migratory fishes pose inherent difficulties for population assessments due to a lack of data throughout an extensive geographical range. Atlantic Tarpon (Tarpon) comprise a valuable recreational fishery in the Gulf of Mexico (GOM), yet large data gaps exist for multiple life stages throughout their GOM range. Tarpon larvae (leptocephali; n=111) collected from the Mississippi Sound estuary by GCRL between 2006 – 2018 are thought to be the product of suspected Tarpon spawning activities in offshore waters of the northern GOM. Body lengths of collected leptocephali ranged between 16 - 27.8 mm SL (mean = 23.1 ± 2.2 mm SL). Age estimates of the larvae based on sagittal otolith (n=101) microstructure analysis ranged 19.5 - 38 days (mean = 27.3 ± 4.3 d). Based upon age-derived back-calculated hatch dates, presumed spawning occurred between June – October. A preliminary particle tracking model was developed using Northern Gulf of Mexico Operational Forecast System (NGOFS) outputs to back-calculate potential spawning areas with larval capture locations and ages as inputs. Preliminary model results are discussed. Small juveniles (n=368, 50 - 359 mm FL, mean = 152.6 mm TL) were collected from coastal marshes identified as Tarpon nursery habitat using cast nets during fall/winter months. Fulton's condition factors (K) were assessed for juvenile fish using their weight-length relationship ($W= 0.000004*FL^{3.17}$, $R^2= 0.98$) and ranged 0.77 -1.69 (mean= 1.11 ± 0.13). Kruskal-Wallis tests revealed that K values varied significantly among juvenile sampling sites ($X^2= 14.38$, $p= 0.0062$). In summer of 2018, pop-up satellite archival transmitting (PSAT) tags were attached to four adult Tarpon south of the Mississippi barrier islands to document their movements off Mississippi and in the north-central GOM. Those data will be forthcoming. This ongoing study is providing key life history metrics on Tarpon from an area of the GOM where data have been historically sparse.

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Parasite-induced anemia and mortality in Channel and Hybrid Catfish exposed to *Bolbophorus damnificus* cercariae

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The trematode *Bolbophorus damnificus* has deleterious effects on production efficiency in farm raised channel (*Ictalurus punctatus)* and hybrid catfish (*I. punctatus x I. furcatus*). Preliminary data suggest hybrid catfish experience lower mortality when than channel catfish cohorts when exposed to similar numbers of cercariae. We evaluated morbidity and mortality in juvenile channel and hybrid catfish for 28 days following exposure to *B. damnificus* (300 cercariae/L). There was a trend towards lower mortality in hybrid catfish, although these differences were not significant ($p \geq 0.05$). A second experiment compared physiological responses in channel and hybrid catfish exposed to 300 cercariae/L. Fish were sampled for 49 days post-challenge to determine changes in blood physiology. Both exposed groups experienced a dramatic drop in hematocrit during the peak mortality window (9-14 d post-challenge), but recovered afterwards, suggesting an anemic response to the development of the parasite. There was marked mortality in the channel catfish exposure groups, while mortality in hybrids was negligible. Lastly, in a third experiment, channel and hybrid catfish fry were exposed to 100 cercariae/L, which resulted in pronounced mortality compared to previous challenges. Again, there was a trend towards lower mortality in hybrids than that observed in channels, but the difference was margininally not significant ($p=0.053$). In all studies, infected fish presented clinical signs consistent with *B. damnificus* infection and all exposed fish had visible metacercariae below the skin. No parasites were observed in any control fish. There was a less substantial drop in hematocrit prior to the recovery period, suggesting the response of hybrid catfish to *B. damnificus* infection is not as severe as in channel catfish. The biological and economic implications of these findings on catfish production are unknown, but suggest outbreaks of *B. damnificus* in hybrids may not result in the same reductions in productivity as observed in channel catfish.

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Results from acoustic monitoring of Red Drum in the Biloxi Bay

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Red Drum are the second most popular sport fish in Mississippi coastal waters and are targeted throughout the year in estuaries, bays, the Mississippi Sound, and south of the barrier islands. Red Drum are primarily targeted as sub adults in inshore waters throughout the Mississippi coast and a smaller harvest of adult Red Drum occurs from the for-hire industry around the barrier islands. In order to collect additional data on Red Drum, MDMR implemented a program to track the movements of Red Drum in the Biloxi Bay through acoustic telemetry monitoring. These new data will help determine duration of residence in the Biloxi Bay estuary, routine distances traveled within the project area, seasonal movements, and determine site fidelity between different size classes of Red Drum. A total of 61 Red Drum, in multiple size classes, were surgically implanted with acoustic transmitters and tagging occurred at three distinct locations within the project area. An acoustic array consisting of 34 acoustic receivers was created to passively detect and track their movements throughout the Biloxi Bay. Hydrological parameters, water temperature and salinity, were monitored at two different locations within the project area in order to determine potential impacts on movement patterns. Early detection results show high site fidelity of Red Drum during the juvenile or sub adult stage. As fish approached three years in age or approximately 600mm in length, the movement patterns expanded and distances traveled increased in the bay, and eventually extended outside the project area. These expanded movements also coincided with the spawning season of Red Drum which typically occurs from mid-summer through early fall. This research and acoustic monitoring of Red Drum is ongoing and will continue through 2019.

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Diet observations of recreationally landed Swordfish, *Xiphias gladius*, in the north central Gulf of Mexico

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Swordfish, *Xiphias gladius*, are pelagic predators with a circumglobal distribution. It has long been targeted by longline fisheries throughout their distribution; however, only relatively recently has the species been included in prize categories at fishing tournaments in the north-central Gulf of Mexico (ncGOM). The current study collected stomachs from 28 Swordfish during the 2017 Mississippi Gulf Coast Billfish Classic. Stomach contents were found in 89% of Swordfish (n = 25), and of these 22 have been examined. Nearly all prey items were highly degraded making visual identification to lower taxonomic levels difficult, but when possible, hard structures (e.g., otoliths) were used to aid in taxonomic resolution. Identifiable prey items were analyzed by numeric abundance (%N), total weight (%W), and frequency of occurrence (%O) as well as Index of Relative Importance (%IRI). Visual examination resulted in broad prey groupings: teleosts (60%O), squid (18%O), vegetative matter (4%O), shrimp (2%O) and unknown remains (13%O). Efforts to further elucidate prey items focused solely on teleosts (n = 374), and representative prey items were sent for DNA barcoding (COI, n = 76). Of the 76 samples, 40 were successfully amplified and sequenced. Of these, 20 species identifications were confirmed based on otolith comparisons and/or specimens from collections. Based on the combined COI and otolith data, we identified 191 prey items (51%) to species level. Our diet analysis indicated that of identifiable items, Luminous Hake, *Steindachneria argentea*, and Blue Runner, *Caranx crysos*, were the two most common teleost species. Luminous Hake represented 32%N, 3%W, 68%O, and 46%IRI of stomach contents; whereas, Blue Runner represented 6%N, 36%W, 54%O, and 44%IRI of stomach contents. Although preliminary, the results of this study indicated that Swordfish in the ncGOM primarily fed on teleosts rather than squid, which is contrary to what has previously been reported for other Atlantic Ocean populations.

