

Room	Meeting Room 16	Meeting Room 17	Meeting Room 18	Meeting Room 19	Meeting Room 20
Saturday, Feb. 4	Paddlefish Conservation	Centrarchids in Streams	Benefits of Competitive Fishing	Student Award	Gen Tech Sat AM1-Fish Pop <i>Mike Porter, Moderator</i>
8:00 AM		The Native Black Bass Initiative (A Southeast Aquatic Resources Partnership Program) <i>Jessica Graham</i>	Finding Mutual Benefit: Competitive Fishing Tournaments and Fisheries Management Agencies <i>Hal Schramm</i>	Independent Effects of Temperature, Dissolved Oxygen, and Swimming on Survival of Angler-Caught Largemouth Bass <i>Kevin R. Keretz</i>	Black Bass Bed Fishing Research: Have We Lost the Point? <i>John Hargrove</i>
8:20 AM		Spawning Behavior and Habitat Use of Shoal Bass in Two Chattahoochee River Tributaries <i>Amy Cottrell</i>	Kansas Style - Balancing Fisheries Resource Management with Sociological Desires <i>Doug Nygren</i>	Over Winter Survival and Habitat Use of Gulf Sturgeon in the Apalachicola River, FL <i>Nathaniel Hancock</i>	Using Angling and Electrofishing to Estimate the Size of a Smallmouth Bass Population in a Regulated River <i>Seth Mycko</i>
8:40 AM	Paddlefish: Ecological, Aquacultural, and Regulatory Challenges of Managing a Global Resource (8:50) <i>Jason D. Schooley</i>	Effect of Flow Variation on Hatch-Date Distributions and Daily Incremental Growth of Juvenile Black Bass in Two Southeastern Rivers <i>Steven Sammons</i>	A Path to Partnership Among Fishery Groups <i>Robert Cartlidge</i>	Where to Stock? : Evaluating Lakes Stocked with Florida Largemouth Bass in Oklahoma <i>Chris Acy</i>	Multisystem-Scale Length Limits: Making It Easy <i>Andrew Shamaskin</i>
9:00 AM	Genetic Management of the North American Paddlefish: Case Studies and Recommendations for Maintaining Diversity <i>Michael Schwemm</i>	First Year Survival and Dispersal of Neosho Smallmouth Bass <i>Shannon K. Brewer</i>	An Alternative Format for a Professional Bass Fishing Tournament: The Story of the Toyota Texas Bass Classic <i>Dave Terre</i>	Atlantic and Shortnose Sturgeon Recruitment in the Savannah River, Georgia <i>Alex Cummins</i>	How Much Harvest Can Trophy Catfish Tolerate: Examining Effects of Hand Fishing <i>Kristopher Bodine</i>

Saturday, Feb. 4	Meeting Room 16	Meeting Room 17	Meeting Room 18	Meeting Room 19	Meeting Room 20
	Paddlefish Conservation	Centrarchids in Streams	Benefits of Competitive Fishing	Student Award	Gen Tech Sat AM2-Fish Pop <i>Mike Porter, Moderator</i>
9:20 AM	Paddlefish Life History: Advances and Applications in Design of Harvest Management Regulations <i>Dennis Scarnecchia</i>	The Decline of a Fluvial Fish: Species Distribution Models in a Fragmented Riverscape <i>Andrew T. Taylor</i>	Catfish Tournaments Today: Connecting Anglers and Agencies <i>Robert Neumann</i>	Fish Assemblages Associated with Cover in the Mudflats of a Reservoir <i>Hunter Hatcher</i>	Assessing Experimental Gear for Channel Catfish <i>Ictalurus punctatus</i> and Crappies <i>Pomoxis</i> spp. to Increase Sample Size <i>Sean Kinney</i>
9:40 AM	BREAK				
					<i>Matt Skoog, Moderator</i>
10:00 AM	Ecological Significance of Paddlefish Seasonal Migrations and Movements: A Review of Tagging and Telemetry Studies <i>Sara Tripp</i>	Movement and Habitat Use of Shoal Bass in a Tributary Stream of the Flint River, Georgia <i>Travis Ingram</i>	Lessons Learned from E-Tournaments in Florida <i>Allen Martin</i>	Economic Value of Recreational Fishing on Reservoir and Tailrace Sections of Millers Ferry Reservoir, Alabama <i>Steven Gratz</i>	Precision of Gizzard Shad Abundance and Size Structure Estimates from Split-Beam Sonar <i>Garrett Johnson</i>
10:20 AM	Anthropogenic Obstructions to Paddlefish Movement and Migration <i>Jan Jeffrey Hoover</i>	Springs As Thermal Refugia: Seasonal Movement and Habitat Use Patterns of Smallmouth Bass in an Ozark River <i>Michael Siepker</i>	Florida's Bass Tournament Permitting System: The Evolution, Benefits, and Partnership Efforts to Better Manage Fisheries <i>Eric Johnson</i>	Food Web Structure and Contaminant Trophic dynamics of an Atlantic Drainage Large River System <i>Tiffany N. Penland</i>	A Hydroacoustic Evaluation of the Santee-Cooper Lakes and Implications of the Dynamics of Threadfin Shad Abundance to the Food Web <i>James Bulak</i>

