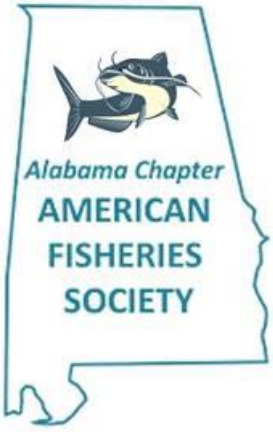
2017 Joint Annual Meeting of the Mississippi and Alabama Chapters of the American Fisheries Society



Biloxi, MS

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22 – 24 February 2017

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Sponsors

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

College of Forest Resources, Department of Wildlife, Fisheries & Aquaculture, Mississippi State University	College of Forest Resources Forest and Wildlife Research Center
Gulf Coast Research Laboratory, The University of Southern Mississippi	THE UNIVERSITY OF SOUTHERN MISSISSIPPI GULF COAST RESEARCH LABORATORY
Center For Fisheries Research and Development	CENTER FOR FISHERIES RESEARCH AND DEVELOPMENT GCRL Fisheries
Midwest Lake Electrofishing Systems	MLES Midwest Lake Electrofishing Systems
Coastal Conservation Association of Mississippi	COASTAL CONSERVATION ASSOCIATION MISSISSIPPI

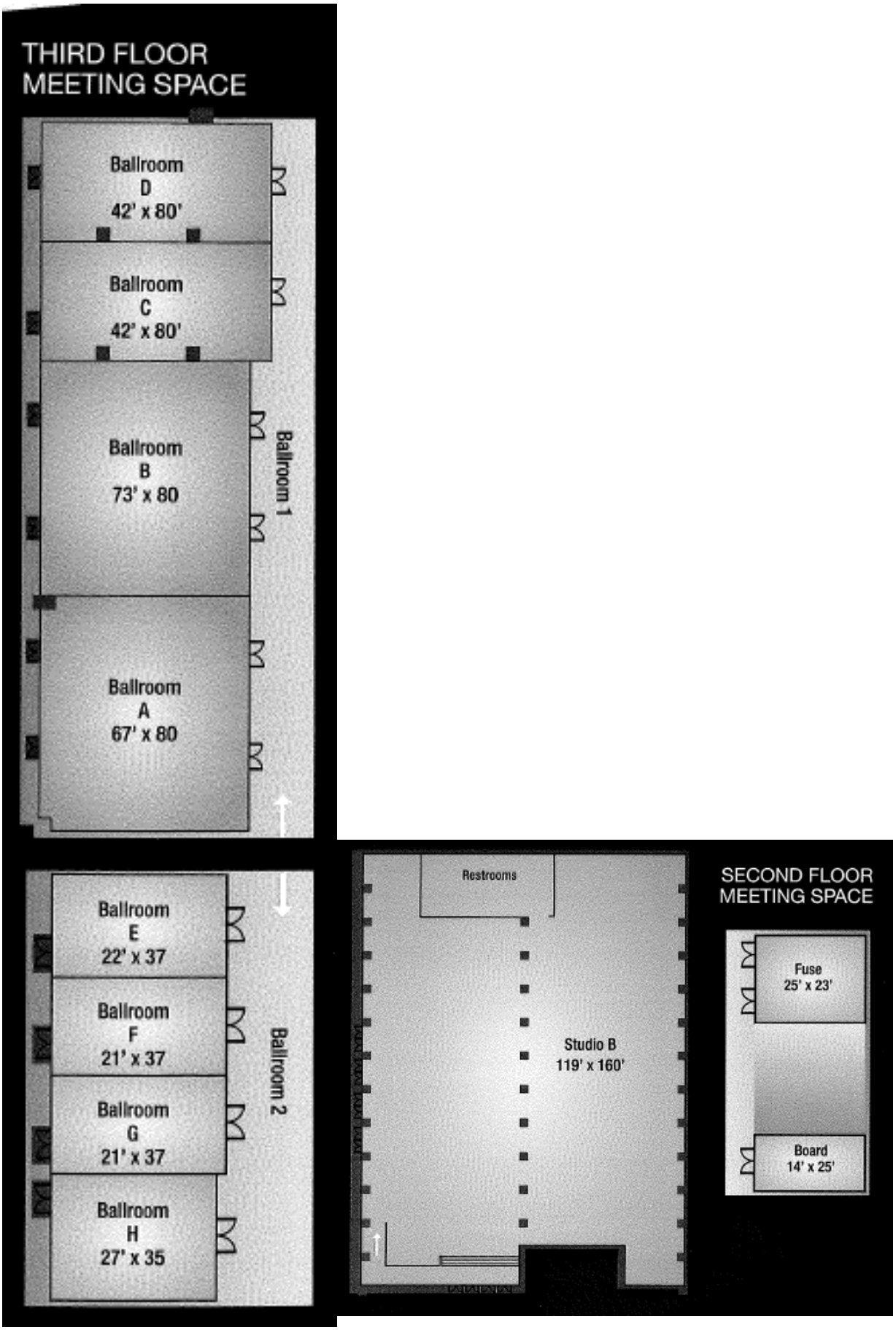
We also thank the Mississippi Department of Wildlife, Fisheries, & Parks for the in-kind donation of printing these programs.

MISSISSIPPI WILDLIFE, FISHERIES, & PARKS

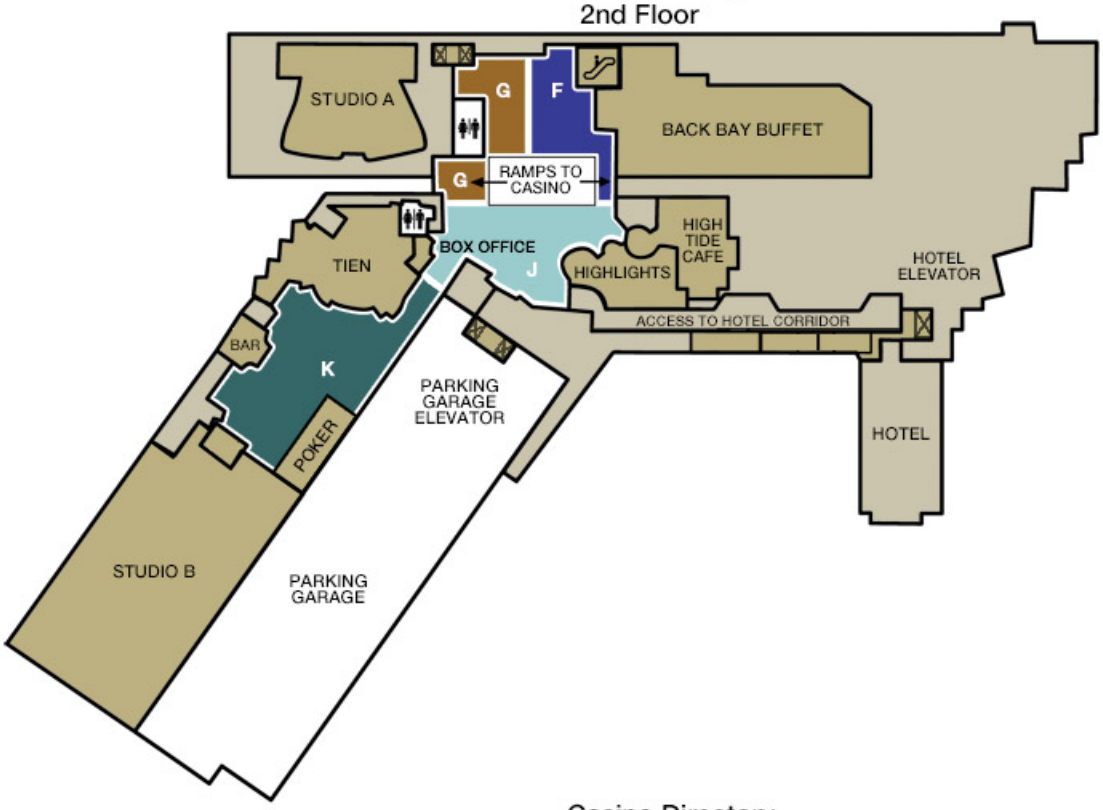
Program-at-a-Glance

All activities will be held on the third floor of the IP Casino and Resort.

	Event	Location
Wednesday, February 22		
5:00 - 7:00 PM	Registration	Ballroom A
6:00 - 9:00 PM	Welcome Social	Ballroom A
8:00 – 10:00 PM	Biloxi Brewery Tasting Tour ($10/per) *OPTIONAL*	Biloxi Brewery 186 Bohn Street
Thursday, February 23		
	Breakfast	On your own
7:00 - 5:00 PM	Registration	Front of Ballrooms C and D
8:00 - 8:15 AM	Welcome	Ballrooms C and D
8:15 - 10:00 AM	Presentations	Ballrooms C and D
10:00 - 10:30 AM	Break	Front of Ballrooms C and D
10:30 - 12:00 PM	Presentations	Ballrooms C and D
12:00 - 1:30 PM	Lunch	On your own
1:30 - 3:00 PM	Presentations	Ballrooms C and D
3:00 - 3:30 PM	Break	Front of Ballrooms C and D
3:30 - 5:15 PM	Presentations	Ballrooms C and D
5:00 - 6:00 PM	Poster Set-up	Ballroom A
6:00 - 7:00 PM	Poster Session	Ballroom A
7:00-10:00 PM	Banquet	Ballroom A
Friday, February 24		
	Breakfast	On your own
8:00 - 9:30 AM	Chapter Business Meeting	MS – Ballroom C
		AL – Ballroom D


THIRD FLOOR
MEETING SPACE
Ballroom
D
42' x 80'
Ballroom
C
42' x 80'
Ballroom
B
73' x 80
Ballroom
A
67' x 80
Ballroom 1
Ballroom
E
22' x 37
Ballroom
F
21' x 37
Ballroom
G
21' x 37
Ballroom
H
27' x 35
Ballroom 2
Restrooms
Studio B
119' x 160'
SECOND FLOOR
MEETING SPACE
Fuse
25' x 23'
Board
14' x 25'

Casino Directory
2nd Floor



Casino Directory
1st Floor

Banquet Speaker: Dr. Jack Killgore

The Greening of the Corps - A Fisheries Biologist's Perspective

Biography

Dr. Jack Killgore received his B.A. degree from University of Arkansas, Master of Science degree at Sam Houston State University in Huntsville, TX, and a Ph.D. at the University of Mississippi. He began his professional career as a Biological Technician for the U.S. Fish and Wildlife Service, National Reservoir Research Program, in Fayetteville, AR in 1976-1978. After completing his MS in 1980, he accepted a position with the U. S. Army Corps of Engineers Waterways Experiment Station (now referred to as Engineer Research and Development Center, ERDC) in Vicksburg, MS where he continues to work as a Research Fisheries Biologist.

Dr. Killgore is a Team Leader in the Environmental Laboratory at ERDC conducting research on environmental biology of fishes, threatened (sturgeon) and invasive (Asian carp) fish species, ecosystem restoration in wetlands large river systems, and environmental impact assessment of U. S. Army Corps of Engineers (USACE) flood control and navigation projects. He and his research Team work with USACE Districts and Divisions on evaluating environmental issues for Congressionally-approved water resource projects. Dr. Killgore focuses much of his research in the Mississippi River and Tributaries, although projects occur across the United States.

Dr. Killgore has been a member of the American Fisheries Society since 1985 and served as the Mississippi Chapter AFS President in 2006. He has received numerous achievement awards including the USFWS Southeast Regional Director’s Conservation Award in 2011, and in 2014, recognition from Tom Bostick, LT General, US Army 53rd Chief of Engineers and Secretary of the Interior Sally Jewell for co-authoring a Conservation Plan for the three endangered species in the Lower Mississippi River. Overall, Dr. Killgore and his colleagues have authored over 150 publications, 60 of which are refereed journal or book articles.

President-elect Candidates
(MS Chapter)

Rick Burris

Rick Burris is a Marine Fisheries Manager for the Mississippi Department of Marine Resources' (MDMR) Office of Marine Fisheries. He began his career with the MDMR in 2007 as the USFWS Sport Fish Restoration Coordinator for Coastal Mississippi. Since 2014 he has been the Director of the Shrimp and Crab Bureau. In addition to his role in the management of Mississippi's marine fisheries, he also oversees Mississippi's Marine Scientific Research Permits, the Licensed Live Bait Shrimp industry, the USFWS Sport Fish Restoration Program, and through a cooperative effort with the US Geological Survey, the Mississippi Sound Real-Time Hydrological Monitoring Program. He currently represents the MDMR for the Gulf of Mexico Fishery Management Council Shrimp Scientific & Statistical Committee, the Gulf and South Atlantic Panel on Aquatic Invasive Species, the Mississippi Crab Task Force, and the Gulf States Marine Fisheries Commission Technical Coordinating Committee (TCC) Crab Subcommittee, where he serves as Chairman. Rick also sits on the recently formed MDMR Stock Assessment Panel (MSAP). Rick earned his BS in Marine Biology and MS in Biology from the University of Southern Mississippi. He is a member of both the National and Mississippi chapters of the American Fisheries Society. He is a passionate outdoorsman who enjoys hunting and fishing, and sharing those experiences with his children.

Jill Hendon

Jill Hendon is the Interim Director of the Center for Fisheries Research and Development at The University of Southern Mississippi's Gulf Coast Research. She has Bachelor's degrees in Biology and English from the University of Wisconsin at Eau Claire and a Master of Science from the University of Southern Mississippi in immunology. Her current work focuses on distribution, movements, population monitoring, and reproduction/age and growth of coastal shark and teleost species. Jill also teaches an undergraduate/graduate level field course for USM's Summer Field Program, and serves on several graduate students' committees. Jill is an active member of AFS at both the national and state levels. She has served as Secretary/Treasurer for the Mississippi Chapter from 2010-2012, and as Financial Manager for the 2012 Southern Division meeting held in Biloxi, Mississippi; she received an AFS Distinguished Service award for her work at the SDAFS meeting. Jill is also recognized by the parent chapter as a Certified Fisheries Professional. At the federal level Jill serves as a panelist for NOAAs Southeast Data Assessment and Review board, and is the state of Mississippi representative for the Southeast Area Monitoring and Assessment Program's Gulf Subcommittee administered by the Gulf States Marine Fisheries Commission. She has also been acknowledged for her research on Capitol Hill in Washington DC where she received the Walter B Jones Memorial Award (for new or improved approaches to coastal or ocean management) for her work in shark stress physiology. Jill states that she would be honored to serve as President of the Mississippi Chapter and appreciates the nomination.