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Feasibility of Low-Energy Electrical Stimuli for Spatial Exclusion of Armored Catfish

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Abstract: Loricariid catfishes native to Central and South America, commonly referred to as suckermouth catfish or armored catfish, have been introduced into the United States. Armored catfishes have been collected from, or have established reproducing populations in, Texas, Florida, Arizona, Colorado, Connecticut, Louisiana, Pennsylvania, Nevada, Hawaii, Mississippi, North Carolina, California, Washington, and Puerto Rico. Communal cavity nesters, burrowing by armored catfish can cause sloughing and erosion of shorelines and increased siltation. Invasive armored catfishes can pose significant threats to native fish communities and aquatic habitats. We evaluated the feasibility of electrical exposure for spatial exclusion of armored catfish. A low-energy electrical exposure was developed to serve as noxious stimuli while avoiding induction of galvanotaxis and immobility. Young-of-year *Pterygoplichthys gibbiceps*, a species of "Sailfin Catfish", were placed in a light-dark box and their usage of the dark "zone" was measured with and without electrical stimuli. Preliminary analysis shows effective spatial exclusion during the electrical exposure, as indicated by significant reductions in the number of fish entries into the dark zone ($p = 0.02$), the cumulative time (s) spent in the dark zone ($p = 0.0012$), and the time spent in the dark zone per entry (i.e., permanence time; $p = 0.0011$). Fish were also observed approaching the electrified dark zone and turning aside to avoid entry. Behaviors also included attempts by fish to back into the electrified exclusion zone. No fish entering the electrical field were immobilized during the tests. Experimental outcomes indicate low-energy electrical stimuli can be effective for induction of spatial avoidance in armored catfish. Additional study is warranted to evaluate this technology in the field.

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The Japanese Mystery Snail (*Bellamya japonica*) in Mississippi

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The Japanese Mystery Snail (*Bellamya japonica*), an operculate live-bearing species, has been repeatedly introduced and established in US waters since the late 1800s; it is used as a food, as an aquarium pet, as forage for fish, and as scavengers in ponds. Largely absent from the lower Mississippi Basin, an isolated population was discovered in the McKinney Bayou system near Hollywood MS in 2007. It consists of two known sub-populations. One, in a tiny tributary upstream, exhibits near-equitable sex ratio (0.7 M: 1.0 F) and is dominated by smaller (< 40 mm), younger individuals (Ages 2-4). Another, 2.2 km downstream in a larger bayou, exhibits a skewed sex ratio (1.7 M: 1.0 F), and is dominated by larger (> 40 mm), older individuals (Ages 4-6). Differences between the two sub-populations could result from differences in habitat (e.g., water depth) and corresponding differences in predation by birds (feeding on larger individuals upstream in shallow water) and fishes (feeding on smaller individuals downstream in deeper water). Snail size (up to 65 mm), densities (1-13/m^2), and fecundity (10-120 young/individual) are comparable to those reported for other populations, but lifespans of Mississippi snails (to Ages 8-9) and maximum fecundities (> 150 young/individual) are unprecedented. The Mississippi population appears to be self-contained with low environmental risk. We are not aware of significant dispersal during the past decade, but the species could be overlooked during biological surveys. Potential for spread is high due to its resistance to desiccation, its longevity and mode of reproduction, and its recent use in ornamental and aquaculture ponds.

Nathaniel W. Jermain, Nathaniel.jermain@usm.edu, 978-491-0294, Student Paper

Evaluating enhancement strategies for Spotted Seatrout (*Cynoscion nebulosus*) in the north-central Gulf of Mexico

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Stock enhancement has received considerable attention as a management tool in addition to effort controls for Spotted Seatrout (*Cynoscion nebulosus*) in the Gulf of Mexico (GOM). However, the assessment of enhancement programs have often focused on the effectiveness of aquaculture production rather than achieving fishery-oriented goals. We evaluated the efficacy of two management strategies 1.) stock enhancement and 2.) reduction of discard mortality to achieve predetermined goals for three Spotted Seatrout stocks in the north-central GOM. The objectives were to estimate the probability of achieving 1.) a 10% increase in the spawning stock biomass (SSB), 2.) a 10% increase in annual harvest, and 3.) a 10% increase in relative stock density (RSD) for each management strategy. For those stocks in Mississippi and Alabama, we found that that stock enhancement programs releasing at least one million individuals annually exhibited very high probability of achieving a 10% increase in harvest and SSB. Only stock enhancement programs that released more than two million individuals annually achieved a 10% increase in the RSD with a probability greater than 50%. Due to the size of the Louisiana stock and magnitude of annual harvest, each candidate stock enhancement effort was found to have a near zero probability of causing a 10% increase in any of the three metrics examined. All feasible reductions in discard mortality exhibited a lower than 25% chance of achieving a 10% increase in the three metrics for each stock. Our results suggest reducing the discard mortality rate does not have a comparable effect to stock enhancement on stock size, RSD, or harvest for Spotted Seatrout. Enhancement efforts in Mississippi and Alabama that release at least one million individuals have the potential to impact harvest and stock size, but any regime releasing less than five million in Louisiana is unlikely to do so.

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Molecular characterization of *Edwardsiella ictaluri* isolates and the efficacy of *E. ictaluri* vaccine to protect channel catfish fingerlings against the field isolates

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Enteric septicemia of catfish (ESC), caused by the bacterium, *Edwardsiella ictaluri* causes major losses in the commercial channel catfish (*Ictalurus punctatus*) industry. A live, attenuated bacterial vaccine (*E. ictaluri* vaccine) developed at the Thad Cochran National Warmwater Aquaculture Center, Stoneville, MS has been successful in controlling ESC. Although, the *E. ictaluri* isolates recovered from catfish in the Southeastern United States are considered genetically and antigenically homogenous, there are reports of the existence of multiple genetic variants. The effectiveness of a vaccine is dependent on the cross protection offered against multiple isolates. Trials were conducted to determine if the vaccine afforded protection against archived field isolates collected over a time span of twenty years (1997-2016). Vaccination followed by bacterial challenge with field isolates were conducted. In all trials, vaccination was shown to protect catfish against all challenge isolates, regardless of host species, geographic region (state and farm location) or isolation year. The *E. ictaluri* isolates were characterized to evaluate their homogeneity/heterogeneity with regard to virulence factors, plasmid profile, and antimicrobial resistance. The homogeneous nature of *E. ictaluri* isolates revealed by rep-PCR and virulence gene amplification negate the need to develop multivalent vaccines to account for antigenic variations occurring over time. Plasmid profiling revealed the heterogeneity of at least four bacterial isolates. Nevertheless, the *E. ictaluri* vaccine protected fish from exposure to all these challenge isolates confirming the efficacy of the vaccine.

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Collaborative agency efforts to contain and eradicate giant salvinia, *Salvinia molesta*, in the Pelahatchie Bay of Ross Barnett Reservoir.

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On June 26th, 2019 giant salvinia, *Salvinia molesta*, was identified on the north shore of Pelahatchie Bay in the Ross Barnett Reservoir located in Central Mississippi. Efforts to contain and eradicate the exotic, invasive plant species continue to present day. Management actions continue based on a collaboration of expertise from multi-agency professionals. Experts from the Mississippi Department of Wildlife, Fisheries, and Parks, United States Army Corps of Engineers, Louisiana Department of Wildlife and Fisheries, Pearl River Valley Water Supply District, and Mississippi State University have provided input. The resulting actions are believed to be the best effort to achieve the objective of eradication. These actions include: the closure of recreational boating within Pelahatchie Bay by Pearl River Valley Water Supply District, aggressive herbicide treatments of various chemical mixtures from airboat, helicopter, and on foot, containment barrier arrangement and monitoring, range surveys completed from boat, drone flight, and on foot, and drawdown of the lake level to expose plants to desiccation and freezing temperatures. Most giant salvinia stands have been killed or severely injured, while scattered plants continue to be identified and treated. Results will be determined by surveys of new growth during the upcoming growing season. Ross Barnett Reservoir is highly recreated by anglers and boaters from all over the state and the southeastern United States. Objective completion is imperative to remove what would be a giant salvinia vector to all other water bodies within the state of Mississippi and beyond.