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10:40 AM	A Review of Factors Affecting Natural Reproduction and Recruitment of Paddlefish: Hypotheses and Lessons from Acipenseriformes <i>Dennis Scarnecchia</i>	Daily Movement and Habitat Selection Patterns of Smallmouth Bass in an Ozark River <i>Michael Siepker</i>	Arkansas and the Bass Tournament Angler: What Have We Done for You Lately? <i>Colton Dennis</i>	Spatial Distributions of Blue Catfish in Lake Dardanelle, and Their Influence on Standardized Electrofishing Protocols <i>Zach Moran</i>	Estimating the Population Size of Degray Lake Hybrid Striped Bass: A Pilot Study <i>Sean Lusk</i>
11:00 AM	Applications of Emerging Fisheries Techniques for Paddlefish <i>Greg Whittedge</i>	Life History Information of Choctaw Bass <i>Micropterus haiaka</i> , a Newly Described Species of Black Bass <i>Neil Branson</i>	Sociodemographic and Economic Characteristics of Black Bass Anglers Participating in Different Tournament Types on Lake Guntersville, Alabama <i>Mike Maceina</i>	The Status of Atlantic Sturgeon in the Satilla, St. Marys and St. Johns Rivers <i>Adam Fox</i>	Optimizing a Standard Sampling Program for Non-Wadeable Rivers in Alabama to Estimate Species Abundance and Richness of Fish Communities <i>Jason Dattilo</i>
11:20 AM	American Paddlefish Condition in the Lower Missouri River, before and after the Bigheaded Carp Invasion <i>Duane Chapman</i>	A Multifaceted Approach to Guadalupe Bass (<i>Micropterus treculii</i>) Restoration in a Texas Hill Country River <i>Ryan McGillicuddy</i>	Effects of Temperature, Dissolved Oxygen, and Swimming on Survival of Angler-caught Largemouth Bass <i>Kevin R. Keretz</i>	Assessment of Smallmouth Bass Spawning Movements and Associated Environmental Conditions in an Intermittent Boston Mountain Stream <i>Jacob H Martin</i>	Estimating Absolute Abundance of Largemouth Bass in a Large Florida Lake <i>Nicholas Feltz</i>
12:00 PM	STUDENT-MENTOR LUNCH				