Session Moderators

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

	Ballroom C		Ballroom D
8:15 – 10:00 AM	Amy Cottrell Auburn University		Taylor Daley University of Southern Mississippi
10:30 – 12:00PM	Trevor Moncrief University of Southern Mississippi		Shay Allred Mississippi State University
1:30 – 3:00 PM	Andrew Shamaskin Mississippi State University		Sarah Walsh Auburn University
3:30 – 5:15 PM	Megumi Oshima University of Southern Mississippi		Bryant Haley Mississippi State University

Presentation Schedule

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

	Ballroom C		Ballroom D
8:15 AM	Spatial variability in the individual growth of Sheepshead (*Archosargus probatocephalus*) in the Gulf of Mexico and Atlantic: Implications for assessment and management. *Grant Adams*[1]		Assessing Red Discoloration in Catfish Fillets *Shay Allred*[1]
8:30 AM	Reducing shark bycatch in commercial and recreational fisheries. *Glenn R. Parsons*		Species-specific variation in elasmobranch interrenal morphology and steroid synthesis *Danielle Bailey*[1]
8:45 AM	Determining the effects of Bigheaded Carp on sport fish communities in floodplain lakes through rotenone sampling. *Nathan Aycock*		Optimizing a standard sampling program for non-wadeable rivers in Alabama to estimate species abundance and richness of fish communities *Jason Dattilo*[2]
9:00 AM	Shoreline rotenone application to control Largemouth Bass recruitment in small impoundments *Matthew Catalano*		Effects of annual droughts on fish communities in Mississippi Sound estuaries *Megan E. Fleming*
9:15 AM	Incubation temperature and parental effects on the hatching success and progeny performance of Channel Catfish *Nagaraj G. Chatakondi*		A Note on associations observed between sharks and teleosts in the Gulf of Mexico *Lauren Fuller*[1]
9:30 AM	Age and development of Tarpon, *Megalops atlanticus*, leptocephali upon arrival in the Mississippi Sound estuary *Patrick Graham*		A comparison of freshwater mussel populations in Boeuf River, Northeast Louisiana: 550 A.D. to recent times *Steven George*
9:45 AM	An alternative to catch curves for estimating year class strength and mortality for inland recreational fisheries *Troy Farmer*		Potential Paddlefish (*Polyodon spathula*) passage in a regulated stream *Chelsea R. Gilliland*[1]
10:00 AM	**BREAK**		**BREAK**
10:30 AM	Growth of captive juvenile Tarpon (*Megalops atlanticus*) from a Mississippi coastal estuary *Dyan Gibson*		Physiological effects of temperature, dissolved oxygen and handling on recovery of Largemouth Bass from simulated angling stress *Colin Dinken*[1]

	Ballroom C		Ballroom D
10:45 AM	Economic Value of Recreational Fishing on Reservoir and Tailrace Sections of Millers Ferry Reservoir, Alabama *Steven M. Gratz*[2]		The Case for Secondary Channel Restoration in the Lower Mississippi River *Audrey B. Harrison*[1]
11:00 AM	Summary of the year one reef fish survey for Mississippi coastal and nearshore Gulf waters *Jennifer L. Green*		Implicit effects of the 2016 Bonnet Carré spillway opening on reef-associated mobile fauna in the Mississippi Sound *Jeremy M. Higgs*
11:15 AM	Evaluation of alizarin red s as a long-term chemical mark in the *Pomoxis* genus *Bryant Haley*[1]		Effective Conductivity-Based Standardization of Electric Barrier Output and Electrofishing for Nile Tilapia *F. Michael Holliman*
11:30 AM	Age and growth of the Gulf Chimaera, *Hydrolagus alberti*, in the northern Gulf of Mexico. *Kristin Hannan*[1]		Multisystem scale length limits: making it easy *Andrew C. Shamaskin*[1]
11:45 AM	Fish assemblages associated with cover in the mudflats of a reservoir *Hunter R. Hatcher*[1]		Dauphin Island Restoration for Sustainable, Conservation Values *Elise Irwin*
12:00 PM	**LUNCH**		**LUNCH**
1:30 PM	Factors influencing juvenile shark abundance and distribution within the Mississippi Sound *Eric Hoffmayer*		Benthic Fish Assemblage in the Mississippi River Below New Orleans: The Last 100 Miles *Jack Killgore*
1:45 PM	How much is enough? Balancing fish and agriculture water needs in the Mississippi Alluvial Valley *Steve Miranda*		A preliminary look at the foraging ecology of the Spotted Seatrout (*Cynoscion nebulosus*) in the coastal waters of Mississippi *Justin P. Lewis*
2:00 PM	Comparison of three egg collection devices for Gulf Killifish (*Fundulus grandis*) *Jacob Jones*[1]		Thermal performance of native and non-native aquatic species in NE Alabama. *Mark Meade*
2:15 PM	Predicting White Crappie (*Pomoxis annularis*) year-class strength on Ross Barnett Reservoir using a mid-water trawl *Ryan Jones*		The presence of the Ticon Cownose ray *(Rhinoptera brasiliensis Müll*er, 1836) in the northern Gulf of Mexico *Christian M. Jones*

	Ballroom C		Ballroom D
2:30 PM	Independent effects of temperature, dissolved oxygen, and swimming on survival of angler-caught Largemouth Bass *Kevin Keretz*[1]		Assessment of Blue Shiner, *Cyprinella caerulea*, Population Distribution in Alabama via Environmental DNA (eDNA) Analysis *Chris Murdock*
2:45 PM	Development of an acoustic array in the Bay of St. Louis, Mississippi to monitor movement patterns of Red Drum, (*Sciaenops ocellatus*), and Bull Sharks, (*Carcharhinus leucas*) *Christopher M. Lapniewski*		An examination of trophic interactions in the northern Gulf of Mexico: Past work, present understanding, and future challenges. *Megumi C. Oshima*[1]
3:00 PM	**BREAK**		**BREAK**
3:30 PM	Experimental design for the determination of high precision estimates of Red Snapper abundance in the Gulf of Mexico. *Robert Leaf*		Analysis of benthic macroinvertebrate communities in regulated and unregulated reaches of the Tallapoosa River, Alabama *Kristie M. Ouellette*[2]
3:45 PM	Age and Growth of Channel Catfish pre- and post-flow management below R.L. Harris Dam on the Tallapoosa River, Alabama *M. Clint Lloyd*[2]		Identification of spawning sites and restoration priorities for Slackwater Darter (*Etheostoma boschungi*) *Meagan B. Roy*[2]
4:00 PM	Age and Growth of Vermilion Snapper (*Rhomboplites aurorubens*) from the north central Gulf of Mexico *Trevor Moncrief*[1]		Estimation of proximate body composition of Channel Catfish (*Ictalurus Punctatus*) using bioelectrical impedance analysis *Julie Sharp*[2]
4:15 PM	Variation in growth of Gulf Menhaden (*Brevoortia patronus*) in relation to environmental conditions: Implications for survival and recruitment. *Grant Adams*[1]		Sturgeon entrainment at the Old River Control Complex: telemetry based support *Todd Slack*
4:30 PM	Development of a Management Inventory of the Oxbow Lakes in the Mississippi Alluvial Plain *Michael Rhodes*[1]		Diet of larval Atlantic Bluefin Tuna (*Thunnus thynnus*) from the central Gulf of Mexico *Jason D. Tilley*[1]
4:45 PM	High reward tagging to estimate Red Snapper exploitation in the northern Gulf of Mexico off Alabama *Dana Sackett*		An Individual-Based Model of the Gulf Menhaden Fishery *Robert Trigg*[1]
5:00 PM	Factors Associated with Jumping in Silver Carp (*Hypophthalmichthys molitrix*) *Jan Jeffrey Hoover*		Improving management of Mississippi's Red Snapper using the Tails n' Scales electronic reporting system *Carly Somerset*

Poster Presentations

Poster Number	Title	First author
1	Conservation management of Alligator Gar, *Atractosteus spatula*, in Alabama: an evaluation of brood fish collections in the Mobile-Tensaw delta, 2008-2015	David Armstrong
2	Developing commercial-scale low-salinity culture protocols for Gulf Killifish, *Fundulus grandis*	Brittany Chesser
3	Composition of Bycatch in Commercial Crab Traps in the Mississippi Blue Crab Fishery	Lillian Collins
4	Performance of agricultural plantings on reservoir mudflats	Giancarlo Coppola[1]
5	Effects of commercial feed provision on early-life diets and growth of Channel, Blue, and ChannelxBlue hybrid catfish	Jesse E. Filbrun
6	A Comparison of Host Genetics and Environmental Effects on the Dermal Microbiome of Banded Sculpin (*Cottus carolinae*)	Joshua D. Millwood
7	Win, lose, or draw: how did larval King Mackerel (*Scomberomorus cavalla*) fare during the Deepwater Horizon oil spill?	Branson Myers
8	Characterization of the Dermal Mucosal Microbiome Across Populations of Red Drum (*Sciaenops ocellatus*)	Tyler Newburn
9	Development of Techniques for Spawning, Sperm Cryopreservation, and Feed-Training of crappie (*Pomoxis* spp.)	Christian Shirley
10	Assessing differential and combined effects of capture depth vs. thermal change on condition and post-release mortality of managed reef fish in the northern Gulf of Mexico	Laura Stewart
11	A multi-geared status assessment in Mississippi and an analysis of diets from museum specimens for Piebald Madtom, *Noturus gladiator*	Matthew D. Wagner

ABSTRACTS

ORAL PRESENTATIONS

Grant D. Adams, grant.adams@usm.edu, (847) 922-3530

Spatial variability in the individual growth of Sheepshead (*Archosargus probatocephalus*) in the Gulf of Mexico and Atlantic: Implications for assessment and management

Grant D. Adams[1], Robert T. Leaf[1], Joseph C. Ballenger[2], Stephen A. Arnott[2], and Christopher J. McDonough[2]

[1]Division of Coastal Sciences, School of Ocean Science and Technology, University of Southern Mississippi 703 East Beach Drive, Ocean Springs, Mississippi 39564, United States
[2]South Carolina Department of Natural Resources, Marine Resources Research Institute, 217 Fort Johnson Road, Post Office Box 12559, Charleston, South Carolina 29412, United States

Understanding geographic variations in individual growth is essential for the management of exploited fish populations because such variations are used to define stock structure and individual growth is known to influence stock productivity. Sheepshead (*Archosargus probatocephalus*) is a sparid of commercial and recreational importance distributed throughout estuarine and coastal waters in the Gulf of Mexico and Atlantic Ocean. Preliminary work indicates that there is substantial heterogeneity in state-specific estimates of length-at-age. To investigate spatially-dynamic individual growth of Sheepshead we used fishery-dependent and –independent age and length data from Texas, Louisiana, Mississippi, Alabama, Florida, South Carolina, North Carolina, and Virginia. These data were used to construct hierarchically structured three parameter von Bertalanffy growth models (VBGM) in the Bayesian framework. Models were structured with sex and state, state, and nonhierarchical effects and compared using deviance information criterion (DIC). The model including both sex and state effects provided the lowest DIC value. Median posterior global VBGM parameter estimates were: L_∞= 442 mm FL, k = 0.28 yr^{-1}, and t_0 = -1.78 yr and these varied considerably among states. Estimates of asymptotic lengths L_∞ were greater in Virginia and Alabama, while estimated growth coefficients k were lower in Atlantic states. Results of the present study indicate that state Sheepshead stocks should be managed separately for maximum efficiency because of the observed heterogeneity in individual growth. Variations in the individual growth of Sheepshead are likely due to variations in environmental conditions between states but we note that state sampling and age determination protocols may also contribute to the observed contrasts.

Grant D. Adams, grant.adams@usm.edu, (847) 922-3530

Variation in growth of Gulf Menhaden *Brevoortia patronus* in relation to environmental conditions: Implications for survival and recruitment

Grant D. Adams and Robert T. Leaf

Division of Coastal Sciences, School of Ocean Science and Technology, University of Southern Mississippi 703 East Beach Drive, Ocean Springs, Mississippi 39564, United States

Gulf Menhaden (*Brevoortia patronus*) is an abundant forage fish distributed throughout the northern Gulf of Mexico (NGOM) and supports a large commercial fishery and indirectly supports multiple recreational fisheries through trophic interactions. Recent stock assessment efforts have documented temporal variations in individual growth, suggesting that a possible environmental forcing mechanism may exist. We developed a von Bertalanffy growth function (VBGF) that was parameterized to examine year-specific variation in individual growth related to the magnitude of winter Mississippi River discharge, Julian day of spring transition, annual Loop Current intrusion, and areal extent of the recurring hypoxic zone in the NGOM. We evaluated temporally variable patterns of size-specific mortality by comparing variation in size-at-age of increment widths from fish scales (n = 488,061) during the first-year of life. VBGF growth coefficient (k yr^{-1}) and asymptotic length ($L\infty$ mm) were negatively correlated to Mississippi River discharge and positively correlated to the day of spring transition. Impacts in individual growth are likely due to the increased areal extent of cool nutrient rich plume waters associated with elevated river discharge and winter northerly winds. Alternatively, k was positively correlated with the northern intrusion of the Loop Current and areal extent of the hypoxic zone, likely due to elevated temperatures associated with the Loop Current and reductions in the areal extent of favorable habitat, respectively. Scale radius was positively correlated with FL (r^2 = 0.77, p < 0.001) indicating that scale width is a good proxy for fish length throughout the age range sampled. Comparison of scale increment width across age classes revealed that size-selective processes operate during the first year of life. Juveniles that were smaller at age-1 preferentially survived. Therefore, environmentally-driven time-varying growth may have consequences for the recruitment of Gulf Menhaden.

Shay Allred, sa1615@msstate.edu, (480) 208-8019

Assessing red discoloration in catfish fillets

Shay Allred[1], Wenjie Shao[2], Wes Schilling[2], and Peter J. Allen[1]

[1]Department of Wildlife, Fisheries and Aquaculture Sciences, Mississippi State University, Starkville, MS, 39762
[2]Department of Food Science, Nutrition and Health Promotion, Mississippi State University, Starkville, MS, 39762

Catfish *Ictalurus* spp. aquaculture accounts for 51% of all food-fish aquaculture in the United States and is focused primarily on two species, Channel Catfish *Ictalurus punctatus*, and a hybrid cross between Channel Catfish and Blue Catfish *I. furcatus*. The industry currently faces multiple challenges such as foreign imports, pricing variability, disease, off-flavor, and fillet discoloration. Discoloration is generally categorized as any color that is not white; most commonly, fillets are rejected by processors for being yellow, pink, and red. Previous scientific research has primarily focused on yellow fillet discoloration, with few studies conducted on the red coloration defect. Two kinds of red fillet coloration exist: distinct spots caused by puncture wounds and indistinct "blotches" theorized to be the result of internal hemorrhaging. Current theories for the internal hemorrhaging include poor water quality, excessive handling, and disease. This study aimed to gain an understanding of the occurrence of blotchy red fillet by biweekly collections of rejected catfish fillets from a processing plant and by reviewing recorded data on the amount of catfish harvested as well as the total amount of fillets rejected. Catfish fillets were analyzed for proximate composition and bacterial infection. On average, 0.20% of fillets that were harvested were rejected by the processing plant. Red discoloration accounted for 90% of all rejected fillets, 40% as punctured fillets and 50% from the accumulation of red blotches. Biweekly microbial analysis indicated that 95% of the blotchy cases have a bacterial infection; although, some of the bacterial species appeared to be ubiquitous in aquatic environments. Future studies will attempt to clarify whether bacterial infection, using the most common species identified, has an influence on the production of blotchy Channel Catfish fillets.