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Underwater Acoustics and USACE Activities: Measurement Methods, Data Analysis, and Risk Management

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Proposed Federal regulations in the United States will restrict anthropogenic noise generation in freshwater and marine environments. These regulations may alter dredging and construction activities of the U.S. Army Corps of Engineers and, ultimately, navigation and flood control. The ERDC Fish Ecology Team collected samples of ambient sounds and anthropogenic sounds generated by common USACE activities including cutter-head dredges, pile driving, underwater blasting, and various vessel activities. ERDC then created a stand-alone software to standardize the processing of sound files. Then, a library of common anthropogenic sounds was created. This library provides common measurements of sound pressure levels and sound exposure levels to USACE Districts and regulatory agencies (e.g. National Marine Fisheries Service). These measurements can be compared to known auditory hearing profiles of animals (e.g. fish, pinnipeds, cetaceans, and sirenians). If the anthropogenic sound levels exceed or encompass the auditory profiles of animals, the team uses those data to evaluate the probability that the excessive sound level causes ecological and physiological effects including behavioral modification, masking of communication, temporary auditory threshold shifts, and permanent auditory threshold shifts. Application of this technology in other regions of the United States is being evaluated. If impacts are likely, appropriate corrective actions are recommended that will minimize exposure of those species to those sounds including shifts in construction schedules (e.g., to times when animals are no longer in the area), operational adjustments (e.g., to reduce decibel levels, alter frequencies, shorten duration), and wildlife management actions (e.g., animal relocation, sound-dampening structures).

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Comparison of Benthic Fish Assemblages along Revetted and Natural Banks in the Lower Mississippi River: A 30-year Perspective

K. Jack Killgore and Steven G. George

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Benthic fish assemblages were compared among three different bank types in the Lower Mississippi River using hoopnets: Articulated Concrete Mattress (ACM) along main channel banks, natural banks along main channel, and natural banks in a secondary channel. From December 2016 to November 2017, 320 hoopnets were fished collecting 26 species. Species richness was highest in secondary channels (21 species), followed by ACM (20 species) and natural banks (16 species). However, abundance of dominant species (i.e., Flathead Catfish, Blue Catfish, Freshwater Drum, and Buffalo) differed seasonally. Blue Catfish were more abundant along natural banks and secondary channels during the summer. Flathead Catfish abundance peaked during the summer in the secondary channels but were also abundant along ACM year-round. Freshwater Drum abundance was highest along natural banks in the winter and ACM in the spring. Juvenile Buffalo utilized secondary channels in the winter indicating the importance of these habitats for over-wintering fishes. Comparison of the native benthic fish assemblage between 1985 and 2016-17 revealed minimal differences in species composition and abundance indicating long-term stability and resilience of Lower Mississippi River fishes. An exception was the prevalence of Asian Carp (Silver and Bighead) in the 2016-17 hoopnet collections. Negative impacts on native fishes are likely because Silver Carp, and to a lesser degree, Bighead Carp, were the most abundant species collected in spring and summer, and their relative abundance was 2-3 times higher than any native species. Further monitoring of invasive species impacts is recommended along with the evaluation of aquatic macroinvertebrates and fish diets among the different bank types to continue assessing long-term ecological responses of river engineering in the Lower Mississippi River.

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Tracking Asian carp movement in the Tennessee River and Tennessee-Tombigbee Waterway

Knight.T[1], D. Rodgers[1], and N. Martin[1]

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Many boaters and anglers are concerned about the growing population and expansion of Asian carp in the Tennessee River and Tennessee-Tombigbee Waterway. For several years, a joint state, federal, and university effort has been underway to try to stop the expansion of Asian carp in two of the most important waterways in the southeast. As part of that effort, collecting data on Asian carp movement has been a focus for MDWFP fisheries personnel in the northeast region. In order to track carp movement, sonic tags were implanted in Silver Carp, *Hypophthalmichthys molitrix*, captured in Pickwick Lake. Acoustic receivers have been deployed throughout the Tennessee River and Tennessee-Tombigbee Waterway. To date, MDWFP biologists, with assistance from Tennessee Tech University and TWRA, have tagged 40 silver carp. Surprisingly, nine of these carp moved downstream to Kentucky and Barkley Lakes. Two of those carp then returned to Pickwick. Current data analysis shows that silver carp can swim over 60 miles per day and utilize lock systems at dams, in order to migrate throughout the lakes in these waterways. The data MDWFP is collecting will be vital in determining the effectiveness of fish passage barriers at locks and dams, as well as securing funding for such structures from Congress.

Branden Kohler, branden.kohler@usm.edu, (610) 306 - 8516, Student Presentation

Delineating isoscapes of selected fish species in the Northern Gulf of Mexico

Branden Kohler and Kevin Dillon

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Stable carbon and nitrogen isotope values of consumers can differ between locations due to spatial and temporal variations in the isotope values of basal resources within ecosystems. Delineating such "isoscapes" to map the spatial variation of stable isotope values can improve food web models and further inform fisheries management decisions. We present spatial and seasonal variation of $\delta^{13}C$ and $\delta^{15}N$ values of Red Snapper (*Lutjanus campechanus*) and other reef fish species collected in 2016 and 2017 across offshore Mississippi waters. The $\delta^{13}C$ values for Red Snapper sampled in 2016 were within a narrow range across all months. In 2017, the Red Snapper had a broader range of $\delta^{13}C$ values with the specimens collected around Chandelier Islands and near the Louisiana birdfoot being more depleted during August and September. The $\delta^{15}N$ values for the Red Snapper showed declining values from nearshore to offshore in both 2016 and 2017 with the greater shift in 2017. Results from a companion study conducted in 2014-2015 also show species-level as well as spatial variation of $\delta^{13}C$ and $\delta^{15}N$ values in many commercially and recreationally important fish species collected from waters in Louisiana to Florida. In general, nearshore and coastal migratory pelagic species showed the most variability in isotope values while reef and large offshore pelagic fish species were more consistent. Among these fish guilds, average $\delta^{13}C$ values increased while average $\delta^{15}N$ values decreased from nearshore to offshore habitats. Red Snapper showed a clear spatial gradient in $\delta^{15}N$ values across the study area while Vermilion Snapper, which occupies a lower trophic level, did not. This is corroborated by the current reef fisheries assessment although seasonal variability is a factor for further analysis.

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Describing annual variability in the movement patterns of Bull Shark, *Carcharhinus leucas,* in St. Louis Bay and adjacent waters using passive acoustic telemetry

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Passive acoustic telemetry is a powerful tool facilitating continuous long-term monitoring of acoustically tagged animals. An array of 44 receivers (Vemco VR2W) deployed throughout St. Louis Bay, MS and adjacent Mississippi Sound waters was used to investigate movement patterns of juvenile Bull Shark, *Carcharhinus leucas*, within the area from 2017 through 2018. Juvenile Bull Shark (n = 17, average TL = 960 mm) caught in the Bay were surgically implanted with Vemco V16 transmitters. Data loggers were deployed to record bottom water temperature, providing long-term data to examine seasonal movement patterns. To describe movement within the study area, the array was divided into three zones: Bay (n = 8 VR2Ws), Bay Mouth (n = 20 VR2Ws), and Sound (n = 16 VR2Ws). Of the 8 sharks tagged in 2017, three were detected in the array in 2018. Interestingly, the proportion of total raw detections recorded in each zone varied greatly between years. In 2017, there were a total of 15,403 raw detections logged within the array. Proportionally, 5.1%, 25.3% and 69.6% of the raw detections were logged in the Bay, Mouth and Sound zones, respectively. In 2018, there were a total of 50,243 raw detections logged within the array. Proportionally, 68.6%, 13.7% and 17.7% of the detections were logged in the Bay, Mouth and Sound zones, respectively. Comparisons of monthly detection data between years also showed a high degree of variability. Timing and location of tagging events each year, coupled with environmental variability, likely influenced the differential use of the study area by month and year. Preliminary results indicate juvenile Bull Shark exhibit site fidelity to St. Louis Bay and the surrounding waters. The high annual variability reported in this study highlights the importance of long term monitoring to better understand the drivers of Bull Shark movements in Mississippi waters.