Saturday, Feb. 4	Meeting Room 16	Meeting Room 17	Meeting Room 18	Meeting Room 19	Meeting Room 20
	Paddlefish Conservation	Centrarchids in Streams	Benefits of Competitive Fishing	Human Dimensions	Gen Tech Sat AM2-Fish Pop <i>Ken Cunningham, Moderator</i>
1:20 PM	Catch-and-Release, Commercial Bycatch, and Boat Propellers: Cryptic Mortality of Paddlefish <i>Phillip Bettoli</i>	Twenty-Five Years of Guadalupe Bass Management: Integrating Population, Habitat, and Watershed Approaches to Conserving and Promoting a Riverine Bass Fishery <i>Preston Bean</i>	Summertime Management and Conditions of Live Wells By Black Bass Club Tournament Anglers in Florida <i>Jared Militello</i>	Exploring Constituent Use and Understanding of a Regulations Publication through Focus Group Conversations <i>Corey A. Jager</i>	Effects of Saugeye Introductions on Southern Reservoir Fish Communities: An Ecosystem Modeling Approach <i>Dray Carl</i>
1:40 PM	Paddlefish Caviar: Trends in Global Value and Modern Tools to Safeguard Resources <i>Steven Fain</i>	Success, Failure, or Somewhere in Between: Assessing Genetic Restoration of an Endemic Black Bass Population <i>Nate Smith</i>	Effects of Tournament Handling Practices on the Physiological Response of Atlantic Tarpon Relative to Tarpon from the Catch-and-Release Recreational Fishery in Boca Grande Pass, Florida <i>Kathryn Guindon</i>	Stakeholder Driven Process to Update Florida Largemouth Bass Regulations <i>Allen Martin</i>	Trends in Abundance of Brown Trout and Brook Trout in an Appalachian Stream <i>John Odenkirk</i>
2:00 PM	A Review of Establishing and Maintaining Paddlefish Populations By Stocking <i>Brent Bristow</i>	Establishment of Genetic Baselines for Bartram's Bass with an Assessment of Landscape Factors Influencing Hybridization with Introduced Species <i>Mark Scott</i>	Tournaments benefits go both ways <i>Gene Gilliland</i>	The Effect of Permit Costs on Fishing Participation <i>Richard Melstrom</i>	Distribution and Movement of Columbia River Redband Trout, <i>Oncorhynchus mykiss gairdneri</i> , in an Intermittent Southern Idaho Stream <i>Sarah Walsh</i>

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2:20 PM	Artificial Propagation of Paddlefish: Contemporary Status <i>William Shelton</i>	Genetic Relationships of Largemouth Bass from Different Habitats within Coastal Rivers of Northwest Florida <i>Matthew Wegener</i>		Assessing Changes in Participation of Fishing Trips By Target Species in Alabama <i>Jessica Quintana</i>	Evaluation of a Slot Length Limit on Rainbow Trout in Lake Taneycomo, Missouri <i>Shane C. Bush</i>
2:40 PM	The Role of Propagation in Paddlefish Restoration and Conservation: A Case Study of the Missouri Paddlefish Propagation Program <i>Christopher Schwinghamer</i>	Analysis of Factors Influencing Rock Bass Population Dynamics in a Missouri Ozark Stream <i>Joshua G. Ward</i>		Creel Surveying the Blue River: Challenges and Approach <i>Matt Gamble</i>	Population Dynamics of Hybrid Striped Bass in Greers Ferry Lake, AR <i>Matt Horton</i>
3:00 PM	BREAK				

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	Paddlefish Conservation	Centrarchids in Streams		Human Dimensions	Gen Tech Sat AM2-Fish Pop <i>Robert Mollenhauer, Moderator</i>
3:20 PM	Distribution and Aquaculture Status of American Paddlefish in China <i>Hong Ji</i>	Growth, Mortality, and Density of Smallmouth, Largemouth, and Spotted Bass in Three Northeastern Oklahoma Streams: The Beginning of a Long-Term Monitoring Project <i>Matt Skoog</i>		Assessing Angler Use and Opinions at a Seasonal Urban Trout Fishery in Northeast Oklahoma <i>Chris Whisenhunt</i>	Habitat-Specific Population Demographics of Red Snapper and Red Grouper in the Eastern Gulf of Mexico <i>Mandy Tyler-Jedlund</i>
3:40 PM	Paddlefish (<i>Polyodon spathula</i>) in Europe: An Aquaculture Species and a Potential Invader <i>Ivan Jaric</i>	Evaluation of a 14-in Minimum Length Limit for Smallmouth Bass in the Eleven Point River <i>Brett Timmons</i>			Shifts in Habitat Use and Diet of Juvenile Reef Fishes in Seagrass Habitats in Response to Varying Abundance of Juvenile Gag <i>Kevin Thompson</i>
4:00 PM	Recreational Fisheries Management of Paddlefish <i>Gerald E. Mestl</i>	Smallmouth Bass Fishing in Missouri: Results from the 2011 Angler Survey <i>Rick Horton</i>			Using Cohort Age Analysis to Understand Spawning Patterns in Atlantic Sturgeon <i>Douglas L. Peterson</i>
4:20 PM	New Approaches to Management of Commercial Paddlefish Fisheries <i>Steven J. Rider</i>	Harvest Evaluation of Smallmouth Bass from Selected Ozark Streams <i>Rick Horton</i>			Climatic Variable Selection Across Space and Time: Development of a Pacific Salmon Migration Timing Forecast Model <i>Ben Staton</i>