Nathan Aycock, nathana@mdwfp.state.ms.us, (662) 759-6444

Determining the effects of Bigheaded Carp on sport fish communities in floodplain lakes through rotenone sampling

Nathan Aycock, Darrin Hardesty, Donta Reed, Chad Washington

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

The invasive Silver Carp and Bighead Carp (collectively known as bigheaded carps) continue to quickly expand their range throughout the United States. Studies have shown the negative effects these fish can have on native planktivores in large river systems, yet their effect on sport fish species is less well known, especially in floodplain lakes connected to large rivers. In 2016 MDWFP conducted rotenone sampling on Lake Whittington, a 3,000 acre oxbow lake of the Mississippi River in Bolivar County, to determine the current fish community composition. This data was then compared to results from rotenone sampling conducted on the lake in the 1980s and 1990s prior to bigheaded carp colonization. We found dramatic differences in the fish community. In 2016 Silver Carp comprised almost 30% of the total fish biomass and was the most abundant fish species by weight. Sport fish biomass has declined from an average of 206 lbs/acre in historical data to 63 lbs/acre today, a decline of 69%. Length data indicates that young-of-year sport fish may be most acutely impacted by the bigheaded carp population. Shad populations also declined dramatically from an average of 283 lbs/acre to 24 lbs/acre. Additional rotenone sampling is planned for 2017 at other lakes to further investigate the abundance and effects of bigheaded carp in Mississippi River oxbows.

Danielle Bailey, danielle.bailey@usm.edu, (973) 294-8413

Species-specific variation in elasmobranch interrenal morphology and steroid synthesis

Danielle Bailey[1], Jill Hendon[2], and Andrew Evans[1]

[1] The University of Southern Mississippi, Gulf Coast Research Laboratory, Department of Coastal Science, Ocean Springs MS 39564
[2] The University of Southern Mississippi, Gulf Coast Research Laboratory, Center for Fisheries Research and Development, Ocean Springs MS 39564

Interrenal tissue in elasmobranchs is homologous to the mammalian adrenal cortex. This tissue is therefore composed of steroidogenic cells, which secrete corticosteroids. These corticosteroids are involved in regulating the stress response and hydromineral balance. Limited literature characterizing elasmobranch interrenal suggests varying number of interrenal bodies within the kidney, which produce the single corticosteroid 1α-hydroxycorticosterone (1α-OHB). To address this critical gap in our understanding of elasmobranch biology this study investigates interrenal morphology and steroid production in four shark species (Finetooth, *Carcharhinus isodon*, Blacktip, *Carcharhinus limbatus*, Atlantic Sharpnose, *Rhizoprionodon terraenovae*, and Bonnethead, *Sphyrna tiburo*). Anatomical studies revealed substantial morphological distinctions in interrenal structures among local shark species including size, number, color and distribution of putative interrenal bodies. *Ex vivo* incubations of putative interrenal tissue confirmed corticosteroid production, validating 1α-OHB as the dominant steroid product; however, other steroid products (corticosterone and deoxycorticosterone) were produced. Our results confirm putative interrenal structures in all species examined, provide further understanding of the elasmobranch stress response, and may indicate species-specific responses to the deleterious effects of transient or prolonged stress.

Matthew Catalano, mjc0028@auburn.edu, (334) 844-7366

Shoreline rotenone application to control Largemouth Bass recruitment in small impoundments

Matthew Catalano[1] and Graves Lovell[2]

[1]School of Fisheries Aquaculture and Aquatic Sciences, Auburn University, 203 Swingle Hall, Auburn AL 36849
[2]Alabama Department of Conservation and Natural Resources, Wildlife and Freshwater Fisheries Division, E.W. Shell Center, Auburn AL 36849

Controlling Largemouth Bass *Micropterus salmoides* recruitment to reduce their population density in small impoundments (<40 ha; hereafter "ponds") is an important management challenge but is necessary to maintain desirable growth rates, body condition, and size structure in these populations. Recruitment of these populations is difficult to control directly because common gears (hook-and-line, electrofishing) for the mechanical removal of Largemouth Bass are inefficient at capturing age-0 fish. We evaluated the shoreline application of the piscicide rotenone to reduce age-0 Largemouth Bass density in five small impoundments in Alabama. Rotenone was applied twice at each pond, with treatments spaced two weeks apart in early to mid-June of 2015. Age-0 Largemouth Bass density was assessed via 15-ft seine hauls one day prior to and one day after rotenone application at treated ponds and also at nearby untreated control ponds. Reductions in age-0 Largemouth Bass seine catch rates averaged 69% and ranged from 41 – 94 % across ponds. Follow-up seine hauls two weeks post-treatment indicated that these reductions were still evident and had not been diminished by new recruitment of age-0 Largemouth Bass to the shoreline. Our findings suggest that shoreline rotenone has the potential to reduce age-0 Largemouth Bass density during summer shortly after recruitment to the littoral zone. However, more work is needed to assess whether these reductions give rise to lower recruitment to age-1 in these systems, and if the recruitment reductions are large enough to improve Largemouth Bass growth and condition.

Nagaraj G. Chatakondi, nchatakondi@ars.usda.gov, (662) 686-3566

Incubation temperature and parental effects on the hatching success and progeny performance of Channel Catfish

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Channel x Blue Catfish are exclusively produced by hormone-induced spawning of Channel Catfish and the stripped eggs are fertilized with pooled Blue Catfish sperm in hatcheries. Even though hybrid fry production has increased in recent years, variable and inconsistent hybrid catfish fry production is evident in commercial hatcheries. Channel Catfish spawning season extends 6 to 10 weeks during spring with water temperatures ranging from 72 to 94 ^{0}F, with optimal temperatures being 80 to 82 ^{0}F. Maturation and ovulation are not synchronized in Channel Catfish and variations exist in egg quality and hatching success of individual fish. This study was conducted to assess the Influence of incubating temperatures (to mimic optimal and extreme temperatures) and parental fish on hatching success and progeny performance of catfish. Eight gravid Channel Catfish females were induced to ovulate with 20+80 µg LHRHa/Kg BW and a portion of the stripped eggs from each female were either fertilized with either Channel Catfish sperm to produce a Channel Catfish family or pooled D&B Blue Catfish sperm to produce a hybrid catfish family. Half-sib Channel Catfish family and hybrid catfish families were incubated either in 80 ^{0}F or 90 ^{0}F waters until hatch. Survival of fry in families was recorded at 0, 5, 25, and 50 days. A six-week growth of 120-day old fish representing select families was conducted in a replicated 80 L aquaria. The fish were fed with 35% protein floating feed once daily to satiation. At 80 ^{0}F, fry were completely hatched in 100 -140 hours (5 days) and at 90 ^{0}F, fry were completely hatched in 90 – 110 hours (4 days). Mean hatching percent of hybrid catfish (46.6) was higher ($P < 0.05$) than Channel Catfish (39.8); mean hatching percent at 80 F (46.6) was higher ($P<0.05$) than 90 F(39.7) and mean hatching percent of individual Channel Catfish females ranged from (33.5 to 59.5). Maturation, genetics, husbandry and nutritional factors in female Channel Catfish were attributed to variations in hatching success of Channel Catfish and hybrid catfish families. Incubation temperatures and paternal contributions did not affect the not growth and survival of fish under controlled conditions. Higher temperatures of incubating hatchery waters during the later part of spawning season reduced the hatching success of catfish eggs in hatcheries. Nutritional and husbandry needs of Channel Catfish females have to be optimized to improve reproductive performance of catfish.

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Optimizing a standard sampling program for non-wadeable rivers in Alabama to estimate species abundance and richness of fish communities

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Alabama's non-wadeable rivers support high biodiversity of fishes but no formal sampling program has been developed to monitor the fish community in these systems. Recent developments in Alabama have caused increased interest by Alabama Department of Conservation and Natural Resources biologists to develop such a sampling program, but studies determining adequate sampling effort are lacking. This study was developed to compare three different boat-based electrofishing methods (bank-line, point sampling, and night-time) to sample the fish community and determine the most cost effective method to accurately represent the fish communities present. Four rivers of various sizes (Alabama, Tallapoosa, Choctawhatchee, and Sipsey) were sampled along two 100-mean-stream-width transects. Because habitat complexity can affect sampling effort, substrate was mapped using side-scan sonar within 12 to 40 km reaches of stream, and low and high complexity transects were identified for electrofishing sampling. Sampling was done in summer and fall of 2015 and 2016. Sampling has just recently been completed though small preserved fish are still being sorted and identified. Point sampling was the least effective of the three methods for determining species richness. Night shocking captured the most individual fish but daytime bank-line sampling captured more species. Species richness was generally higher in the high habitat transects than in the low transects. Results are limited at this stage of the project but sampling yielded more than 60,000 individual fish representing over 100 species in 24 families.

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Physiological effects of temperature, dissolved oxygen and handling on recovery of Largemouth Bass from simulated angling stress

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Tournaments and recreational angling for black bass typically involve live release after weigh-in procedures or handling. However, post-release survival may vary due to cumulative physiological effects of multiple, sub-lethal stressors, notably exercise from angling, ambient water temperature, live well water temperature and dissolved oxygen content. Although tournaments are common, the connection between typical procedures and physiological stress and subsequent implications on mortality is not well established. This information would be particularly useful for species-specific guidelines on minimizing sub-lethal effects and mortality in Largemouth Bass, *Micropterus salmoides*. Therefore, the objectives of this study were to examine: 1) the effects of acute temperature change (-4, 0, +4 °C) and handling stress over a range of acclimation temperatures (17, 25, 33 °C) and 2) the effects of a range of dissolved oxygen concentrations (2.0, 5.5, 8.5 mg/L) and handling stress over a range of acclimation temperatures (25, 29, 33 °C) on physiological responses to stress and post-stress recovery in Largemouth Bass. Bass were reared in an indoor aquaculture facility and later in ponds, with a finishing diet of live forage (Bluegill, *Lepomis macrochirus* and Golden Shiners, *Notemigonus crysoleucas*) 4-6 weeks prior to experimentation. Following acclimation to treatment conditions, fish were stressed by chasing in 4,000-L, 2.3-m diameter circular tanks to simulate angling, transferred to 4 live wells where temperature and dissolved oxygen were manipulated for up to 8 hours, subjected to a simulated weigh-in procedure, and released into recovery tanks at original conditions. At each stage, blood was sampled from a subset of fish and measured for stress responses including hematocrit, plasma cortisol, lactate, glucose, osmolality and pH. Results of this experiment will provide information on the stress response and recovery of Largemouth Bass subjected to tournament and catch-and-release conditions across a range of environmental and live well conditions.

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An alternative to catch curves for estimating year class strength and mortality for inland recreational fisheries

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Year class strength and mortality of inland recreational fish stocks have traditionally been assessed by applying catch curve methods to electrofishing survey data. An alternative to the catch curve method, statistical catch at age analysis (SCAA), is a more flexible approach and may make more efficient use of available data, but has yet to be applied to inland reservoir stocks such as Largemouth Bass and Black Crappie. We applied SCAA to three Largemouth Bass stocks from Alabama and used computer simulation to test model performance (bias and precision) for Largemouth Bass and Black Crappie under a range of data quantity, quality, and assumption violations. The model was able to generate a >20 year time series of year class strength and mortality estimates for the three Alabama Largemouth Bass stocks. Simulation testing suggested the model was unbiased and provided reasonably precise estimates as long sampling occurred at least every three years and assumed vulnerability schedules were accurate. The model estimates were sensitive to biases in assumed fishery vulnerability, which highlights the need for data on the age or length distribution of the recreational catch to allow for vulnerability estimation within the model. Our results suggest that the SCAA model can provide accurate estimates of year class strength and mortality from occasional electrofishing surveys and represents a coherent and flexible platform for inland fishery stock assessment.

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Effects of annual droughts on fish communities in Mississippi Sound estuaries

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The Mississippi coastal region has two major rivers and four smaller rivers influencing the estuaries that make up the Mississippi Sound. The islands off Mississippi create a barrier which allows the area to be a widespread, productive estuarine region. With such a dependence on discharge from the drainages, it is important to understand the effect of salinity regimes on the fish community. Drought conditions in other regions have been shown to dramatically change the fish community structure. We used the long running Interjurisdictional Fisheries Program (IJ) database (2006-2013) within Mississippi state waters and compared yearly fish communities between drought and non-drought years. Non-metric Multidimensional Scaling (nm-MDS) and indicator species analyses were completed to compare drought and non-drought conditions in the Mississippi Sound. During 2006 and 2007, which were identified as drought years by the Palmer Drought Severity Index (PDSI), significant differences in fish community structure were identified (Sig. < 0.001) compared to non-drought years (2008-2009 and 2011-2013). Indicator species analysis identified a total of eight species significantly influenced by drought years. Of the eight species, the abundance of seven species significantly decreased while the abundance of one species significantly increased. With an increasing human population in central and south Mississippi, fresh water demand will most certainly increase resulting in possible changes in the fish community dynamics of the Mississippi Sound. Understanding the influence of decreased river discharges will assist managers in determining the impacts of freshwater withdrawals during base flow periods.

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A note on associations observed between sharks and teleosts in the Gulf of Mexico

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We report herein on observations of associations between two teleost species and a variety of shark species in the Gulf of Mexico. Using underwater video, Round Scad (*Decapterus punctatus*) and Atlantic Bumper (*Chloroscombrus chrysurus*) were observed associating with both Blacktip Sharks (*Carcharhinus limbatus*) and Spinner Sharks (*Carcharhinus brevipinna*). Additionally, we observed scad associating with Blacknose Sharks (*Carcharhinus acronotus*). Both Scad and Bumpers were observed schooling around and following these sharks. Schools of Scad had a mean size of 54 individuals and tended to stay posterior to the pectoral fins of the shark. These observations prompted an on-line image survey wherein additional un-reported associations were discovered. We discuss possible explanations for these associations, including the optomotor response or a commensal hydrodynamic advantage.