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An introduction to the Mississippi Department of Marine Resources operated Lyman Fish Hatchery focused on marine aquaculture and coastal restoration.

Michael Lee[1], Sara Smith[1], Jason Snawder[1], Bryce McKim[1]

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Lyman aquaculture facility is a MDMR operated property that focuses on aquaculture restoration and commercial aquaculture opportunities. Research at the Lyman Hatchery is refining and developing standard procedures and protocols to rear and release costal marine fishes through the MDMR aquaculture program. The MDMR Lyman hatchery has worked in collaboration with the Thad Chochran Marine Aquaculture at USM since 2006 to advance stock enhancement of marine species in Mississippi. Currently the aquaculture program is working with spotted seatrout, blue crab, salt marsh plants, koi (as a protein food source), and diamond-back terrapin. Lyman is optimizing procedures for repeated use of artificially made seawater for all phases of species production and constructed saltmarsh areas for treating and reusing wastewater. Continued infrastructure work and upgrades to the hatchery will improve future fish pond culture and lower the cost of stocking. Operations at the Lyman aquaculture facility are critical to the sustainability of marine fisheries as well as important to the economy of the State of Mississippi. The Lyman hatchery is involved with educational outreach and continues to work with conservation groups and different state agencies to advance aquaculture on the Mississippi coast.

Olivia Lestrade, Olivia.lestrade@usm.edu, 228-697-6188, Student Paper

Evidence for Microplastic Ingestion by Juvenile Fishes Associated with *Sargassum* Habitats in the Gulf of Mexico

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Microplastics (plastic pieces less than 5 mm in size) are a growing concern because they are highly durable, ubiquitous in many marine environments and have the potential to be ingested by smaller organisms like larval and juvenile fishes. Because plastics are buoyant, microplastics tend to aggregate at the ocean surface via atmospheric and oceanic processes, such as Langmuir circulation. This aggregation puts microplastics in contact with other floating habitats that converge in the same manner, such as the holopelagic brown algae complex, *Sargassum.* *Sargassum* provides a nursery habitat for many economically important larval and juvenile fishes. Larval and juvenile fishes are especially vulnerable because they may mistake microplastics for food which could potentially affect their development and survival. To better understand the species at risk of ingesting microplastics, juvenile fishes collected from *Sargassum* habitats in the Gulf of Mexico will be examined for the presence of microplastics and frequency of occurrence. Here we present preliminary results from these analyses. The results from this project may have implications for future fisheries-based management strategies for *Sargassum* and associated fishes in the Gulf of Mexico.

Anna K Millender, anna.millender@usm.edu, 662-266-1626, Student Paper

An initial life history assessment of recreationally landed Swordfish, *Xiphias gladius*, in the northern Gulf of Mexico

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Swordfish, *Xiphias gladius*, is a highly migratory pelagic species found circumglobally in tropical, subtropical and temperate ocean waters. Historically, studies investigating age, growth and reproduction of swordfish have primarily been conducted on specimens collected from commercial longline fisheries in the Atlantic and Pacific Oceans and the Mediterranean Sea, with information lacking from the Gulf of Mexico (GOM). Increased recreational fishing for swordfish in the northern GOM dictates the need to collect regional life history data to inform future stock assessments in support of effective management of swordfish populations in the GOM. The current study collected biological samples and data from 33 swordfish (27 females and 6 males) ranging in size from 82.6- 213 cm lower jaw fork length that were landed during fishing tournaments in the northern Gulf of Mexico during June 2017 and 2018. Histological examination of gonadal tissue from an initial subset of 26 fish indicated that all had reached sexual maturity and all males were spawning capable. Sixty percent of female swordfish were in the early developing reproductive phase, while 10% were in the spawning capable phase. Additionally, females exhibited asynchronous oocyte development indicating batch spawning. Anal spines were removed from each of the 33 specimens, and the second spine was prepared for age analysis. Independent readers provided annuli count with no prior knowledge of specimen size, sex, or previous counts. Age estimates ranged between 3 - 11 years. Back-calculations of age were conducted to model growth due to limited sample size and resulting values fitted to four growth models (two- and three-parameter von Bertalanffy, Gompertz, and logistic). The three-parameter von Bertalanffy was the model of best fit to the data (L_{inf} = 224.47879, k = 0.18274). To our knowledge this ongoing study is the first to investigate life history of recreationally landed swordfish in the GOM.

Segmentation of Mississippi's natural and artificial lakes

L.E. Miranda[1], L.A. Bull[2], M.E. Colvin[3], W.D. Hubbard[2], L.L. Pugh[2]

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Segmentations divide a diverse resource into groups, or segments, based on distinctive attributes that may respond similarly to management actions. A 4-way segmentation based on lake origin (natural or artificial) and size (small or large) was constructed for Mississippi lakes using a 30 year data set. We aimed to document elements distinguishing these segments to understand relationships among them and to seek insight into lake management that may be apparent at the segment scale but not at the lake scale. Analyses pinpointed differences among the 4 segments relative to nutrient levels, fish assemblage composition, fishery characteristics, angler catch, and fishery management objectives. In general, most artificial lakes were eutrophic, varied widely relative to species composition depending on whether they impounded small or large rivers, their fish assemblages could be heavily influenced by stocking, provided principally centrarchids fisheries, and the management focus was on angler harvest. Most natural lakes were hypereutrophic, included higher species richness, provided a greater diversity of fisheries, and the management focus was on fish populations and habitat. Fishing success was similar across segments.

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DNA barcoding leads to higher resolution of Red Snapper diet in the northern GOM

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Diet studies based exclusively on visual identification of stomach contents commonly result in high percentages of unidentified items due to the varying stages of digestion deteriorating morphological features. Additionally, it is unclear how well the identifiable diet reflects the unidentified portion. Recently, molecular techniques (e.g. DNA barcoding) have been used in diet studies, and have provided higher resolution for prey identification. With an emphasis on moving toward ecosystem-based fisheries management, increased availability of data on trophic relationships is paramount. Numerous studies have assessed the diet of Red Snapper throughout the northern Gulf of Mexico, however, very few have implemented molecular techniques. To address this issue, we analyzed stomach contents from 389 Red Snapper captured in Mississippi coastal and nearshore Gulf waters. With traditional visual identification, 34.5% of prey items were identified to either order, family, genus, or species. The addition of DNA barcoding resulted in a 45.0% increase of prey richness, with nearly half of which have not previously been recorded in this region. We found that Red Snapper feed across a wide variety of taxa (e.g., teleosts, sponges, copepods, jellyfish, and polychaetes). We also found the presence of Red Snapper itself in the gut contents, which has only been shown in one other study. Low taxonomic resolution in prey identification often obscures the complexity of trophic links, thus it is essential that empirical dietary data be collected. Our findings show that a barcoding approach significantly increases the taxonomic scope by documenting an even broader distribution of species consumed by Red Snapper.