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	Paddlefish Conservation	Centrarchids in Streams		Human Dimensions	Gen Tech Sat AM2-Fish Pop <i>Robert Mollenhauer, Moderator</i>
4:40 PM	Multi-Jurisdictional Management of a State-Managed Fish: MICRA Moving Forward <i>Kirk Hansen</i>	Resample, recapture, and re-analyze: using the 3 Rs to resurrect the scale method for estimating fish age <i>Colt Holley</i>			Global Estimate of Fish Harvest from Inland Lakes <i>Mark Rogers</i>

Sunday, Feb. 5	Meeting Room 16	Meeting Room 17	Meeting Room 18	Meeting Room 19
	American Eels	Gen Tech Sun AM1-Native Fish <i>Cindy Williams, Moderator</i>	Gen Tech Sun AM1-Ancient Fish <i>Jason D. Schooley, Moderator</i>	Gen Tech Sun AM1-Habitat and Env. <i>Edie Marsh-Matthews, Moderator</i>
8:00 AM		USFWS Status of At-Risk Aquatic Species <i>Cindy Williams</i>	Attachment Site Selection and Size-Selectivity of Chestnut Lampreys (<i>Ichthyomyzon castaneus</i>) on Rainbow Trout (<i>Oncorhynchus mykiss</i>) in Hatchery Raceways in Arkansas <i>Jeremiah Salinger</i>	Influence of hydrology on the age-specific abundance and growth of freshwater drum and gizzard shad from lotic and lentic habitats in Oklahoma <i>John Datillo</i>
8:20 AM		Current Status and Distribution of the Strawberry Darter in the Tributaries and Main Stem of the Strawberry River Drainage <i>Kyler Hecke</i>	Population Responses of Shovelnose Sturgeon <i>Scaphirhynchus platyrhynchus</i> in the Arkansas and Red River Basins to Landscape Characteristics <i>Josh Johnston</i>	Fishes of a Heavy Metal Contaminated Stream (Tar Creek, Ottawa County, Oklahoma) after Operation of a Passive Treatment System <i>William Matthews</i>
8:40 AM		Relative Abundance and Habitat Use by Sickle Darters (<i>Percina williamsi</i>) in Tennessee <i>J. Brian Alford</i>	Seasonal Habitat Use of Adult Pallid Sturgeon in the Lower Mississippi River <i>Dylan A. Hann</i>	A Simple Optimization Tool to Prioritize Barrier Removal in Streams: Implications for Convergence Among Divergent Conservation Objectives <i>Ryan A. McManamay</i>
9:00 AM	Utility of Mining Historic and Current Data Sources for Insights into Distribution and Ecology of American Eels in the Gulf of Mexico <i>Dean Hendrickson</i>	Determining Habitat-Abundance Relationships to Extrapolate Abundance of Harlequin Darters in Northwest Florida <i>Kate Harriger</i>	Predation of Juvenile Paddlefish by Some Piscivorous Fishes Found in North America <i>William Shelton</i>	Demographic Structure Influences How Environmental Forcing Affects Alewife Recruitment in Lake Michigan <i>Tiffany Vidal</i>