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A comparison of freshwater mussel populations in the Boeuf River, Northeast Louisiana: 550 A.D. to recent times

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In 1996, the Department of Geosciences at the University of Louisiana at Monroe conducted an archeological dig in the middens of Landerneau Mounds (16CA87) on the Boeuf River to determine the food resource of Native Americans. Many species of fishes and mammals were excavated along with freshwater mussels. Nineteen species of freshwater mussels were identified. Dominant species from 2,504 mussels valves were threeridge (*Amblema plicata*) 33%, pyramid pigtoe (*Pleurobema rubrum*) 20% and wabash pigtoe (*Fusconaia flava*) 14%. Numerically less abundant mussels included: washboard (*Megalonaias nervosa*) 7.9%, pimpleback (*Quadrula pustulosa*) 5.3%, southern hickory nut (*Obovaria jacksoniana*) 4.9%, bankclimber (*Plectomerus dombeyanus*) 4.7%, mapleleaf (*Quadrula quadrula*) 4%, spike (*Elliptio dilatata*) 2.6%, and Louisiana fat mucket (*Lampsilis hydiana*) 1.2 %. Rare mussel species represented by < 1% were: western mapleleaf (*Quadula apiculata*), threehorn wartyback (*Obliquaria reflexa*), wartyback (*Quadrula nodulata*), lilliput (*Toxolasma spp.*), yellow sandshell (*Lampilis teres*), bleufer (*Potamilus purpuratus*), pistolgrip (*Tritogonia verrucosa*), black sandshell (*Ligumia recta*) and round pearlyshell (*Glebula rotundata*). Recent mollusk surveys in the Boeuf River at five stations yielded twenty-one species of native mussels and the exotic Asiatic clam, *Corbicula fluminea*. Threeridge (*Amblema plicata*) was the dominant mussel at one of the stations sampled and appeared to show no changes in its relative abundance since 550 A.D. Preliminary comparisons of long-term changes in all the other mollusks were apparent. Five species of mussels found at Landerneau Mounds were absent from the recent survey. Changes in the mollusk assemblage are likely due to anthropogenic impacts to streams which included: channelization, weirs and deforestation resulting in increased sedimentation. As a result, several of these species are likely extirpated from the Boeuf River. The use of freshwater mussels discarded by Native Americans not only provides records of their diet, but gives insight of the prehistoric mollusk assemblages.

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Growth of captive juvenile Tarpon (*Megalops atlanticus*) from a Mississippi coastal estuary

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Juvenile Tarpon (*Megalops atlanticus*) collected from a shallow tidal slough located on the northern shoreline of the Mississippi Sound were maintained live in an indoor, recirculating aquaculture system for a period of 224 days to observe their growth. Water temperature, salinity and dissolved oxygen ranged 25.4–28.5 ^{o}C, 19.0-28.0 ppt. and 7.0-8.3 mg/L, respectively, and pH was maintained at 8.0. Lighting was provided via controlled day/night photoperiod cycle in accordance with the local natural seasons, and the fish were fed commercial pellets once/day to satiation. At the initiation of the study, 39 juveniles were separated into two size groups (small, 84-125mm FL, 6.3-22.4g TW, n=18; large, 138-200mm FL, 22.6-84.6g TW, n=21) and placed into individual culture tanks by size group. Length and weight of the fish were recorded at three other time intervals (Day 61, Day 141, and Day 224). The mean daily growth rate over the duration of the study for each size group and both groups combined was: small (0.321mm/day FL, 0.308g/day TW), large (0.301 mm/day FL, 0.624g/day TW) and overall (0.328 mm/day FL, 0.44g/day TW), representing an overall growth of 33% in length and 76.7% in weight. Growth rates varied within and between size groups over time. A length-weight regression (power) calculated for specimens at the end of the study was TW (g) = 4E-05*(FL (mm)$^{2.8073}$, R^2 = 0.9412). This was the first juvenile tarpon growth study conducted on specimens from the northern Gulf of Mexico. At the conclusion of the study, all fish were released in local waters, with the exception of three specimens provided to the Mississippi Museum of Natural Science for live display.

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Potential Paddlefish *Polyodon spathula* passage in a regulated stream

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Sam D. Hamilton Noxubee National Wildlife Refuge (Noxubee NWR) contains two major impoundments that are managed for water level to provide habitat for Wood Storks, American Alligators, and overwintering waterfowl. Bluff Lake impounds Oktoc Creek, a tributary of the Noxubee River, and water level is controlled using a radial arm gates at one of two outflows. A large population of Paddlefish occupy a small pool below this water control structure. In the rainy winter and spring months, corresponding with Paddlefish spawning periods, it is not uncommon for the Noxubee River and tributaries to overtop their banks and extend over their vast floodplain, making longitudinal movement possible in the river system. However, in late spring and summer, rainfall is scarce and portions of the river become shallow and impassable. In this study, we examined minimum stream flow requirements to allow passage of the largest Paddlefish observed in the population.We caught 63 Paddlefish using multifilament gill nets to determine maximum size. Eye-to-Fork-Length of captured fish ranged from 607 mm to 1,130 mm mm to 1,524 mm and weights ranged from 3 kg to 22 kg, with a maximum girth of 877 mm. To assess the potential for Paddlefish passage, we randomly selected ten 100 m sites downstream of the Bluff Lake radial arm gate spillway and measured the crossectional stream bed profile every 10 m. We then compared depths to river stage to calculate the stage at which the entire length of Oktoc Creek is passable by Paddlefish. To achieve 100% downstream passage from the spillway pool to the Noxubee River by the largest Paddlefish observed, preliminary analyses indicate that refuge managers need to increase base flow stream stage by 40 cm. Linking stream stage to Paddlefish girth will provide refuge managers with an understanding of radial arm gate operations necessary to promote downstream fish passage, and inform future experimental flow releases.

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Age and development of Tarpon, *Megalops atlanticus*, leptocephali upon arrival in the Mississippi Sound estuary

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Tarpon, *Megalops atlanticus*, are large, migratory fish that frequent coastal and inshore waters of the tropical and subtropical Western Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. Occurrence of adult Tarpon in Mississippi waters is infrequent and thought to coincide with summer feeding migrations. Tarpon possess a unique larval form (leptocephalus) transported on ocean currents from offshore spawning grounds to inshore nursery areas. Once in estuarine waters, leptocephali undergo a metamorphosis accompanied by a drastic decrease in length, prior to juvenile growth. Historically, Tarpon leptocephali were rare in Gulf Coast Research Laboratory fisheries assessment and monitoring collections prior to summer/fall 2013, at which time directed sampling for leptocephali produced 40 larvae (20.2 - 27.5 mm SL). Additional collection efforts along the Mississippi Sound shoreline in 2015 and 2016 provided 53 additional specimens (16.0 – 27.8 mm SL). All larvae were collected July - October using a beam plankton trawl (BPL, 750µm mesh) pulled by hand at fixed stations (< 1.5m depth) during daytime. Leptocephali were collected at surface water temperatures and salinities of 24.8 - 34.1^{o}C and 13.4 - 28.9 ppt., respectively. Some larvae were in the first developmental stage (Stage 1, pre-metamorphic), but most collections were in the shrinking stage (Stage 2, metamorphic) of development. Developmental stages were determined by the placement of the dorsal/anal fins, myomere counts and standard length. Preliminary larval age estimates based on otolith (sagittae) microstructure analysis ranged 20 - 65 days. The source of the leptocephali is unknown, but based on dates of collection, calculated hatch dates, preliminary examination of coastal current patterns within the Mississippi Bight, and recent evidence of spawning capable Tarpon from the northern Gulf of Mexico, it is presumed the larvae were dispersed from suspected summer spawning grounds located offshore Mississippi into local estuaries.

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Economic Value of Recreational Fishing on Reservoir and Tailrace Sections of Millers Ferry Reservoir, Alabama

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Recreational fishing creates a large source of income within the state of Alabama through both direct sales for local communities and taxes. Knowing how much and where anglers spend money fishing specific destinations allows fisheries managers to better understand the economic impact of these fisheries to the local economy. This economic impact was evaluated for Millers Ferry Reservoir, which was split into six sections covering 157.1 km of the Alabama River, using a stratified, non-uniform probability sampling design. Instantaneous counts (N=188), on-site roving creel surveys (N=729), and follow-up telephone interviews (N=506) were conducted to obtain fishing effort and expenditure data from January to December 2015. Data were then extrapolated to estimate total fishing effort on the reservoir at 164,145 ± 36,184 hours. Recreational boat anglers were responsible for 89% of the effort while the remaining effort was from shore anglers for a total of 23,156 and 4,589 trip days, respectively. Recreational anglers who visited Millers Ferry Reservoir spent $2.5 million on their trips for resources (fuel, lodging, food, tournament fees, etc.). Fuel for boats and vehicles ($1.0 million) and food ($0.5 million) were the sources of the majority of the expenditures. Anglers targeting bass *Micropterus* spp. spent $1.7 million on their trips with most of the effort concentrated in the sections directly above the dam. Fisheries managers can use these economic impact estimates to better understand a fishery and improve the opportunities for recreational anglers.

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Summary of the year one reef fish survey for Mississippi coastal and nearshore Gulf waters

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The State of Mississippi currently manages more than 16,000 acres of permitted offshore artificial reef sites at 15 fish havens. These sites, as well as numerous oil and gas platforms, serve as habitat for reef fish. As these areas have not been closely monitored through standardized sampling, the State's ability to assess its reef fish populations and thereby contribute to regional management decisions is limited. In attempt to fill this data gap, a research program was designed using standardized SEAMAP vertical line methodologies in the northern GOM waters off Mississippi. From April through November, 2016, 161 stations were sampled at non-structure, fish haven, oil/gas platform, and Rigs-to-Reef sites across three depth strata (< 20m, 20-49m, and 50-100m). At each station three bandit reels consisting of a backbone with ten gangions of one circle hook size (8/0, 11/0, 15/0) were fished at or near the bottom simultaneously for five minutes. A total of 521 fish were caught from 17 different species, with Red Snapper, *Lutjanus campechanus*, dominating the catch. The majority of individuals (56.4%) were collected from oil/gas platforms and the highest monthly catch occurred in May (27.9%). Overall catch by hook size (8/0, 11/0 and 15/0) was 37.3%, 46.5% and 16.2%, respectively. Highest overall catch occurred in the 20-49 m depth strata (n=250), while the greatest species diversity was noted in the deepest strata (n=13 spp.). All fish in this study were retained for age, growth, reproduction, diet, and trophic assessment and will ultimately result in a thorough biological assessment of the fish using the reefs. These data fill a gap in our knowledge of reef fish stocks on Mississippi shelf structure. Continued assessment of these sites in future years will allow for more comprehensive assessments of these stocks to be conducted and will aid in ensuring sustained fisheries.

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Evaluation of alizarin red s as a long-term chemical mark in the *Pomoxis* genus

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Accurate assessment of stocking success requires that hatchery fish can be discerned from wild-spawned fish, usually achieved by application of an identifiable mark. Marking large groups of juvenile fish presents significant challenges due to their small size and large number of individuals, and batch-marking using chemical immersion is often the most viable option. A popular choice for marking fish is the broad-spectrum antibiotic oxytetracycline (OTC). However, increasing concerns about the indiscriminant spread of antibiotics warrant the identification of alternatives to OTC. Alizarin red s (ARS) has been successfully used as a chemical marking agent for a limited number of finfish species, but no literature currently exists on its efficacy in marking the *Pomoxis* genus. In this study, we tested the marking efficacy and long-term retention of ARS marks for juvenile White Crappie *P. annularis*. Special care and handling considerations are also discussed.

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Age and growth of the Gulf Chimaera, *Hydrolagus alberti*, in the northern Gulf of Mexico.

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Almost half of chondrichthyan diversity is found in deep water (>200 m), yet life history information for most species, particularly chimaeras, is lacking. Difficulties associated with sampling in deep water have resulted in a limited number of chimaera specimens available for study. To assess the effects of the Deepwater Horizon oil spill, the National Marine Fisheries Service conducted extensive sampling in deepwater habitats of the northern Gulf of Mexico from 2010- 2011. This sampling provided a unique opportunity to examine a large number of chimaeras from the region. A total of 138 males and 108 female Gulf chimaeras (*Hydrolagus alberti*) were collected and precaudal lengths ranged from 97 to 490 mm. Direct age estimates were obtained from dorsal fin spines and vomerine tooth plates. Growth of male and female Gulf chimaeras was not significantly different and was best described by a logistic growth curve, with a moderate growth coefficient (k = 0.15-0.27 y^{-1}) and theoretical maximum age estimates ranging from 13-29 years. This study provides the first age and growth estimates for the Gulf chimaera and represents the sole examination of the growth dynamics of any deepwater chondrichthyan in the Gulf of Mexico. As anthropogenic influences continue to expand into offshore waters, baseline life history information for deepwater inhabitants will be necessary to assess the impacts of human activity.

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The Case for Secondary Channel Restoration in the Lower Mississippi River

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Secondary (side) channels are a common habitat type of large rivers worldwide. The Lower Mississippi River contains over 100 naturally occurring secondary channels comprising roughly one third the length of this 1500-km stretch. In highly engineered systems, such as the Lower Mississippi River, secondary channels have the potential to serve as more natural surrogates for main channel habitat. In general, these channels have retained habitat features no longer common in the navigation channel, such as natural steep clay banks, pockets of reduced flow velocity, large amounts of woody debris, and a variety of substrate types. The great majority of secondary channels, however, have been modified by river training structures that alter their natural flow regimes. These changes in flow are most noticeable in periods of low river stages, such as summer and fall, when many secondary channels become disconnected from the main river channel at one or both ends. Disconnection causes an immediate change from lotic to lentic conditions, which affects the water chemistry, sediment types, and biotic community. The macroinvertebrate community, for example, relies on year-round stability of habitat conditions, and the majority of aquatic macroinvertebrates are adapted to living in either lotic or lentic environments, but generally not both. Our results indicate that loss of connectivity to the main channel has a negative year-round effect on macroinvertebrate diversity, which is problematic for insectivorous riverine fishes and their predators. We are also finding that ongoing projects to increase connectivity to secondary channels (e.g., dike notching) are increasing the biodiversity of macroinvertebrate communities. This leaves us hopeful that dike notching, along with other restoration efforts will promote the natural function of secondary channels and provide complex and diverse habitats for riverine communities within the Lower Mississippi River.

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Fish assemblages associated with cover in the mudflats of a reservoir

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We evaluated fishes at sites with natural cover and sites without cover to estimate the effect of cover on the fish assemblages of reservoir mudflats. Sampling with electrofishing was conducted at 60 shallow (<1 m) mudflat sites, 20 with cover and 40 without cover, at Enid Lake, Mississippi, during August 2016. All fish collected were identified to the species level. In all, 17 species were collected, 16 in sites with cover and 15 in sites without cover. A non-metric multivariate analysis of variance indicated fish assemblage composition differed between sites with cover and those without ($P = 0.02$), although biodiversity metrics (e.g., species richness, diversity, evenness) did not ($P = 0.53$). Further analyses with ordination indicated sites with cover emphasized *Centrarchid* species whereas sites without cover emphasized *Ictalurid*, *Cyprinid*, and *Clupeid* species. These findings indicate that the presence of cover may play a role in structuring fish assemblages in reservoirs, and that cover supplementation may be useful for fisheries managers to manipulate fish assemblage composition.