Bradley M. Richardson, bmr380@msstate.edu, (618) 697-3178, Student Paper

State Boundaries Draw Hard Lines in *Aeromonas hydrophila* Disease Strains of Farm-raised Channel Catfish, *Ictalurus punctatus*

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Atypical *A. hydrophila* (aAh) has been plaguing channel catfish *Ictalurus punctatus* aquaculture farms in the southeastern US since the late 2000s. Multiple serotypes of aAh effect various parts of Alabama and Mississippi, and clinical symptoms vary with serotype. Our study aimed to investigate the status of aAh in catfish aquaculture ponds of the Southeast. Bacterial isolates were collected from incoming clinical cases and cryo-preserved for later testing. Isolates from Alabama covered 2010 to 2015, while isolates from Mississippi covered 2013 to 2018. All Alabama cases from the denoted years matched the ML09-119 strain that was originally collected from Alabama facilities in 2009. However, the proportion of ML09-119 cases in Mississippi were quickly supplanted by the S14-452 strain after its discovery in 2014. After 2016, no clinical cases matched the original ML09-119 strain. The lack of presence of the S14-452 strain in the Alabama samples raises many questions about transmission of this bacterium. Essentially all fry used in Channel Catfish aquaculture originate in the Delta region of Mississippi. So, of the S14-452 strain is dominant in this region, why has it not spread to other regions that import these fry? Ongoing studies are focusing on outbreak predictors, such as environmental drivers, and possible vaccines. At this point, only one antibiotic is available for treating aAh outbreaks. This lack of treatment options increases the risk of antibiotic resistance in the pathogen and could exasperate the issue even further.

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Dealing with the Press – Being Reactive and Proactive

Dennis Riecke

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

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

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Evaluating the effect of simulated spring duration on white crappie (*Pomoxis annularis)* spawning success

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Interest in increasing crappie (*Pomoxis* spp.) production has led to research on developing out-of-season spawning protocols. Previous studies have established out-of-season spawning White Crappie (*P. annularis*) is possible after simulated winter and gradual adjustment to spring conditions, with duration at final spring conditions suggested to improve spawning success. Therefore, the effects of 2 or 3 weeks at spring conditions (22°C, 16-hour light) were examined for White Crappie spawning success (i.e., percent females spawned, egg fertilization percent, ovulated egg volume, gonadosomatic index (GSI), and mean egg diameter). Fish were exposed to a simulated 2-week winter (10°C, 10-hour light), a 6-week spring transition phase, and held for either 2 or 3 weeks at final spring conditions. Fish were induced to spawn with intramuscular injections of gonadotropin-releasing hormone analog (GnRHa) and strip-spawned after ovulation. In the 2-week spring treatment, all females (n=9) ovulated, with a mean (± SE) egg fertilization of 34 ± 8%, ovulated egg volume of 17.5 ± 3.1 mL and egg diameter of 0.82 ± 0.01 mm. All females in the 3-week treatment ovulated (n=10) with a mean (± SE) egg fertilization of 65 ± 10%, ovulated egg volume of 16.9 ± 4.5 mL, and egg diameter of 0.81 ± 0.02 mm. Egg fertilization percent was greater in the 3-week spring treatment, indicating White Crappie out-of-season spawning success benefits from increased duration of spring conditions.

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Using USACE motor vessels to monitor fish movements in the Mississippi River: tracking high-profile species using acoustic telemetry

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To evaluate longitudinal occurrence patterns, movement history and influence of USACE construction activities on telemetry tagged fishes, the ERDC Fish Ecology Team utilized passive acoustic telemetry receivers mounted aboard USACE support vessels during their routine travels within the Mississippi River Valley (MRV). Receivers have been deployed since 15 SEP 2015 (last download 30 OCT 2018) on the MV *Mississippi*, MV *Benyaurd* and the USACE Matt Sinking Unit (i.e., quarter boat and anchor barge) resulting in a total of 15,361 detections from 53 unique tags. Ten tags contributed to 97% of the total detections with 21 of the 53 detected tags (40%) documented with ≤ 3 detections. Eleven tags were noted with only a single detection and may represent false detections. Movement patterns were observed in several fish species including telemetry tagged Shovelnose Sturgeon, Pallid Sturgeon, Flathead Catfish and Paddlefish. This program effectively integrates the efforts of numerous independent telemetry programs operating within the MRV which includes universities and state and federal agencies, and illustrates an important multiagency collaboration on tracking important riverine fish species. One example includes a Paddlefish originally tagged by Missouri Department of Conservation on 28 MAR 2016 on the Mississippi River near the confluence of the Ohio River (RM 948.5). The fish was subsequently detected by the MV *Mississippi* receiver 21-28 September 2016 in the Yazoo River as the vessel was motoring between the Vicksburg Harbor and Mississippi River (RM 437.2). The fish was later detected by the MV *Mississippi* at RM 125 on 30 October 2016. The USFWS documented the fish on their acoustic array located in the Delta National Wildlife Refuge (RM 3) 17-21 December 2016 and again 4-6 January 2017. Our estimates note the Paddlefish covered approximate 944.5 river miles in 265 days at an average downstream speed of 3.6 miles per day.

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Largemouth bass growth in the Pascagoula Marsh post-Katrina

Samantha Stelmack and Stephen Brown

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Many aquatic species along the Mississippi Gulf Coast were greatly affected during Hurricane Katrina and its aftermath. One such affected species was the Largemouth bass (*Micropterus salmoides*) population in the Pascagoula River and Marsh. To foster successful management of Largemouth bass throughout the Pascagoula River watershed, age and growth analysis was conducted to evaluate the 12-inch minimum length limit and compare growth rates to the state averages. Fish were collected from the Pascagoula Marsh in 2011 and 2016 during standard annual electrofishing surveys. In 2011 and 2016, very few Largemouth bass were collected that were spawned pre-Hurricane Katrina. Largemouth bass in 2011 took 2.3 years to reach 12 inches with an L_∞ of just 394 mm (15.5 inches). This is expected with very few older individuals observed in the population. In 2016, Largemouth bass took 2.7 years to reach 12 inches with an L_∞ of 508 mm (20 inches). The Von Bertalanffy growth curve showed that growth was slower in 2016 and with older individuals observed in the population a marked increase was calculated for the L_∞. Growth to the 12-inch quality size of Pascagoula Marsh bass is similar to the median for the largemouth population statewide median while the observed L_∞ of 508 mm is much lower than the median L_∞ of 770 mm (30.3 inches) for the state. Therefore, growth of Largemouth bass in the Pascagoula Marsh for the first 3 years is similar to the statewide average but decreases significantly for fish older than 3 years. Growth may be inhibited at older ages due to density dependence (i.e. lack of harvest), energy constraints due to osmoregulation in a brackish environment, or simply genetics. Further investigation is necessary to determine the effectiveness and necessity of the 12-inch minimum length limit.