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9:20 AM	Using Non-Target Surveys to Assess Health and Population Genetic Structure of Florida's American Eels <i>Kimberly Bonvechio</i>	Development of Techniques for Assessment of Population Characteristics of the Diamond Darter <i>Austin Rizzo</i>	Potential Paddlefish <i>Polyodon spathula</i> Entrainment and Passage in a Regulated Stream <i>Chelsea Gilliland</i>	
9:40 AM	Recruitment of American Eel (<i>Anguilla rostrata</i>) in Northeast Florida <i>Eric Johnson</i>	Conservation Efforts for Yazoo Darter (<i>Etheostoma raneyi</i>), a Headwater Species Endemic to North Mississippi <i>Angeline Rodgers</i>	Use of Innovative Trawling Methods (Butterfly Skimmer and Surface Trawl) for Paddlefish Monitoring <i>Wyatt Doyle</i>	
10:00 AM	BREAK			
Sunday, Feb. 5	Meeting Room 16	Meeting Room 17	Meeting Room 18	Meeting Room 19
	American Eels	Gen Tech Sun AM1-Native Fish <i>Anthony Rodger, Moderator</i>	Gen Tech Sun AM1-Nonnative Fish <i>Nathan Copeland, Moderator</i>	Gen Tech Sun AM1-Stocking and Marking <i>Gene Gilliland, Moderator</i>
10:20 AM	Beginning American Eel Studies in Louisiana and Gulf States <i>Robby Maxwell</i>	Factors Influencing Occupancy of Prairie Chub (<i>Macrhybopsis australis</i>) within the Upper Red River Basin <i>Anthony Rodger</i>	Predation of Invasive White Perch in Sooner Reservoir: A Possible Biological Control <i>Nathan Copeland</i>	Evaluation of Alizarin Red S as a Long-Term Chemical Mark in the Pomoxis Genus <i>Bryant Haley</i>
10:40 AM	Upstream Passage Plan for American Eel at Toledo Bend Hydropower Project, TX-LA, Sabine River <i>Arturo Vale III</i>	Movements and Demography of Blue Sucker in the Lower Colorado River, TX <i>Matthew R. Acre</i>	Catchment Scale Determinants of Nonindigenous Minnow Richness <i>Brandon Peoples</i>	Calcein Marking: A Non-Lethal Batch Marking Option for Stocking Evaluation <i>Greyson Farris</i>

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11:00 AM	American Eel (<i>Anguilla rostrata</i>) in Rivers of the Caribbean Mainland Drainages: Observations from the Watersheds of the La Amistad World Heritage Site (Costa Rica/Panama) <i>William McLarney</i>	Assessment of the Lake Eustis Pupfish <i>Cyprinodon variegatus hubbsi</i> in Florida <i>John Benton</i>	Hydrologic Factors Associated with Detection and Occupancy of Riparian Areas By Asian Swamp Eel in the Chattahoochee River System, Georgia <i>Jeffery Johnson</i>	Post-Stocking Predation of Black Crappie and White Crappie in Arkansas Reservoirs <i>Andrew Porterfield</i>
11:20 AM	Management and Stock Assessment of American Eel on the U.S. East Coast <i>Laura M. Lee</i>	Contributions of Mussels and Fish as Biogeochemical Hotspots <i>Garrett Hopper</i>	Food Habits of Introduced Flathead Catfish in a Chesapeake Bay Tributary <i>Jason Emmel</i>	Advanced Fingerling Largemouth Bass Survival and Contribution to Age-0 Cohort 90 Days Post-Stocking <i>Jeff Buckingham</i>
11:40 AM		Distribution and Community Structure of Fish Species in Large Tributary Streams of the Middle Chattahoochee River, Georgia and Alabama <i>David Belkoski</i>		Historical Environmental Data May Assist in the Determination of Timing of Sampling, Brood Stock Collection, Hatchery Pond Preparation, Plankton Abundance, and Stocking <i>Steve O'Donnell</i>
12:00 PM	ADJOURN			

25724

Resample, Recapture, and Re-Analyze: Using the 3 R's to Resurrect the Scale Method of Estimating Fish Age

Colt T Holley, Andrew T Taylor and James Long

As imperilment of freshwater fishes increases, non-lethal yet reliable age and growth data is becoming more important. Otolith-based age estimation is the current standard, but may not be practical for species or populations of conservation concern. We marked and resampled three populations of Shoal Bass (*Micropterus cataractae*), a fluvial specialist considered vulnerable to extinction, in Georgia over a three-year period. For each of the three populations, we obtained scales at initial capture, implanted a PIT tag, and resampled for two subsequent years, taking scale samples for age estimation from all fish. This process allowed us to compare age estimates against known times-at-large, providing an estimate of accuracy. Additionally, two readers independently estimated age twice for each fish, in conjunction with a concert age-estimation, to provide estimates of bias and precision. Precision was high for fish >3 years old, but variable for individuals ≤2 years old. Concert age-estimation reduced between-reader bias across all age classes. Scales ultimately provided accurate age estimates through 10 years of age, but variance increased for individuals ≥6 years old due to small sample sizes. Our results show promise for this method using scales to obtain accurate, non-lethal age estimates of stream-dwelling centrarchid fishes.