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Implicit effects of the 2016 Bonnet Carré spillway opening on reef-associated mobile fauna in the Mississippi Sound

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In January 2016, the Bonnet Carrè spillway was opened due to elevated flood stages in the Mississippi River. Following the opening of the spillway, an inundation of freshwater was anticipated for the Mississippi Sound potentially impacting mobile fauna associated with nearshore reefs. To determine any adverse response, mobile fauna from four nearshore, low profile reefs were monitored from the western edge of the Sound to the mouth of the Pascagoula River in the East. Four substrate trays filled with crushed limestone were deployed for two consecutive six week periods at each reef location. Comparisons between reef sites during the first sample period indicated low production, biomass and taxa densities on the western and eastern reefs, which were both potentially affected by freshwater inundation. Taxa diversity generally increased from western reefs to eastern reefs during this period. Similarly, comparisons of observed reef production, biomass and taxa density values during the second sampling period showed parallel relative differences between sites. However, unlike the first sampling period, diversity peaked at the central reef location. Comparisons between sampling periods indicated that taxa density, productivity and biomass were greater during the second sampling period, with the exception of the central reef location, which was less affected by the outflow. The apparent increase in mobile fauna at more inundated sites during the second period was indicative of gradual reef recovery. Additionally, species diversity was higher in the second sampling period, with the exception of the eastern reef. The results from this study will help better define impacts due to isolated instances of highly altered hydrological regimes; particularly those involving mobile fauna associated with low profile reefs across the Mississippi Sound.

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Factors influencing juvenile shark abundance and distribution within the Mississippi Sound

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Shark nursery grounds are an important habitat that promotes young-of-year (YOY) and juvenile shark survivorship. Both abiotic and biotic variables play key roles in the abundance and distribution of individuals within these nursery grounds. From 2004 to 2014, 1,005 sampling sets using either a 183-m gillnet (stretched mesh panels of 8.9 to 20.2 cm), a 152-m bottom longline (12/0 circle hook), or 1.85-km bottom longline (15/0 circle hook), were conducted in the Mississippi Sound by the University of Southern Mississippi Gulf Coast Research Laboratory's Shark Research Program. The use of multiple gear types allowed for a comprehensive look into the dominant species composition, including all developmental stages (i.e. YOY, juvenile, and adults). A two-step hurdle model was used to determine the effect of the biotic and abiotic variables had on the distribution of multiple shark species caught in the Mississippi Sound. A multi-model inference approach was ultimately used for each step to determine the variables that strongly influenced the presence and abundance of each shark species. Atlantic Sharpnose, Blacktip, and Finetooth sharks represented the three most abundant shark species encountered. In general, YOY and juvenile sharks were often present in more turbid, warmer waters. Interestingly, the presence of juvenile Atlantic Sharpnose and Blacktip sharks increased with increasing predator presence.

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Effective conductivity-based standardization of electric barrier output and electrofishing for Nile Tilapia

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Nile Tilapia *Oreochromis niloticus* are popular aquaculture fish in the US and around the globe. Native to tropical and subtropical Africa, Nile Tilapia may be introduced into non-native regions by escape from aquaculture. In the US, Nile Tilapia are established along the Gulf Coast from Florida to Texas, with potential to invade to the north. Electric Barrier Systems could be used to aid containment of Nile tilapia in aquaculture or within bodies of water. Electrofishing may be used for detection of Nile tilapia invasion, monitoring of established populations, and removal (population control). Estimates of Nile tilapia Effective Conductivity are needed to standardize electrofishing and electric barrier output across environmental conditions. We conducted Response Threshold Testing to estimate effective conductivity of Nile Tilapia. Testing was conducted on 240 Nile Tilapia at two levels of water temperature and multiple levels of water conductivity. Preliminary outcomes estimate Nile Tilapia effective conductivity at 40µS/cm, which is considerably lower than estimates available for other fishes. The power estimate for induction of immobility in Nile tilapia under matched conditions was about five times that estimated for small bighead carp. Preliminary outcomes support anecdotal reports that Nile tilapia are not as susceptible to electrofishing (i.e., resistant to electrical exposure) compared to many other North American fishes. Outcomes will be used to develop electrofishing and electric barrier output standardization protocols for various environmental conditions.

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Factors associated with jumping in Silver Carp (*Hypophthalmichthys molitrix*)

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Twenty-four surveys of jumping Silver Carp (*Hypophthalmichthys molitrix*) were conducted from a moving boat in a single side channel of the Lower Mississippi River during a 5-year period and resulted in observations of 2462 individual fish. Mean standardized abundance of jumping carp was 31.5 carp/km but variation in counts and in standardized abundance were substantial (CV>175%). Majority of observations (> 50%) were consistently behind the boat, but total counts varied with environmental conditions. Greater numbers of observations were made when maximum channel depth < 3 m and surface water temperature was > 25 C. Multiple regression analysis confirmed that maximum channel depth was negatively correlated with jumper density but also indicated that channel width and specific conductance were positively correlated. Abundance of fish and size of fish were weakly correlated with numbers of jumping fish, although counts were higher when CPUE was high, and larger fish were disproportionally represented in jumpers. Both genders were equally or inconsistently represented among jumping fish. Results are supported by preliminary data from an ongoing study in other waters. Data demonstrate that sound sources, water quality, and water levels are significantly associated with Silver Carp jumping activity. Data suggest that such variables can be used to assess risks to public safety (i.e., likelihood of collisions with boaters) and risks to public waters (i.e., likelihood of breaching vertical barriers and expanding geographic range range).

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Dauphin Island restoration for sustainable, conservation values

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Dauphin Island is a strategically significant barrier island along the northern Gulf of Mexico and, more specifically, serves as the only barrier island providing protection to much of the State of Alabama's coastal natural resources. The island has sustained impacts from both storms and the recent Deepwater Horizon oil spill warranting evaluation of restoration options. This work will identify the most beneficial and effective restoration activities for Dauphin Island that, if implemented, would ensure long-term sustainability and resiliency of the state of Alabama's only barrier island, its habitats, the living coastal and marine resources it supports, as well as estuarine conditions in Mississippi Sound and the extensive coastal wetlands to the north. We have identified multiple objectives associated with long-term sustainability and resiliency of Dauphin Island. To evaluate the influence of restoration alternatives on conservation values we are developing a decision tool for the decision maker (Alabama Department of Conservation and Natural Resources) that will constitute a transparent assessment of the tradeoffs among the restoration strategies. Major uncertainties in project planning and design center largely around climate change, sea level rise, and how the system will respond to these changes over time. To reduce this uncertainty, climate change and sea level rise scenarios will be incorporated in the analysis to assess sustainability of potential future realizations. Data regarding risk of these changing conditions on restoration actions implemented for achieving conservation objectives is critical for long-term decision making.

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The presence of the Ticon Cownose ray *(Rhinoptera brasiliensis* Müller, 1836) in the northern Gulf of Mexico

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In 2007, three rays identified as *Rhinoptera brasiliensis* Müller, 1836, based on tooth series counts, were captured in the northern Gulf of Mexico (GOM), a region far outside their accepted range of the coastal waters of southern Brazil. Genetic analyses confirmed that these individuals were distinct from *Rhinoptera bonasus* (Mitchill, 1815), the only recognized indigenous species. Further analyses of over 300 specimens, including reference mitochondrial DNA sequences from voucher specimens, confirmed the widespread occurrence of two species of cownose rays in the northern GOM. Genetic analyses indicated the second species relates most closely to *R. brasiliensis*. The distributions of the two species differed, with *R. bonasus* being more prevalent in the eastern GOM, and *R. brasiliensis* more prevalent in the western GOM. There was an approximately 90% rate of agreement between identifications based on tooth series counts (*R. bonasus* = 5 to 13, *R. brasiliensis* = 7 to 15), which have been the standard for differentiating among rhinopterids, and those based on mitochondrial DNA sequences. Analyses of morphological and skeletal data identified several additional potential discriminating characters. While several skeletal characters were discrete, the degree of overlap of the morphological measurements between the two species rendered them impractical for identification purposes. The shapes of several skeletal elements (supracranial fontanelle and lateral stay on cervicothoracic synarcual) and spiral valve lamellae counts (*R. bonasus* = 26 to 28, *R. brasiliensis* = usually 29 to 31) also appeared to be consistently reliable in differentiating between the two species. This is the first study to verify the occurrence and distribution of *R. brasiliensis* in the northern GOM; however, the close genetic relationships to other rhinopterid species, as well as the morphological similarity of the group as a whole, require additional research.

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Comparison of three egg collection devices for Gulf Killifish (*Fundulus grandis*)

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The Gulf killifish (*Fundulus grandis*) is a small, euryhaline fish species occurring in estuarine areas along the northern Gulf of Mexico coast. This species is capable of rapidly moving between fresh and salt water and as a result is quite hardy to environmental changes, leading to its popularity as a baitfish for sportfish species such as Red Drum (*Sciaenops ocellatus*) and Spotted Seatrout (*Cynoscion nebulosus*). This remarkable trait also facilitates its culture in low salinity conditions, even freshwater ponds. However, several culture bottlenecks remain before Gulf Killifish can be developed at the commercial level. The primary bottleneck is the collection and incubation of eggs. In nature, females deposit eggs episodically on vegetation during new moon phases of tidal cycles. Recent research has shown that eggs can be collected in spawning mats suspended in tanks and incubated in a moist aerial environment, such as an incubator. Limitations are in difficulties associated with the separation of eggs from collection mats, and the space required to incubate eggs. Simplification of the process of egg collection and incubation is needed prior to commercialization. Therefore, this experiment compared egg deposition and fertilization by Gulf Killifish and the difficulty of collecting eggs using three different collection devices: spawning mats, disk collectors, and nylon mesh collectors. Adult Gulf Killifish were distributed in three commercial-scale (4,000-L) recirculating tank systems at 9 ppt. All three types of egg collection devices were used in each tank, with eggs collected every two days, quantifying collection time, egg abundance, and fertilization percentage. Information will be useful for determining the most efficient egg collection device and guiding commercial culture protocols through estimates of egg output per female and periodicity between egg collection.

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Predicting White Crappie, *Pomoxis annularis*, year-class strength on Ross Barnett Reservoir using a mid-water trawl

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The cyclical nature of White Crappie, *Pomoxis annularis*, reproduction can make management of this species difficult. Efforts were conducted to determine if a mid-water trawl can be used to adequately predict year class strength of White Crappie in Ross Barnett Reservoir. In conjunction with the trawl sampling, angler harvested White Crappie are being aged by collecting otoliths from carcasses collected from area campgrounds. Final efforts are to determine if significant correlations exist between trawl catch rates or the proportion of sites with YOY crappie present and angler harvested catch rates of the same year class at ages 2, 3 and 4. In the eighth year of the ten year study, trawl sampling results appear to predict White Crappie spawning success or lack thereof. Additional samples are necessary due to the delayed evaluation period associated with the project. Evaluation of a single trawl sample starts two years later when the year class recruits to the angler gear at age two and is assessed through age four. Presently, only four year classes are available for analysis. The determinate metric has been proportion of sites with YOY White Crappie present. Year classes with low proportion of presence values have shown low angler catch rates at age two, three, and four.

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Independent effects of temperature, dissolved oxygen, and swimming on survival of angler-caught Largemouth Bass

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Largemouth Bass *Micropterus salmoides* are sought by millions of recreational anglers, most of whom practice voluntary live release, and many of whom compete in tournaments that enforce live release. Further, most Largemouth Bass fisheries are regulated by harvest restrictions requiring release of angled bass. Yet, the independent effects of water temperature, live well (LW) dissolved oxygen, and angling stress on survival have not been measured. This controlled laboratory study measured the effect of ambient temperature (17-33 °C) and simulated angling (1 and 3 min forced swimming) on 5-day survival of Largemouth Bass >300 mm subjected to simulated catch and release or tournament conditions at different ambient and LW temperature differentials (ΔT of −4, 0, and + 4 °C), LW dissolved oxygen (DO) concentrations (2, 5.5 and 8.5 mg/L), and different levels of angling stress. When stressed by a 1-min swim, survival of caught-and-released fish was 100% at ambient temperatures ≤29 °C and ranged from 70-100% at 33 °C, and survival after 8 h LW retention with LW DO ≥ 5.5 mg/L was 85-100% at ambient temperatures ≤29 °C but decreased to 70% at 33 °C. Live well temperature manipulations had little effect except at 33 °C ambient temperature when survival significantly decreased at ΔT = +4 °C. Survival following all LW DO treatments was ≥80% at ambient temperatures ≤29 °C, significantly decreased at 33 °C, and was 30% at 33 °C and 2 mg/L DO. Survival of fish immediately released and held in LWs decreased after the 3-min swim. Results indicate high survival can be attained for caught-and-released Largemouth Bass at temperatures ≤33 °C and for tournament-handled Largemouth Bass at temperatures ≤29 °C and LW DO ≥5.5 mg/L when the fish are landed quickly and handled carefully. Largemouth Bass survival decreases when fish are subjected to longer swimming stressors.

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Benthic Fish Assemblage in the Mississippi River Below New Orleans: The Last 100 Miles

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The lower 100 miles of the Mississippi River is an important navigation corridor for large ocean-going vessels, marshes extend from both banks of the river, and a saltwater wedge can travel upstream as far as New Orleans during low water. In addition, large water diversions and dredged sediments are proposed to build marsh habitat in coastal Louisiana. Despite its economic and environmental importance, little is known about the lowermost reach of our nation's largest river. A map of major habitat features was developed including revetted and natural banks, deep (>100 ft.) holes, large sandbars, and inlets to adjacent marshes and borrow pits. We have periodically sampled these habitats below New Orleans beginning in 2004 and continued through 2016 using trotlines and benthic otter trawls. A total of 40 species have been documented in the channel of the Mississippi River below New Orleans compared to 72 species above New Orleans, although sampling has been more intensive in the upper reach. However, the Bay Anchovy *Anchoa mitchilli* comprised 62% of the total individuals in trawls below New Orleans compared to four species above New Orleans that comprised 67% of the total individuals: Shoal Chub *Macrhybopsis hyostoma*, Channel Shiner *Notropis wickliffi*, Freshwater Drum *Aplodinotus grunniens*, and Blue Catfish *Ictalurus furcatus*. A total of 14 estuarine species, including Bay Anchovy, were collected below New Orleans, but were absent from the upper reach. Bottom salinity varied from freshwater up to 27 ppt depending on location and river discharge. Two young-of-year *Scaphirhynchus* sp. were recently collected at River Mile 33, which is now the most downstream distribution of river sturgeon documented in the Lower Mississippi River. These data will continue to be collected and used in environmental assessments of channel deepening to accommodate large vessels and potential entrainment effects of large freshwater diversions for marsh restoration.