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Results from a 2018 Status Survey for Frecklebelly Madtom (*Noturus munitus*) in the Pearl River Drainage

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The Frecklebelly Madtom, Noturus munitus (Suttkus and Taylor 1965), is found in the Pearl and Mobile River drainages and is currently petitioned by the Center for Biological Diversity for federal listing under the Endangered Species Act with a listing decision deadline of 2020. The most recent targeted survey in 1999 in the Pearl River considered populations of Frecklebelly Madtom to be in decline, where only 13 Frecklebelly Madtom were collected among 8 of 53 historical localities surveyed. Herein, we reassessed the status of the Pearl River population of Frecklebelly Madtom, we addressed the lack of recent data by completing status surveys at 109 localities throughout the Pearl River in Mississippi (n = 75) and Louisiana (n = 34) from February through October 2018. Surveys resulted in 1228 Frecklebelly Madtom collected and an 83% presence at known localities surveyed. The high rate of presence at historic localities and high catch rates indicate the Pearl River population of Frecklebelly Madtom is not in need of additional protection and the state endangered status in Mississippi may not be warranted for the Pearl River population. These results are incongruent with the results of historic surveys and suggest that the species is abundant and widespread throughout the Pearl River basin.

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Monitoring Southern Flounder (*Paralichthys lethostigma*) in the Mississippi Sound using Fyke Nets.

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Southern Flounder (*Paralichthys lethostigma*) is a popular fish harvested by both recreational and commercial fishermen along the Mississippi coast; however, in recent years, annual harvest estimates have declined. Due to the selectivity and sampling regime of current fishery-independent surveys, this species is rarely and inconsistently sampled leading to difficulties estimating relative abundance each year. With these issues in mind, the goals of this project are to 1) establish a long-term monitoring survey specifically for Southern Flounder, 2) evaluate the effectiveness of the sampling regime by analyzing data collected to-date, and 3) discover possible environmental factors that could affect the relative abundance of Southern Flounder within the Mississippi Sound. A total of 49 Southern Flounder were caught between the three sampling stations (Deer Island, Davis Bayou, and Belle Fontaine). Belle Fontaine was observed to produce the highest number of Southern Flounder sampled with 24, next was Deer Island with 17, and finally Davis Bayou with 8. These sites were chosen due to their ideal habitat for Southern Flounder and ease of access to sample. Sampling took place once every two weeks, with a 48-hour soak time, from the months of June - November. All Southern Flounder collected were female in the immature/developing reproductive phase. Sizes ranged from 194 mm - 460 mm (TL), and weights ranged from 88 g -1282 g. Environmental factors observed did not vary between sites, but discussions are being made for the possibility of added stations. Moving forward, with a longer sampling period and the possibility of new sites a pattern may emerge overtime. Results of this study will aid in informing future stock assessments and management recommendations for Southern Flounder in the Mississippi Sound.

Bayley M. Wilmoth, bw1524@msstate.edu, Student Paper

Ontogeny of Southern Brook Lamprey, *Ichthyomyzon gagei*, with emphasis on abundance, distribution, and morphology in a small watershed

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The ecology of many non-game fish species is understudied, thus little information is known about the life-history and population structure of diverse fishes. Very little is known about the spatial structure and abundances of Southern Brook Lamprey populations, and less is known about their early life-history and ontogeny outside of living for up to seven years and experiencing an ammocoete, metamorphosis, and adult life stage. We estimated lamprey abundance at seven stream reaches in Panther Creek to describe their population structure and identify factors that affect the metamorphosis from ammocoetes to adult. We electro-fished hundred meter reaches along the creek beginning March 2018. Captured individuals were measured for total length, photographed for morphological analyses in the ImageJ software, and assigned to one of the three life stages based on the development of gill slits, caudal fins, and photopic vision. Southern Brook Lamprey were not present in the left fork of the creek, and 124 individuals were captured across the sites where lamprey were present. There was a 26% chance of an individual being metamorphic or an adult if it is at least 120 mm long and approximately a 59% chance at 150mm. It is possible that there is another environmental or biological influence of metamorphosis which has yet to be determined because even at lengths larger than 150mm ammocoetes have been documented. Additional sampling of Panther Creek will provide clarity about the population structure and distribution of lamprey in this watershed and potentially identify mechanisms that regulate transition between life stages. Identifying potential metamorphosis triggers would allow for management efforts to be put in place to increase reproductive and recruitment rates, thus allowing Southern Brook Lamprey to avoid the endangered species list like the Northern Brook Lamprey.

Poster Abstracts

Abstracts are in alphabetical order by presenting author's last name.
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Early look: Performance of machine learning to classify age from age-length data

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Fish length and age are common measurements collected by fisheries agencies. Together with catch per unit, agencies can assess important population parameters such as growth, mortality, and recruitment. But estimating age of individual fish is costly (e.g., time, fish mortality), and therefore age structure is typically estimated from a subsample and expanded to the whole sample. Expanding and estimating age structure of the whole sample is done using a probability matrix of age and length-class to partition individuals of the complete sample (age-length key [ALK]). Aging error, failure to appropriately include data stratification, and instances of many ages represented in a length-class can introduce error when using ALK to expand age structure to unaged fish. The use of covariates can more accurately assign an age to unaged fish, but additional data collection can be resources limited. Since only length and age data will likely be used to estimate population age structure and growth we evaluated if the number of correct age classifications (sensitivity) could be improved using a naïve Bayes classifier (NB) relative to an ALK. We used a repeated *k*-fold cross-validation on six simulated data sets and then compared mean sensitivity of ALK and NB classifiers. Sensitivity NB was better at assigning age than ALK with sensitivities of 86% and 77% respectively. Evaluation of a sample of largemouth bass (*Micropterus salmoides*) lengths and ages, resulted in negligible differences in sensitivity (ALK 52% and NB 53%). Additionally, von Bertalanffy growth curves estimated using age assigned from each method showed little variation. While NB may have higher sensitivity, these gains may only be for younger age-classes and seem not to affect estimated growth curves. Further investigation may reveal additional benefits of NB or the robustness of ALK for age-length data.

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Teaching and tagging: Expanding marine education through species investigation

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The Marine Education Center (MEC) at the University of Southern Mississippi, Gulf Coast Research Laboratory (USM GCRL) serves as the education and outreach arm to the Gulf Coast Research Laboratory. The MEC provides memorable hands-on experiences to educate the community and produce informed stewards of coastal ecosystem. In 2011, the MEC partnered with USMs Center for Fisheries Research and Development, to develop a weeklong camp designed to provide middle and high school age participants with in-depth classroom learning and hands on experience with elasmobranchs common to the Mississippi Sound. The camp is now known as Sharkheads Shark Fest. From 2011-2018 Shark Fest has reached 465 participates with attendance rates of approximately 77 students each summer. During the camp, participants are given the opportunity to experience hook and line and longline fishing techniques; measure and weigh, and tag and release caught sharks; and enjoy environmental education while aboard GCRL research vessels. This one of a kind, hands-on experience has allowed students to encounter a number of local species including sharks, rays, and a variety of teleost fish. Over the eight years of Shark Fest, participants have caught 734 individuals of 12 elasmobranch species. Throughout the duration of this program Atlantic Sharpnose and Blacktip sharks were the most frequently caught, 77% and 13%, respectively. Pre- and post- test data have shown a statistically significant increase in participants' knowledge evaluated by t-tests (Clardy, S., MDWFP-YPI). Overall, the model of this program has proven to provide a unique opportunity to engage students and teach the importance of being stewards of the marine environment to ensure future generations can fully appreciate the natural ecosystem of Mississippi coastal waters.