25758

Trends in Abundance of Brown Trout and Brook Trout in an Appalachian Stream

John Odenkirk and Mike Isel

A self-sustaining Brown Trout *Salmo trutta* population was discovered coexisting with Brook Trout *Salvelinus fontinalis* in the Conway River, Madison County, Virginia in 1987. These populations were monitored through 2016 along with a Brook Trout population in the nearby Rapidan River where no Brown Trout were present. Brook Trout biomass in both streams changed little over time and appeared stable but was greater in the Rapidan River (Conway River Brook Trout mean kg/ha=380 [$n=13$; $SD=134$]; Rapidan River Brook Trout mean kg/ha=879 [$n=12$; $SD=440$]). However, Brown Trout numbers in the Conway River increased dramatically from 04 kg/ha in 1987 to 599 kg/ha in 2016 ($r^2=0.59$; $P=0.002$; $n=13$), while proportion of Brown Trout biomass in this stream increased from less than 1% to 56% over the same period ($r^2=0.74$; $P<0.0001$; $n=13$). Assumptions that the increase of a nonnative would occur at the expense of a native coexisting salmonid may not be valid in this case, as potential differences in trophic guild and/or habitat partitioning may allow both species ample access to forage and spawning substrate. Continued monitoring is needed, as Brown Trout biomass may have reached (or could reach) critical levels and begin to impair this Brook Trout fishery.

25775

Spawning Behavior and Habitat Use of Shoal Bass in Two Chattahoochee River Tributaries

Amy Cottrell and Steve Sammons

Officially described as a species in 1999, little is known about Shoal Bass biology. Their native range is limited to the Appalachian-Chattahoochee-Flint River system, and native populations are threatened due to land-use changes, dam implementation, and introduced species. Dams prevent upstream passage and completion of their migratory spawning life stage. Introduced Spotted Bass compete with Shoal Bass for habitat resources. As habitat specialists, rocky shoal substrate used for spawning as well as maintaining the larval nursery is crucial, yet it's a relatively understudied component.

This study occurs within Flat Shoals Creek and Mulberry Creek, two tributaries of the Chattahoochee River in Georgia, where viable, native populations remain. We're using radio telemetry to determine movement patterns and document spawning and nesting behavior for two consecutive years. 20 individuals from each creek were tagged, and tributaries were tracked every two weeks. 15 additional males were tagged in Flat Shoals Creek and are tracked every 3-5 days during spawning season to document nest selection and associated habitat variables. Abundance, daily growth, and hatch-date frequency will be investigated by collecting 50 age-0 fish each July. We hope to use the results to implement effective conservation and management practices as part of the Native Black Bass Initiative (NBBI).

25779

Life History Information of Choctaw Bass *Micropterus Haiaka*, a Newly Described Species of Black Bass

Katie Woodside, Matthew Wegener, Neil Branson and Chris Paxton

The Choctaw Bass *Micropterus haiaka* is a newly discovered species of black bass found in coastal river systems of northwest Florida and southern Alabama. The species was detected when an unidentified genetic profile was revealed in 2007 by a black bass study in the Chipola River, Florida. Morphologically similar to the Spotted Bass *Micropterus punctulatus*, the Choctaw Bass was described as a unique species at the 2013 AFS Black Bass Diversity Symposium. Prior to this study, there was limited life history information specific to this species. Our research examines age, growth, mortality, and diet of Choctaw Bass collected from the Choctawhatchee River and Holmes Creek, a major tributary of the Choctawhatchee River, Florida in fall 2012 and 2013. Diets of Choctaw Bass are similar to other riverine *Micropterus* spp in the East Gulf Coastal Plain although they do differ intraspecifically between rivers. Diets of fish collected from the Choctawhatchee River consisted primarily of fish while diets from fish collected from Holmes Creek consisted primarily of crayfish. Mean total length at age was described by von Bertalanffy growth curves. Choctawhatchee River and Holmes Creek fish exhibited similar growth rates. The oldest Choctaw Bass was age-11 and the longest fish was 418 mm total length.