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Development of an acoustic array in the Bay of St. Louis, Mississippi to monitor movement patterns of Red Drum, *Sciaenops ocellatus*, and Bull Sharks, *Carcharhinus* leucas

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The rare occurrence of 700 - 800 mm total length (TL) Red Drum in GCRL monthly sport fish sampling has triggered the question of how this species utilizes the Bay St. Louis (Bay) system throughout its ontogeny. Data are also limited when examining the environmental preferences and movements of juvenile Bull Shark in the system. The objectives of this project are to use acoustic telemetry in the Bay system to determine 1) the whereabouts of 700 – 800 mm Red Drum, 2) immigration and emigration patterns of Red Drum and juvenile Bull Shark, and 3) general directionality these species pursue when leaving the system. The fish are captured by hook and line and gill netting, anesthetized, surgically implanted with a V13 (600 – 800 mm TL Red Drum) or V16 (juvenile Bull Shark) acoustic tag, and released following recovery. A total of 44 VEMCO VR2W acoustic receivers strategically deployed throughout the Bay system and at its mouth will detect and record the presence of tagged fish along with a time and date stamp, allowing us to investigate presence and directionality of movement within the Bay system and associated coastal drainages. In addition to acoustic receivers, 12 Onset HOBO data loggers were deployed around the Bay to record bottom water temperature and conductivity, allowing environmental data to be correlated with acoustic data. The telemetry data obtained during this study will aid in the future management of both species and inform the spatial design and placement of future fish-tracking acoustic arrays within Mississippi's coastal waters.

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Experimental design for the determination of high precision estimates of Red Snapper abundance in the Gulf of Mexico

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The objectives of this project were to describe the expected precision of a regional abundance estimate of age-2+ Red Snapper that can be obtained using a two-year conventional tag and recapture study. Abundance estimates, derived from tag-recapture models, are influenced by intrinsic and exogenous factors. To address the impacts of these factors we constructed an individual-based simulation model parameterized using values derived from expert opinion and examination of the literature. Because of the time required for evaluating the individual-based model output using the large sample sizes from the IBM we evaluated similarly derived, but smaller data set, in a tag-recapture model. The individual-based model we constructed is scalable and generic in all respects. It is parameterized for the regional spatial characteristics of the Mississippi Bight. Habitat characteristics in this region include Oil and Gas Platforms, Artificial Reef habitats, and naturally-occurring hard bottom habitats. In the case of naturally-occurring hard bottom habitat, only a portion of this habitat is known to the stakeholders and scientific community. The model evaluates, on weekly scales, the growth, mortality, and recruitment of fish to the population of interest (age 2+). Individual movement is evaluated on a weekly time scale and is density-, age-, and habitat dependent. Fish move in a spatial grid to and from discrete habitat which differ in their area and area-specific carrying capacity. Tagging and recapture of individuals is determined by fishery-dependent and fish-independent methods. Tagging can induce mortality which is depth-specific and tags can be shed. In the case of fishery-dependent data collection, reporting can be imperfect. Sampling from fishery-independent and dependent means results in binary recapture probabilities that can be evaluated in a tag-recapture framework. We analyzed the binary-recapture probabilities in different scenarios in a Bayesian framework to determine the characteristics of the posterior distribution on the estimated parameter “population size” under different scenarios. Using “scaled down” versions of the IBM-derived tag-recapture histories we found that the median and 2.5 and 97.5% quantiles were very sensitive to the number of tags deployed. When the number of tags employed approached 5% of the population size. The population size parameters were well estimated under “base” model conditions.

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A preliminary look at the foraging ecology of the Spotted Seatrout (*Cynoscion nebulosus*) in the coastal waters of Mississippi

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As management agencies move towards holistic approaches that incorporate natural and anthropogenic impacts, characterizing the interactions among species becomes increasingly important. Stomach contents analysis of predatory fishes provide a basic, yet effective, way to connect species within local food webs. Such information is particularly important for species, like the Spotted Seatrout (*Cynoscion nebulosus*), which establish localized resident populations and feed on other economically important species. Preliminary results will be presented from an ongoing study that describes the foraging ecology of Spotted Seatrout in coastal Mississippi. These include seasonal changes in diet and estimates of diel variation in stomach fullness (i.e. the weight of the prey divided by the weight of the predator), which can be used to infer the time of day at which peak feeding occurs. Expanding our sampling effort in upcoming years will provide insight into inter- and intra-annual variability in diet and permit an estimation of daily ration. This information will fill important knowledge gaps concerning the feeding ecology of Mississippi's Spotted Seatrout population.

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Age and growth of Channel Catfish pre- and post- flow management below R. L. Harris Dam on the Tallapoosa River, Alabama

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Anthropogenic alteration in flow regimes below hydropeaking dams are often considered one of the most serious and continuing threats to aquatic biodiversity in streams and rivers. Four dams owned by the Alabama Power Company regulate the Tallapoosa River in eastern Alabama. R. L. Harris Dam is the newest and upper most facility (operating since 1983); flows from the dam have been managed adaptively for multiple stakeholder objectives since 2005. One of the stakeholder's primary objectives is to provide quality sport fisheries in the Tallapoosa River in the managed area below the dam. Historically, Ictalurids and Cyprinids dominated the river above Lake Martin. However, investigations after Harris Dam closed have detected a shift in community structure from Ictalurids and Cyprinids to domination by Centrarchids. Flow management (termed the Green Plan) has been occurring since March 2005; however, sport fish populations as measured by recruitment of age-0 sport fishes (black basses and catfishes) below the dam relative to recruitment at unregulated sites has not responded adequately to flow management. In this study, we investigated Channel Catfish *Ictalurus punctatus* age and growth before and after implementation of the Green Plan to determine if changes in flow regime had any effects on Channel Catfish growth. Channel Catfish were captured via boat electrofishing from 1996-1997 (pre-Green Plan), 2009-2011 and 2015-2016 (post-Green Plan). Fish were measured, aged and data were fitted to von Bertalanffy growth models. Estimated growth parameters did not differ between Channel Catfish captured prior to and post implementation of flow management at Harris Dam. These results indicate Channel Catfish populations may be affected by other anthropogenic and environmental factors such as growth overfishing or altered thermal regimes.

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Thermal performance of native and non-native aquatic species in NE Alabama.

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The impact of non-native aquatic species to non-native habitats is of concern to ecological managers. Either accidentally or intentionally, numerous aquatic species occur in non-native habitats worldwide. The direct impact of non-native species has been documented and includes many detrimental changes to aquatic systems including changes in water quality, habitat quality, and biotic quality. The direct, or biotic, competition between non-natives and natives is clearly of concern to managers; however, information on indirect, or abiotic, competition between non-natives and natives can further be used to assess population stability and viability. Physiological measurements of respiratory rates, indicative of overall metabolic rates, have been used to compare physiological performance between non-native and native aquatic species in response to changing environmental conditions. Our overall goals have been to establish the effect of changing environmental parameters on the ability of species to maintain physiological processes for optimal growth and reproduction. We have measured and compared the metabolism of the non-native Asiatic weatherfish, *Misgurnus anquillicaudatus*, and the Asiatic clam, *Corbicula fluminea*, acclimated to various environmental temperatures (15 – 40C) to those rates of several native Alabama species (*Cyprinella caerulea*, *Etheostoma brevirostrum*, *Elassoma zonaturm*, *Cambarus latimanus, and Villosa lienosa*) acclimated to similar environmental temperatures. Data on native species was collected up to a maximal of 25C whereas the two non-natives were easily acclimated to temperatures near 40C. Comparisons of Q_{10} response over similar temperature ranges indicates that the non-native species are physiological generalists with the ability to maintain relatively stable metabolic rates as temperatures increase. Estimated energy budgets suggest that native species will show reduced growth and fecundity if environmental temperatures increase compared to the non-natives. The thermal performance of the two non-native species is likely one factor contributing to their ability to adapt to habitats worldwide.

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How much is enough? Balancing fish and agriculture water needs in the Mississippi Alluvial Valley

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The Mississippi Alluvial Valley between Cairo, IL and Baton Rouge, LA is a fascinating region. It includes hundreds of oxbow lakes carved in the valley by the lateral migration of prehistoric and contemporary rivers. These lakes support unique fish assemblages and high biodiversity. Once covered by forests, about 80% of the valley has been cleared to support agriculture. Irrigation practices have lowered the water table in parts of the valley, making it more expensive to pump water. In response, farmers are beginning to use oxbow lakes as a source of water for irrigation. This development has prompted the need to regulate water withdrawals to protect aquatic resources. However, it has not been established how much water can be withdrawn from lakes before fish assemblages begin to be upset. To estimate withdrawal limits, I examined lake water quality and fish assemblage patterns relative to depth in a sample of over 50 oxbow lakes in Mississippi and Arkansas. Analyses point toward thresholds at which patterns shift. These change points may inform regulatory decisions about water withdrawal limits.

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Age and Growth of Vermilion Snapper (*Rhomboplites aurorubens)* from the north central Gulf of Mexico

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Vermilion Snapper (*Rhomboplites aurorubens)* are a commercially and recreationally valuable resource in the Gulf of Mexico (GOM). However despite its popularity, life-history metrics of Vermilion Snapper are known only from the eastern GOM. Our goals were 1) to describe length-at-age and weight-at-length relationships of Vermilion Snapper in the north-central GOM using multiple non-linear growth models, and 2) to compare length-at-age parameter estimates to published estimates from other regions. A total of 371 Vermilion Snapper were collected from May 2015 through June 2016 off Mississippi and Alabama in the north-central GOM using hook and line sampling along with collections from charter vessels. Age was determined from annular otolith rings, and ranged from 1 to 13 years for both males and females. A multi-model approach was fit to total length (TL) and included the two and three-parameter Von Bertalanffy Growth Function (VBGF) as well as the Logistic Growth Function. Weight-at-length was also fit to a power function. Comparison of male and female growth yielded no significant differences between parameter estimates for all models used. Using combined sex data and Akaike Information Criterion (AIC), we found that the two-parameter VBGF was the best supported model (ΔAIC = 0.0) of the three, followed by the logistic function (ΔAIC = 2.76) and the three-parameter VBGF (ΔAIC = 9.22). Fitting a power function to our weight-at-length data yielded mean parameter estimates of a = 2.74E-08 (95% CI: 1.70e-08 to 4.36e-08) and b= 2.86 (95% CI: 2.79 to 2.94). Comparison of parameter estimates to published data from the GOM showed our parameters were significantly different from two studies in the GOM, although we believe our estimates are more accurate for Vermilion Snapper in the north-central GOM. Results from this study will aid in future stock assessments and allow for a region-specific overview of life-history of Vermilion Snapper.

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Assessment of Blue Shiner, *Cyprinella caerulea*, population distribution in Alabama via environmental DNA (eDNA) analysis

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Blue shiners, *Cyprinella caerulea*, were once found within the Cahaba and Coosa River systems in Alabama. More recent surveys have indicated that *C. caerulea* are now expatriated from the Cahaba River and their range has diminished within the Coosa River system. The need for current *C. caerulea* population distribution data is essential in order to address possible impacts and management decisions. In the reported study, environmental DNA (eDNA) sampling methodology, which represents an efficient, non-invasive sampling approach, was developed to assess *C. caerulea* populations in Alabama. A real-time PCR assay was developed for the amplification of a mitochondrial gene, NADH dehydrogenase subunit 2 (ND2) gene, for *C. caerulea* . The primers and dual-labeled oligonucleotide probe were designed to anneal to a section of the ND2 gene that allowed for species-specific DNA amplification, while excluding sister taxa known to cohabitate the survey sites. Water samples were collected from sites in the Coosa and Cahaba river systems in Alabama. All samples were filtered, on site, using manual vacuum pumps in conjunction with 0.45 micron filters/disposable funnels. Environmental DNA samples were subsequently isolated from these filters and tested for the presence of *C. caerulea* DNA using the aforementioned PCR assay. The current study revealed the continued presence of *C. caerulea* in the Coosa River system, specifically at sites in Little River and Choccolocco Creek. In reference to sites surveyed within the Cahaba River system, no *C. caerulea* positive eDNA samples were found. These finding are in concordance with previous studies that have suggested that *C. caerulea* has been expatriated from the Cahaba River. Future research will continue to monitor these established *C. caerulea* populations using the reported eDNA assay.

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An examination of trophic interactions in the northern Gulf of Mexico: Past work, present understanding, and future challenges

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The recent paradigm shift in fisheries management to an ecosystem-based approach requires an improved understanding of the interactions among taxonomic groups. A primary interaction is the dynamics of predator and prey. In this work we present a novel method for visualizing and analyzing trophic interactions using social networks. Social networks are used to describe connectivity, identify important interactions, and understand the structure and stability of complex systems. The objectives of the present study are to evaluate the temporal, spatial, and taxonomic gaps and patterns in diet studies conducted in the northern Gulf of Mexico (NGOM) and assess how our understanding of trophic dynamics is informed and biased by available information. We conducted a comprehensive literature search for stomach content analyses for ray-finned fishes in the NGOM and we complied data from 136 literature sources, including peer-reviewed journal publications, technical reports, and theses and into a database of 240 unique predator species. We then created trophic webs using social networks and analyzed the response to random and directed disturbances through simulation. We found that fewer studies were conducted in the 1990's and 2000's than in the 1970's and 1980's and there was a lack of long-term (> five years duration) studies. We also found fewer studies from the western NGOM than from the Florida Gulf Coast. Commercially targeted and lower trophic level fishes such as Red Snapper (*Lutjanus campechanus*) and Bay Anchovy (*Anchoa mitchilli*) were well represented, however, the taxonomic resolution of the prey items was inconsistent. We found that social networks were sensitive to the amount of information available and responded to random and directed disturbances. Our work can improve understanding of the robustness of the NGOM trophic network and identify keystone species, providing a new perspective on ecosystem-based fishery management and multi-species interactions.

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Analysis of benthic macroinvertebrate communities in regulated and unregulated reaches of the Tallapoosa River, Alabama

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Hydropeaking is a common practice used by hydropower facilities to generate power during peak electricity demand. Intense changes to flow and temperature may be related to such events, ultimately creating stressful environmental conditions for downstream aquatic communities. R.L. Harris Dam is a hydropower facility located in the upper-central Tallapoosa River basin that has been the subject of an adaptive flow management project since 2005. Macroinvertebrates have been collected since project inception in spring and fall seasons, to investigate effects on communities subject to river regulation and natural variation in hydrology. The objectives of this study were to investigate macroinvertebrate community structures in regulated and unregulated reaches of the Tallapoosa River basin for fall samples from two years (2005 and 2014; a wet and normal year, respectively). Nonmetric multidimensional scaling and cluster analysis indicated that there were fundamental differences in macroinvertebrate community structure among regulated and unregulated reaches. Years also tended to show separation, indicating temporal differences especially in the unregulated reaches. Non-insects and various Diptera tended to be more strongly associated with regulated reaches; whereas, other insect groups were more prevalent in unregulated reaches. Several droughts (water years 2007-08 and 2011-12) occurred during the study period, allowing for the opportunity to study community response to extreme drought (unregulated) and 'anti-drought' conditions (i.e., maintaining a low flow state that is greater than the naturally occurring flows) below the dam. Future analysis will include specific hydrology and temperature metrics to explain variation in the macroinvertebrate data over the study period. We hypothesize that hydrologic and thermal conditions influence community structure; however, the impacts of 'anti-drought' conditions extant below R.L. Harris Dam due to river regulation and downstream water needs during droughts are unknown.