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Tiny Fish, Big River: Occurrence of Stonecat and Freckled Madtoms in the Lower Mississippi River

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Previous collections within the Lower Mississippi River (LMR) of two madtom species, Stonecat *Noturus flavus* and Freckled Madtom *Noturus nocturnus*, have been limited to five individuals south of the confluence with the Hatchie River (TN). These individuals have been attributed to accidental drift from Stonecat populations in the Middle Mississippi River (MMR) and Freckled Madtom populations in the smaller tributary streams. From 2003-2016, the ERDC Fish Team has documented the capture of 187 Stonecats and 35 Freckled Madtoms in the LMR below the confluence with the Hatchie River using gear that specifically targets benthic fishes (Missouri trawl and 60 hook trotlines). Stonecats captured ranged in length (12mm-188mm) and included both larval and adult fish. Captured Freckled Madtoms also included larval and adult individuals (16mm-98mm TL), and at least one adult was a gravid female. Stonecats were collected at several sites on the LMR in a forty-mile stretch (RM 640-688) and Freckled Madtoms were captured in the LMR ranging from river mile 194-738. Both species were typically caught in meanders of the main channel along point bars with sand, gravel, or clay substrates. The number of captured individuals paired with the wide range in ages and capture locations point toward resident, reproductively capable populations in the LMR for both species.

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Gulf of Mexico Shark Pupping and Nursery Survey: a review of the survey from 2015 to 2018 in Mississippi coastal waters

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Data on the abundance and habitat use of coastal elasmobranch species are necessary for informing accurate management decisions. Using gillnet data from the cooperative Gulf of Mexico Shark Pupping and Nursery survey, we quantified the shark assemblage of the Mississippi Sound from April-October in years 2015-2018. Sampling effort consisted of 84 gillnet sets totaling 127 hours of soak time with a 183 x 3 meter gillnet with six, 30.5 meter panels of varying mesh sizes. A total of 568 elasmobranchs (505 sharks, 63 rays) representing 12 species were collected. The Blacktip, *Carcharhinus limbatus* (41.5%), Atlantic Sharpnose, *Rhizoprionodon terranovae* (22.7%), and Finetooth, *Carcharhinus isodon* (22.5%) Shark were the most frequently encountered species. Of the ray species, the Cownose Ray, *Rhinoptera bonasus* (46%) and Bluntnose Stingray, *Dasyatis say* (26%) comprised the majority of the catch. Similar to other studies from the Mississippi Sound, young-of-year and juvenile life stages represented the bulk of the elasmobranch catch at a combined 76%. Kruskal-Wallis tests revealed no significant differences in combined elasmobranch catch-per-unit effort (CPUE) by year, month or depth strata. Species-specific habitat associations will be further discussed. Sex ratios of elasmobranchs were tested for a departure from equality with Chi-squared tests for goodness of fit. Combined elasmobranch sex ratios were significantly skewed towards males (1.3:1, $p = 0.0011$). Of the dominant species, sex ratios were significantly skewed towards males for Atlantic Sharpnose (3.5:1, $p = 3.094e\text{-}9$) and towards females for Finetooth (1.5:1, $p = 0.029$). Blacktip sharks showed no significant difference in sex ratio (1.2:1, $p = 0.1235$). Data from this ongoing survey will provide meaningful information to better assess elasmobranch populations in coastal waters of Mississippi and inform future stock assessments.

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Otolith shape analysis for Gulf Menhaden (*Brevoortia patronus*) in the north-central Gulf of Mexico

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Recent assessment of Gulf Menhaden (*Brevoortia patronus*) in the northern Gulf of Mexico (GOM) stock identified the determination of stock structure to be a “very high” priority in effectively managing the fishery. Genetic studies have traditionally been used to understand stock structure and examine the degree of homogeneity of this stock and others. To corroborate previously reported results, that indicate that the stock of Gulf Menhaden is homogenous in the region, we investigated the homogeneity of stock structure using an alternate method of assessing phenotypic dissimilarity, otolith shape analysis. The objective of this study was to investigate the geographic variability in otolith shape as an indication of stock structure for Gulf Menhaden in the north-central GOM. We found that otolith shape differed significantly (α = 0.05) among the three geographic regions examined. The greatest dissimilarity in shape occurred between samples taken from Mississippi and Texas. Shape coefficients associated with the dorsal rostrum and ventral antirostrum regions of the otolith accounted for the greatest proportion of the total variance in coefficients. Our results suggest the presence of subdivisions in the Gulf Menhaden stock and support the need for a more comprehensive genetic investigation.

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Preliminary observations of adult/sub-adult Red Drum (*Sciaenops ocellatus*) abundance in coastal Mississippi waters using a long-term monitoring program

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Red Drum (*Scianops ocellatus*) is an important sportfish species throughout coastal communities along the northern Gulf of Mexico. Because of limited information regarding Red Drum movements and connectivity in coastal Mississippi, a long-term tagging program was initiated in 2008. The primary goal of this initiative was to collect relative abundance data for Red Drum that occur in Mississippi coastal waters. Red Drum were collected during six months of the year (March-May and October-December) using four distinct 300-ft monofilament gill nets of various mesh sizes (2.75, 3.5, 4.0, and 5.0" stretched). All nets were deployed for 90 minutes at four fixed coastal stations (Grassy Point, Bayou Portage, Fort Bayou, Davis Bayou). Viable Red Drum measuring <500 mm TL were measured, tagged, and released alive. In an effort to increase sample size for age data on larger fish, all Red Drum ≥500 mm TL were further processed at the laboratory for sex, reproductive stage, and total weight. Total Red Drum abundances were highest during 2009 and 2018. Additionally, fish measuring 350-399 mm were the most frequently observed size class. Because this is an ongoing project, continued Red Drum sampling during future years will provide data beneficial to state resource managers and to NOAA Fisheries for implementation in the Southeast Data Assessment and Review (SEDAR) program.

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Differences in Habitat use Between Immature and Mature Female Red Snapper

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Previous studies of Red Snapper (*Lutjanus campechanus*) in the Gulf of Mexico have compared reproductive output among natural vs. artificial reefs, but have not looked at differences in depth. This study compared age and fork length (FL) between immature and mature female Red Snapper at different artificial structures (reefs and oil/gas platforms) and depth strata (shallow, < 20m; mid, 20-49m; deep, 50-100m) to determine differences in habitat use off the coast of Mississippi in 2016 and 2017.

Overall, immature fish ranged from 168–525 mm FL and 0.8–5.3 years while mature females were 265-795 mm FL and 0.3–22.3 years old. Although most immature and mature females were captured at mid-depth, more mature fish were captured in deep water (24%) than immature fish (4%). The highest percentage of immature females was on shallow platforms.

For immature fish, there was no significant difference in FL or age by structure type or depth (shallow and mid depths only). Mature fish were significantly larger and older in deep water than other depths ($p<0.001$), but there was no significant difference between age or FL and structure type. At both shallow and mid depths, mature females were always significantly longer and older than immature females within the same depth strata ($p<0.01$). Additionally, mature females were significantly longer and older than immature females on both platforms and artificial reefs ($p<0.001$).

Differences in habitat use between immature and mature Red Snapper could help rebuild their population. Fishing pressure is higher on shallower structures, where immature fish are most abundant but generally below the legal size limit. Mature fish are more abundant at deeper sites where fishing pressure is lower. The changes in habitat use in combination with differences in fishing pressure gives Red Snapper a greater opportunity to reproduce and contribute to population growth.

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Morphological and molecular identification of a *Posthodiplostomum* sp. associated with mortality in farmed largemouth bass *Micropterus salmoides* in the southeastern United States

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Production losses attributed to parasitic diseases are a significant economic threat to aquaculture industries across the globe. Largemouth bass *Micropterus salmoides* has become an important aquaculture species in the southeastern United States, with 176 farms yielding sales of $14.5 million in 2013. During the summer of 2016, a largemouth bass farm in Arkansas experienced recurring mortalities in fingerlings. Moribund fish were submitted to the Aquatic Research and Diagnostic Laboratory at the Thad Cochran National Warmwater Aquaculture Center in Stoneville, MS. Necropsies of affected fish revealed the presence of severe infections with the metacercaria of a *Posthodiplostomum* sp. in the spleen, liver, and the anterior and posterior kidneys. Most commonly referred to as white grub, *Posthodiplostomum* spp. are cosmopolitan parasites which sequentially develop in piscivorous birds, freshwater snails and fish hosts. Histopathological examination of affected organs of moribund fish was performed on a subsample of bass. Metacercaria were recovered for both morphological and molecular characterization. *Physa gyrina* (*n*=1,080) and *Galba truncatula* (*n*=504) snails were collected from the vegetation of three affected ponds in attempts to identify the snail host of the *Posthodiplostomum* sp. A diplostomid cercaria was detected from *P. gyrina* (0.28%). Given the morphological ambiguity of larval trematodes, ribosomal and mitochondrial genomic DNA regions were sequenced and used to confirm conspecificity between cercaria and metacercaria stages. Direct comparisons of sequence data to publicly available sequences supported morphological data and identified the isolate as *Posthodiplostomum* sp. 8, previously described from wild largemouth and smallmouth bass *Micropterus dolomieu* in North America. This is the first report of *Posthodiplostomum* sp. 8 associated with morbidity and mortality events that represent a threat to largemouth bass production. Future work will focus on identifying the avian host and evaluating physiological and pathological effects in bass and other fish hosts through controlled experimental infections.

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Establishing Ground Cover in Reservoir Mudflats to Foster Fish Assemblages

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Flood control reservoirs experience fish habitat degradation particularly in littoral areas. To rejuvenate these habitats, we are researching the establishment of cool-season agricultural plantings on reservoir mudflats. Enid Lake is a 6,500-ha flood control reservoir in North Mississippi that exemplifies this type of habitat degradation. We established experimental plots by seeding shorelines exposed during Enid Lake's fall drawdown. Several agricultural species commonly used for wildlife food plots were selected based on their ability to grow during winter and under adverse soil conditions. Two grass species, ryegrass and triticale, out preformed all other crops and local vegetation despite low quality soils and drought. Ryegrass excelled in ground cover and biomass and triticale in maximum height. These complementing features contribute to diversity of fish habitat structure. To evaluate the performance of crops as potential fish habitat, we performed a mesocosm experiment monitoring the structural persistence of plants following inundation. Accelerated post inundation decomposition occurred in plants with shorter growing seasons prior to flooding. In October 2018 we re-planted the study area, with evaluations of both plant growth and fish use scheduled for Spring of 2019. Our results so far suggest that selected species grow well on mudflats, and may provide important structural complexity for spawning and age-0 fish post inundation.

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Spatial differences in condition impact caloric density of Gulf Menhaden (*Brevoortia patronus*) in the northern Gulf of Mexico

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Understanding energy densities of common prey species in ecosystems can provide key insight into system-level trophic ecology and predator prey dynamics. For example, in the northern Gulf of Mexico, "forage fishes" such as Gulf Menhaden, *Brevoortia patronus*, are considered critical links for transferring energy from primary and secondary producers to recreationally and commercially important fish species. The objectives of this research were to develop appropriate methodology for obtaining dry energy densities for Gulf Menhaden and evaluate intra-annual patterns of caloric value. Gulf Menhaden were collected from gillnet surveys conducted by the state resource agencies of Texas, Louisiana, and Alabama March to November, 2017. The range of length of fish sampled was 107 mm to 220 mm (fork length). To determine dry energy density, tissue samples from Gulf Menhaden were homogenized and freeze-dried for 48 hours. Bomb calorimetry was then used to determine caloric value of each individual sample, ~1 g. Gulf Menhaden dry energy densities were found to be high in the early spring, slightly decrease in the summer and later increase and peak in September, to approximately around 6.3 kcal g-1 dry weight. Understanding seasonal patterns of energy density help to inform predator-prey interactions and we hypothesize that temporal shifts in diet patterns of predators may be influenced by caloric value of prey. Overall, this work is an initial investigation into energy density of abundance prey species in the Gulf of Mexico.

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Comparison of catch per unit effort (CPUE) between commercial and recreational catch of legal blue crab, *Callinectes sapidus*, in Mississippi coastal waters

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The blue crab, *Callinectes sapidus*, supports a commercial and recreational fishery along the Mississippi Gulf Coast, the majority of which are harvested by traps. Historical harvest strategies within Mississippi waters have been designed around life stage habitat usage. As a result, commercial harvest is restricted to all waters south of the CSX railroad bridges. Recreational harvest can occur in all state waters including all rivers and bay systems south of Interstate 10. The catch per unit effort (CPUE) of legal blue crab was evaluated for the recreational and commercial catch in each of the coastal Mississippi counties (Jackson, Harrison, Hancock). The recreational portion of this study involves setting traps in each of the major bay systems north of the CSX railroad bridges in each of the three counties. The commercial portion of this survey was obtained by accompanying crab fishermen aboard their vessels and recording data on their catch. The CPUE for Jackson county was significantly higher than the CPUE for the other two counties in both the commercial and recreational catch. No statistical difference was found between the recreational and commercial CPUE except for the 2016 commercial catch which was significantly higher than any other year in both commercial and recreational catch. In Jackson county, most of the crabs caught in the recreational fishing grounds tended to be males with the opposite trend occurring in the commercial catch. The sex frequency shifted from a majority in Jackson county toward equal numbers in the east to west direction. This difference in sex frequency is expected as different salinity regimes exist between the recreational and commercial fishing grounds and between the three coastal counties. This study provides insight into the recreational CPUE compared to the commercial CPUE and could be beneficial to the future management of the blue crab fishery.

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Molecular, morphological, and histopathological data for the pentastome *Levisunguis subaequalis* in Western Mosquitofish *Gambusia affinis*

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Pentastomes are endoparasitic crustaceans which live as adults in the lungs or respiratory tracts of birds, mammals, and reptiles while the larvae of many species live in the viscera of fish. Adverse pathology in response to both adult and nymphal pentastome infection ranges from minimal to severe, with severe infections characterized by hemorrhage and inflammation of affected host tissues. *Levisunguis subaequalis* is a pentastome of softshell turtles *Apalone* spp. and Western Mosquitofish *Gambusia affinis*. While this parasite species has been morphologically characterized, molecular data has not been published and histological data highlighting the effects of infection is lacking. Using pentastomes opportunistically recovered from *G. affinis* in an exhibit at the Birmingham Zoo, novel morphological and molecular data are provided for *L. subaequalis*. While morphological data was used to identify *L. subaequalis* to species level, molecular data was used to assess evolutionary relationships of this species in both Bayesian and maximum likelihood phylogenetic analyses. Concatenated DNA sequences from the 18S and 28S ribosomal genes as well as the *cox*1 mitochondrial gene supported current pentastomid systematics, though data from more species are needed. A subsample of infected fish was also examined histologically to determine health impacts on the host. While *L. subaequalis* nymphs were observed to cause space-occupying compression of the adjacent viscera and fed on the blood of the fish host, limited adverse pathology was observed in this host species. Nonetheless, the present study provides the requisite morphological and molecular data to rapidly distinguish these parasites from morphologically similar species, especially in aberrant hosts. Furthermore, histochemical techniques more appropriate for detecting pentastomes and characterizing their associated pathology are described. Together, these data will assist in future efforts to characterize pentastomes and associated disease processes in the fishes of the southeastern United States.