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Reducing shark bycatch in commercial and recreational fisheries.

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Fisheries scientists have become increasingly alarmed at the recent reductions in numbers of open-ocean predators. Reducing shark bycatch in pelagic longline fisheries will help reverse this decline. I report here on research into reducing bycatch of sharks in commercial and recreational fisheries. Our approach is to exploit differences in tooth morphology between sharks and target species (typical fish, tuna, swordfish) to develop a fishing leader that will allow sharks to self-release while retaining target species. The “entangling leader” is designed with loops of leader such that when a shark takes the bait, the loops entangle in the teeth and are broken. Preliminary field testing has shown that experimental, entangling leaders frequently result in broken leaders while control, monofilament leaders fished contemporaneously continue to catch sharks. “Leader-cam” video footage provided documentation of the interaction between sharks and the entangling leader. Additionally, our research suggests that a simple change from monofilament line to ultra-high molecular weight polyethylene will result in significantly increased “bite-offs” and significantly reduced bycatch.

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Development of a management inventory of the oxbow lakes in the Mississippi Alluvial Plain

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The Mississippi Alluvial Plain (MAP) spreads across roughly 130,000 km^2 from Illinois to Louisiana (Baker et al. 1991). Representing the historical floodplain of the lower Mississippi River, the MAP was formerly characterized by one of the largest contiguous wetlands in North America (Wilken et al. 2011). Today the MAP contains a diverse mosaic of aquatic habitats formed through the meandering of the Mississippi River, including many perennial lakes formed via channel cut-offs, known as oxbow lakes. While environmental data is sometimes available on these natural lake systems it is scattered throughout multiple databases and system characterization remains inadequate. The goal of this project is to create an inventory of the oxbow lakes in the MAP containing biophysical data relevant to the management of biological resources. Three specifics objectives were identified to achieve this goal. First, GIS data on the spatial distribution of surface waters will be used to identify the location of naturally occurring perennial lakes. Second, remotely sensed data will be applied to estimate a set of ecologically significant biophysical characteristics for each lake including depth seasonality, surrounding land-cover, and connectivity. Third, data will be integrated into an inventory and used to create a GIS data package for use in biological resource management.

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Identification of spawning sites and restoration priorities for Slackwater Darter (*Etheostoma boschungi*)

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Breeding and nonbreeding populations of the Slackwater Darter (*Etheostoma boschungi*) have been identified in select systems of the Tennessee River drainage in northern Alabama and south-central Tennessee; however, distinct breeding sites within the Limestone Creek watershed have yet to be detected. When coupled with the species' low detectability and specific breeding requirements, lack of known breeding habitat exponentially increases the difficulty of implementing habitat conservation actions. By entering Slackwater Darter population data into ArcGIS, we have created a predictive model that identifies land within the Limestone Creek system suitable for Slackwater Darter breeding habitat. We have used this model to identify 22 potential breeding sites, and have utilized eDNA testing to assess our model's predictive capabilities. We also determined that Slackwater Darter presence/absence throughout the current known range is significantly affected by two factors: land use/land cover and farm pond density. By incorporating these and other key environmental and anthropogenic variables into a final model, we have ranked Slackwater Darter habitat from sites of least to greatest conservation concern and have identified several high-priority sites—including the prolific Dodd Site in the Cypress Creek watershed. We recommend purchasing private land adjacent to these "hotspots" and transitioning from agricultural use to natural cover, as well as restoring stream channels and riparian zones along more heavily developed areas to help mitigate hydrological alteration and potential migration impediments.

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High reward tagging to estimate Red Snapper exploitation in the northern Gulf of Mexico off Alabama

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High-reward tagging studies offer a simple and direct approach to estimate exploitation rates. For economically important and controversial fisheries such as Red Snapper, these studies can help resolve assessment uncertainties while involving anglers directly in data collection. We used computer simulation to evaluate studies designs for a high-reward tagging study for Red Snapper in the Alabama waters of the Gulf of Mexico, then implemented a tagging program during the 2017 recreational fishery. The simulations explored a range of sample sizes (number tagged), exploitation, tagging mortality, tag loss, proportion double-tagged, and spatial variation in fish density, tag releases, and fishing effort. The most cost-effective study design involved tagging between 400 and 1600 fish with high-reward tags, with 40% double-tagged, and spatially distributed in proportion to the population. We tagged 724 red snapper off the coast of Alabama in 2017. Tagging based exploitation rates were higher in shallow (<30 m; u = 0.19) than deep (30-60 m; u = 0.05) water. Tag loss rates were estimated at 12% from double tagging. Our model estimates of exploitation rate were insensitive to natural mortality due to the short duration of the recreational fishing season, though were sensitive to assumed tagging-mortality rates. We suggest more work to estimate tagging-mortality and evaluate angler reporting rates to ensure exploitation rate estimates are unbiased.

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Multisystem scale length limits: making it easy

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A multisystem scale of management involves a wide range of inputs and nuances, which can preclude effective communication and interpretation of pertinent information. A consistent approach, which managers can replicate, can improve transparency of decision making, and clarify how information informs management plans. Forecasting the effect of length-limit regulations on fish population indices contributes meaningful guidance towards weighing decisions and how decisions meet management objectives. However, traditional length-limit models are limited to a single system and by uncertainty and the inherent variation among cohorts within a length limit evaluation. Through the development of a quantitative decision model, we demonstrate a consistent way to compare length limits applied to multiple systems and how length limits meet multiple objectives. We developed an extension of the Beverton-Holt yield-per-recruit function, coupled with a multi-attribute utility function, to compare length limits with an overall score for multiple systems. The model gives the user control over sources of uncertainty and the relative value of outcomes. We show how application of this model balances a multitude of management objectives, and formalizes the decision-making process.

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Estimation of proximate body composition of Channel Catfish, *Ictalurus punctatus*, using bioelectrical impedance analysis

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Assessment of body composition serves as an accurate measure of fish condition. Fat content in particular is known to be a reliable indicator because animals with more stored energy are assumed to be in better condition and more capable of successful reproduction and survival. Techniques to measure composition include physiological and biochemical measures which often require time and fiscal resources for laboratory analysis and are not applicable for animals which cannot be sacrificed or if replication on individuals is needed. Bioelectrical impedance analysis (BIA) is a non-lethal technique used to calculate body composition values, such as fat, protein, and water content, from simple impedance measurements. Accurate BIA requires initial model development to relate impedance values to percent dry weight (%DW) values. While models have been developed for only a few species of fish, development of a BIA model for measuring body composition of Channel Catfish, *Ictalurus punctatus*, is desirable because of the economic importance of the species and immediate needs to measure condition in the field. Model development is accomplished by correlating electrical property variables, calculated from reactance and resistance, to %DW or body composition values. Impedance values will be correlated to %DW as this can be estimated at a fraction of the cost of other proximate body composition analysis. Relations between %DW and proximate composition estimates will be established for Channel Catfish, as has been done successfully for other species, with simple conversion equations. The influence of electrode location on reactance and resistance measurements will be assessed to determine which positions allow for the most accurate predictions. Lastly, effects of temperature on impedance measurements will be analyzed and used to develop correction equations which will lend the models more readily to use in the field.

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Sturgeon entrainment at the Old River Control Complex: telemetry based support

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The Old River Control Complex (ORCC) located on the Lower Mississippi River (LMR) 45 miles SSW of Natchez, LA (RM 317-304) consists of a low sill, an overbank structure and Old River L&D with construction occurring between 1955 and 1963. An auxiliary structure was completed in 1986 followed in 1990 with the completion of the Sydney A. Murray Jr. Hydroelectric Facility. Up to 30% of the water from the Mississippi River is diverted through the ORCC into the Atchafalaya River. Shovelnose Sturgeon historically occurred within the upper Red River system; however, Pallid Sturgeon were not considered part of this historic fauna but were first noted within the system in 1991 following presumed entrainment from the LMR through the ORCC. We began a telemetry based assessment in April 2015 to document entrainment rates of Pallid Sturgeon at ORCC through the use of telemetry tagged fish released nearby in the Mississippi River as part of ongoing collaborative field efforts with biologists at the Mississippi Department of Wildlife, Fisheries and Parks, Mississippi State University and U.S. Fish and Wildlife Service. To date, 105 telemetry tagged river sturgeon caught primarily within the project area have been processed, and we have recorded over 272,000 detections on deployed receivers. Detections include > 55 telemetry tagged individuals representing five species, including 48 telemetry tagged river sturgeon processed as part of this project. In addition, we documented at least 24 entrainment events during the current project period represented by telemetry tagged Pallid Sturgeon, Shovelnose Sturgeon, American Eel, Bighead Carp and Silver Carp. The information obtained from this project is critical for future consultation with USFWS regarding potential impacts of ORCC on endangered Pallid Sturgeon, particularly since the ORCC is the only remaining USACE Mississippi River & Tributary (MR&T) project not currently covered by a Biological Opinion (BO).

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Improving management of Mississippi's Red Snapper using the Tails n' Scales electronic reporting system

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Red Snapper is currently one of the Gulf of Mexico's most important recreationally targeted species. Accurate and timely estimation of recreational Red Snapper harvest and angler effort is crucial for the current Gulf-wide management plan. The current management of Red Snapper includes a derby style federal season with multiple and highly variable state seasons. Accurate estimation of seasonal harvest including harvest within season is valuable for fisheries managers to set and adjust fishing restrictions. Estimation of in-season harvest on a timelier basis is one of the most important metrics in preventing overages, allowing each state and the entire Gulf to more accurately harvest within its allocated quota. In 2014, Mississippi's Commission of Marine Resources adopted a modification to Mississippi regulations, requiring mandatory reporting of all recreational Red Snapper landings in the state. In 2015, The Mississippi Department of Marine Resources (MDMR) partnered with a software developer to design a mobile application for accomplishing this task. The goal of the mobile application design was to provide an easily accessible and intuitive system to enable Red Snapper private and for-hire anglers to report their Red Snapper landings in real time. MDMR currently has two complete years (2015 and 2016) of Red Snapper harvest data. These data are currently being used in a peer-reviewed federal certification process to discuss the ability of the Tails n' Scales program as a scientifically acceptable system to estimate Red Snapper harvest in Mississippi. This reporting program has provided the MDMR more robust data which identifies effort levels in the fishery and a more precise number of Red Snapper being landed in Mississippi. Although Tails n' Scales is currently being used only for Red Snapper reporting, MDMR will expand to additional species in future years.

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Diet of larval Atlantic Bluefin Tuna *Thunnus thynnus* from the central Gulf of Mexico

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Atlantic Bluefin Tuna *Thunnus thynnus* are highly migratory pelagic predators that support valuable fisheries throughout the temperate Atlantic Ocean. Survival during larval stages is a major factor regulating fisheries recruitment; therefore, knowledge of larval *T. thynnus* feeding ecology is essential to understanding the survival of this species during critical early life stages. Diet was examined for larval *T. thynnus* collected from the central Gulf of Mexico (GOM) during May 2008, 2009, and 2010 [n = 100; 3.0–6.7 mm body length (BL)]. Collections in 2010 included larvae sampled from waters contaminated by the Deepwater Horizon (DWH) oil spill. Predominant prey groups were copepods, cirripeds, and cladocerans. No fish prey were observed, which suggests piscivory in GOM *T. thynnus* does not occur at sizes <6 mm. Diet was best predicted in a multinomial linear mixed model by year and BL. The observed ontogenetic and inter-annual variability in diet suggests *T. thynnus* feed in a dynamic prey environment, which may contribute to annual fluctuations in larval survival.

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An Individual-Based Model of the Gulf Menhaden Fishery

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This study investigates the movement and harvest dynamics of the Gulf Menhaden (*Brevoortia patronus*) fishery. The fishery-dependent data collected by NOAA (years 2006-2009 and 2011) describe vessel-specific information on catch locations (latitude and longitude) and magnitude of harvest in metric tons (mt). The interquartile range (IQR) of the number of harvests events per vessel day was four harvests with a median of five harvests for all vessel days and a median of six harvests for vessel day of more than four hours on the fishing grounds. The IQR of the magnitude of harvest was 21.2 mt with a median of 18.5 mt. The IQR for the distances traveled between harvest locations was 20.5 km (12.8 mi) with a median of 5.60 km (3.48 mi). A series of probability distribution functions (PDFs) were fit to the frequency distributions of number of harvests per day (Poisson), between-harvest distances (gamma), and harvest magnitude (log-normal). These analyses were used to inform an individual-based model (IBM). The IBM was run under different spatial restriction regimes, including (1) current regulations in Texas, Louisiana, Mississippi, and Alabama; (2) additional restrictions off the coast of Jackson County, MS; (3) an extension of current regulations to two miles from shore; and (4) closures of random areas in the fishery's historical extent. This study describes fleet dynamics of one of the most important commercial fisheries in the region and illustrates how they can be simulated using a spatially-explicit IBM.

POSTER PRESENTATIONS

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Conservation management of Alligator Gar, *Atractosteus spatula*, in Alabama: an evaluation of brood fish collections in the Mobile-Tensaw Delta, 2008-2015

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Exploitation of Alligator Gar, Atractosteus spatula (AGR), combined with agency concerns about their population status led to Alabama's Department of Conservation and Natural Resources promulgation of the first protective regulation (2 fish/angler/day) for this species in 1992. Population assessments and limited distribution of AGR (8225 ha in Mobile-Tensaw Delta, lower Alabama and Tombigbee Rivers), further led to designation as a species of moderate conservation concern in 2004. Results of a meeting with gar anglers, along with concerns over commercial pressure were re-evaluated, and subsequently, fishing regulations were amended in 2005 (1 fish/angler/day). Biologists determined that team-coordinated field collections of brood fish for hatchery culture could be used as a tool to expand and enhance the AGR population within the middle Alabama River (Claiborne Reservoir). Results of brood fish collections thus far reveal that, 75 sample dates during February to April (50.7% successful dates) over 8 years resulted in capture of individuals (N=101) ranging in length from 102 to 221 cm. Collectors deployed a total of 578 (12.5% successful net-sets) multi-filament gill nets, expending 2167 hours of effort. By late 2010, hatchery staff determined that AGR ranging from 121.9 to 127 cm were not consistently mature and nearly 24% of captured fish were considered too small. The majority (91.7%) of small AGR were captured specifically in 102 mm mesh nets. Collections since 2011 have limited use of 102 mm mesh nets and only individuals $\geq$ 137.2 cm were transported to hatcheries for spawning.

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Developing commercial-scale low-salinity culture protocols for Gulf Killifish, *Fundulus grandis*

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Interest in culturing Gulf Killifish, *Fundulus grandis*, a native estuarine species found along the Northern coast of the Gulf of Mexico and the Eastern coast of Florida, has been growing due to their salinity tolerance and use as a baitfish. Although culture protocols are established, many producers are not likely to adopt these suggestions due to economic efficiency and needs for advances related to inland production. Therefore, the purpose of this study is to evaluate current setbacks in order to increase the potential for Gulf Killifish to become a commercially produced species. Currently, inland producers have little guidance in all production stages including broodstock stocking, egg production, egg incubation, and pond stocking and management. In order to maximize production, various densities of broodstock and their egg output will be evaluated. Gulf Killifish embryos have the unique ability to incubate terrestrially. Producers can take advantage of this ability; however, a moist incubation chamber facilitates the growth of water mold (*Saprolegnia* spp.). Literature on water mold is water incubation based; therefore, commonly used prophylactic treatments will be evaluated on eggs that are air incubated. Once hatched, fry can begin freshwater grow out as early as 7 weeks, but little information has been provided on the grow-out period for this species. Experiments will be conducted to provide more detailed protocols for freshwater grow out including determining optimal pond density in terms of growth and cannibalism rates, protein levels in feed in terms of increased growth rates, and whether this species can be rapidly reintroduced to higher salinities. Overall, culture practices for Gulf Killifish, from stocking broodstock to harvesting, handling, and hauling to bait shops, need to be defined for producers. If these protocols are not adjusted and evaluated in more depth, producers will not be able to fully adopt this species for culture.

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Composition of bycatch in commercial crab traps in Mississippi Blue Crab fishery

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Bycatch, the unintentional catch of animals in fishing gear, is a recognized problem in commercial fisheries, including the blue crab fishery. While commercial crab traps are very effective at collecting blue crabs, trap catch often includes several different bycatch species. Relatively little information exists on prevalence, species composition, and condition of bycatch in the Mississippi blue crab fishery. A study of the fishery was initiated in May 2007 to provide information on catch-per-unit-effort, fishing effort, biological characterization of the catch, and disposition of the commercial harvest. Twice a month, project personnel accompany three fishermen to collect data for each trap harvested. As a part of this study, data on bycatch, including species, quantity, and condition are collected for each crab trap. Current data cover the period May 2007 to December 2016. Typically, the amount of bycatch follows a seasonal pattern, with more caught during warm months. Species diversity is highest in traps located in Jackson County and lowest in Hancock County. Overall, over 100 different bycatch species have been collected in commercial crab traps. While bycatch mortality does occur, the vast majority of species are released alive.

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Performance of agricultural plantings on reservoir mudflats

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Shorelines of aging flood control reservoirs become barren mudflats void of structure due to insufficient seed beds, terrestrial origin of soils, and water level fluctuations too extreme for long term plant colonization. Establishing terrestrial vegetation on mudflats during drawdown stages will likely provide cover for fish during annual springtime flooding cycles. Exposed mudflats of Enid Lake, a flood control reservoir in northwestern Mississippi, were seeded with various cold-weather crops to potentially improve fish habitat during flooding stages. Experimental plots were planted over a two-week period in October, 2016, with ryegrass (*Lolium multiflorum*), triticale (*Triticale hexploide*), berseem clover (*Trifolium alexandrinum*), and balansa clover (*Trifolium michelianum*). Treatments consisted of five replicates of four monocultures, two mixed plantings, and a control. Each plot was 0.5 ha in area resulting in 35 plots and 17.5 ha of sowed area. Success of seeding was monitored in fall and winter to estimate ground cover, biomass, and plant height. Seeding success metrics were compared among treatments using analysis of variance and covariance models. Results may give reservoir and fisheries managers insight towards vegetative habitat improvement strategies and decision making in impounded rivers.

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Effects of commercial feed provision on early-life diets and growth of Channel, Blue, and Channel × Blue hybrid catfish

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Hybrid catfish (Channel Catfish *Ictalurus punctatus* ♀ × Blue Catfish ♂ *I. furcatus*) increasingly support the United States catfish industry. To maintain a reliable supply of hybrid catfish fry to stock into grow-out ponds, hatchery managers must develop appropriate feeding methods for fry of both parent species and their F1 hybrids. Two tank experiments were conducted at Southern Arkansas University to test the effects of commercial feed provision on diets and growth of Channel, Blue, and hybrid catfish during the transition from yolk-sac to exogenous feeding. Both experiments were performed in 75L glass aquaria filled with pond water and stocked with high densities of live crustacean zooplankton. Experiment 1 was completed using a 2×2 factorial design by stocking Channel or hybrid catfish in tanks and providing the fish access to zooplankton only or zooplankton plus a commercial feed. Experiment 2 was performed by providing Channel, Blue, or hybrid catfish access to zooplankton plus a commercial feed. In Experiment 1, both Channel and hybrid catfish grew faster in length and weight when provided zooplankton plus commercial feed as compared to zooplankton alone. However, there were no differences in growth rate between catfish type within each diet treatment. In Experiment 2, Blue and hybrid catfish grew faster in length and weight than Channel Catfish, although the Channel Catfish were smaller from hatching. The effects of feed provision on live prey selection have yet to be measured. Results of these experiments will ultimately help to provide hatchery managers recommendations to improve fry production reliability.

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A Comparison of Host Genetics and Environmental Effects on the Dermal Microbiome of Banded Sculpin (*Cottus carolinae*)

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The "slime" layer of fishes is of ecological and evolutionary importance, as it is inhabited by a co-evolving community of microbes, including commensals and potential pathogens. The diversity and dynamics of this community are influenced by the host genetics and the environment, but the relative contributions of these two factors remain largely unexplored. We are applying high-throughput molecular techniques to test for differential host and environment effects on the microbiome of Banded Sculpin (*Cottus carolinae*), a species with strong population structure and a broad geographic range. We focus on the Mobile River Basin, where the species occupies both upland and lowland habitats. One population is found in Rabbit Creek, Clark County, AL; which is part of the Tombigbee River drainage. The other is found in Reedy Creek, Clarke County, AL; which is part of the Alabama River drainage. While these populations are within 15 miles of each other, and nearly 100 miles from upland populations, they do not share a recent common ancestor. Genetic evidence allies the Rabbit Creek population to species found in the Black Warrior drainage while the Reedy Creek population is more similar to sculpins found in the Cahaba and Tallapoosa Rivers. The microbiome analysis reveals significant direct effects of genes (clades) and environment, as well an interaction effect. We discuss the relative importance of each, along with future directions involving the application of phylogenetic comparative methods to microbiome analysis.

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Win, lose, or draw: how did larval King Mackerel (*Scomberomorus cavalla*) fare during the Deepwater Horizon oil spill?

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Neritic plankton communities in the northern Gulf of Mexico were certainly impacted during the Deepwater Horizon oil spill event, but the degree and complexity of impacts on different taxa are poorly understood. The crustacean zooplankton community changed during the peak of the event, but quickly returned to the pre-impact composition. Larval fishes had likewise varied responses that were veiled by a suite of ecosystem drivers synchronized with the oil spill, including fisheries closures and natural variation in the physical environment. Recent studies reported that larval Red Snapper were in poorer body condition during and after the event as compared to pre-impact years, whereas larval Spanish Mackerel were in better body condition during the event. To further survey taxon-specific responses, body condition was measured for larval King Mackerel, which recruit into a highly managed fishery. Larval King Mackerel were collected during 2007–2011 by an ichthyoplankton survey off coastal Alabama within a region that was frequently exposed to oil. After sorting and identification, each larva was imaged and measured for a suite of body dimensions that varied with body condition, including body depth and head size. Body condition was then compared before and during the oil spill event and by sampling location. Patterns in larval King Mackerel body condition were further compared to those for larval Spanish Mackerel. We predict that continued investigations of larval fish responses to the oil spill event will reveal a complex story of taxon-specific “winners and losers,” each according to its ecological niche and environmental tolerances.

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Characterization of the dermal mucosal microbiome across populations of Red Drum (*Sciaenops ocellatus*)

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The teleost dermal mucosa is a host-mediated ecosystem for commensal microbes, and the first line of defense against pathogens. Despite advances in microbial taxonomy and DNA sequencing technology, microbial diversity within fish "slime" remains poorly described. We provide the first description of a microbiome in the dermal mucosa and some of the factors controlling the microbiome of *Sciaenops ocellatus* (Red Drum). *S. ocellatus* is a well-known euryhaline sport fish that has been of conservation concern in the southeastern United States for many years following a population crash. Following the Deepwater Horizon Oil Spill, *S. ocellatus* became an important target for microbial surveillance, because an outbreak of dermal lesions was reportedly due to *Mycobacterium ulcerans* - the etiologic agent for Buruli Ulcer. We hypothesized that *M. ulcerans* was carried east along the Gulf Loop Current during and after the oil spill. To test the hypothesis, and to characterize the dermal mucosal microbiome of healthy *Sciaenops ocellatus*, we collected 200 specimens from coastal waters of Mississippi, Alabama, Florida, and Louisiana. We applied microsatellite primers to check for genetic differences between fish as well as using Next Generation Sequencing to quantify the proportion of DNA fragments assigned to known microbe families, genera, and species. We report substantial variation in microbiome diversity in the dermal mucosa of *S. ocellatus*, but low incidence of (0-3%) of *Mycobacterium*. Results show that Proteobacteria, including *Vibrio* sp. dominate the dermal mucosa of *S. ocellatus*, at least in marine environments. The apparently low incidence of *Mycobacterium* is discussed, and two new hypotheses are posed to explain disease variability documented since 2013. Ongoing research seeks to identify the mechanism for host mediation of the dermal microbiome, and to identify keystone microbial species within this largely unexplored ecosystem.

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Development of techniques for spawning, sperm cryopreservation, and feed-training of crappie (*Pomoxis spp*.)

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Crappie (*Pomoxis* spp.) are popular game fish, but unlike other species of the family, Centrarchidae, aquaculture techniques for crappie are not well defined. In this study, I will expand on recent works to refine and optimize spawning techniques, cryopreservation, and feed-training of crappie for hatchery use. Spawning studies have strip-spawned White Crappie (*Pomoxis annularis*) following induced ovulation using the hormone GnRHa, although timing of spawning techniques following injection needs optimization for hatchery protocols. Therefore, optimization of hormone injection timing and strip-spawning protocols of White Crappie will be assessed during the spring spawn. Cryopreservation of sperm for intensive spawning practices can reduce the need to collect and retain broodstock males and allows ease of storage and access. Black-stripe Black Crappie, *Pomoxis nigromaculatus*, possess a rare, black pre-dorsal stripe phenotype that makes fish easily recognizable as hatchery origin fish for stocking and genetic studies. However, cryopreservation techniques have not been developed. Therefore, sperm cryopreservation techniques including cryopreservation and thawing procedures will be assessed. Out-of-season spawning capabilities would increase production of crappie. In previous experiments, fish were separated by sex and strip-spawned after injection with GnRHa, with moderate success. Since male crappie naturally spawn with multiple females, mixed-sex tanks will be used to assess the effect of sex ratios on spawning success. Spawning fish out-of-season necessitates rearing fish indoors until natural water temperature and food availability allow stocking into outdoor grow-out ponds. A recent study successfully trained juvenile crappie to accept commercial feed, however no attempts to feed-train larval fish have been recorded. Therefore, protocols of live and commercial diet will be tested for efficiency of larval and juvenile crappie growth and survival. If spawning protocols, cryopreservation techniques, tank holding procedures for out-of-season spawning, and feed-training techniques can be identified, many limitations of crappie aquaculture would be removed.

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Assessing differential and combined effects of capture depth vs. thermal change on condition and post-release mortality of managed reef fish in the northern Gulf of Mexico

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Increased management restrictions have led to an increase in the catch-and-release of targeted and non-targeted reef fish species. This can be problematic for fish captured at appreciable depths in which significant changes in their environment are experienced during ascent. This dramatic change results in fish often suffering from thermal stress and pressure-related injuries, ultimately leading to high release mortality. While the effects of capture depth have received considerable attention, the contribution of the magnitude of thermal change experienced has not been sufficiently assessed despite evidence for an effect of season on mortality. Furthermore, few studies have estimated post-release survival based on physiological measurements, which can yield valuable insight into biological factors that ultimately result in survival vs. mortality. Objectives of this on-going study are to use physiological and general condition metrics to examine seasonal and species-specific effects of barotrauma and temperature stress on managed reef fish in the northern Gulf of Mexico. To address our objectives, we sampled 5 reef fish species (Red Snapper, *Lutjanus campechanus*, n=44; Vermilion Snapper, *Rhomboplites aurorubens*, n=35; Scamp Grouper, *Mycteroperca phenax*, n=11; Greater Amberjack, *Seriola dumerili*, n=15; Gray Triggerfish, *Balistes capriscus*, n=34) during summer and winter months of 2016. Upon capture, 1 mL of blood was taken and fish were assessed for condition using a barotrauma-reflex (BtR) score. To assess recovery potential and post-release mortality, fish were placed into live wells and held on board for 30 mins. Subsequently, blood was taken, fish were scored based on condition and released. We are quantifying physiological parameters indicative of stress and barotrauma. The results from our study will provide essential estimates of discard mortality, while also providing information on how thermal and seasonal difference can affect these estimates. Information from this study can be directly incorporated into stock assessments to better manage these highly-exploited reef fish species.

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A multi-geared status assessment in Mississippi and an analysis of diets from museum specimens for of Piebald Madtom, *Noturus gladiator*

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The Piebald Madtom, *Noturus gladiator* (Thomas and Burr), is found in direct tributaries to the Mississippi River from the Big Black River in central Mississippi to the Obion River in northern Tennessee. The species is considered vulnerable by the American Fisheries Society, deemed in need of management in Tennessee, ranked as state endangered in Mississippi, and currently petitioned for federal listing. In order to best inform the Fish and Wildlife Service with the most up to date data for the federal listing process we assessed the current range of the species in Mississippi utilizing four different survey methods. A total of 13 sites were sampled throughout the Big Black River (n=2), Tippah River (n=1), Coldwater River (n=3), Hatchie River (n=6), and Wolf River (n=1) in Mississippi using three active gears (backpack electrofishing, seining, and dipnetting) and one passive gear (baited Gee style minnow traps). At each site, up to five 100 meter transects we completed with each gear. Surveys resulted in a total of 14 *Noturus gladiator* collected among 4 of the 13 sites surveyed. One individual was collected with a Gee style minnow trap, two individuals were collected with a backpack electrofishing unit, and ten individuals were collected with a seine. No individuals were collected with a dipnet. Additionally, as no diet data exists for the species, diets were extracted from all individuals caught during this survey (n=13) and also extracted from all available museum specimens (n=27). Diet analysis revealed 16 different diet items; however, diets predominantly consisted of Trichoptera with sand cases, leaf dwelling Odonata, and Chironomidae.