25780

A Multifaceted Approach to Guadalupe Bass (*Micropterus treculii*) Restoration in a Texas Hill Country River

Stephan Magnelia, Gordon Linam, Ryan McGillicuddy, Ken Saunders, Dijar Lutz-Carrillo, Melissa Parker and Rachael Ranft

The Blanco River is located in a portion of Texas experiencing some of the most rapid urbanization in the United States. Incompatible development, unsustainable water use, unsound vegetation clearing, untenable grazing practices, and non-native invasive species are major stressors on the river's aquatic life. Historically the river was home to the official state fish of Texas, Guadalupe Bass, but was extirpated from the watersheds a result of hybridization with introduced Smallmouth Bass. A restoration project was initiated in summer 2011 when severe drought reduced upper sections of the river to a series of enduring pools, and provided an opportunity to remove Smallmouth Bass upstream of a natural fish passage barrier. Genetically pure Guadalupe Bass were stocked in the restoration area once flows returned. Genetics monitoring in 2014, and in 2015 following a historic flood which breached the fish passage barrier, indicated only pure Guadalupe Bass in the restoration area. While the success of Guadalupe Bass reintroduction efforts were encouraging, stressors affecting the overall health of the system needed to be addressed. The Texas Parks and Wildlife Department and The Nature Conservancy encouraged voluntary collaboration with private landowners, community leaders, government agencies and other non-governmental organizations to improve overall aquatic system function. Such collaborative actions have included riparian workshops, invasive species management, technical guidance visits, riparian plant giveaways, the development of restoration design guidelines for streamside management, and the establishment of conservation demonstration areas.

25781

Evaluation of a 14-in Minimum Length Limit for Smallmouth Bass in the Eleven Point River

Brett Timmons, Jeremy Risley, Casey Cox and Sam Henry

The Eleven Point River is a 138-mile long river running through Southern Missouri and Northern Arkansas. The Eleven Point River originates in Howell County near Willow Springs Missouri and enters Arkansas in Randolph County before converging with the Spring River southwest of Pocahontas Arkansas. The Lower Eleven Point River consists of a 40-mile stretch in northern Arkansas. In 2005, the smallmouth bass minimum length limit (*MLL*) and creel was changed from 305 mm *MLL* and 4-fish creel to a 355 *MLL* and a 2-fish creel. Smallmouth bass were sampled in the fall of 2002 -2004 and again in the fall of 2011-2012. Mean length (\pm SD) for 2002-2004 and 2001-2012 were 2442 ± 697 mm and 2515 ± 721 mm respectively. Mean age for 2002-2004 and 2001-2012 samples were 2 yr and 3 yr respectively. Growth rates for 2002-2004 and 2001-2012 were 0.29 and 0.15, respectively. Years to reach 355mm (14 in) in 2002-2004 and 2001-2012 were 44 yrs and 54 yrs, respectively. Total annual mortality of 2002-2004 and 2001-2012 were 61% and 50%, respectively. Comparisons Evaluation of the *MLL* and daily bag limit produced unclear results.

25784

Genetic Relationships of Largemouth Bass from Different Habitats within Coastal Rivers of Northwest Florida

Matthew Wegener

Coastal rivers provide exceptional freshwater fishing opportunities throughout the southeastern US. Largemouth Bass are a major component of these fisheries and are highly valued by anglers, especially in northwest Florida where few impoundments exist. Like most northern Gulf Coast rivers, salinity levels in the upper Escambia and Yellow Rivers are low but may exceed 13 ppt in the lower, mesohaline section of the river. Recent studies have documented considerable differences in the age and size structure in Largemouth Bass inhabiting riverine habitats versus marsh habitats in these systems. Previous research has shown that there are significant life history differences between Largemouth Bass inhabiting the Mobile Delta estuary versus upriver habitats. However, it was not clear whether these differences were the result of phenotypic plasticity or genetic divergence. We collected genetic samples from both the riverine and marsh habitats in the Escambia and Yellow Rivers in Florida to determine whether individuals from the two habitats existed as a single randomly mating (panmictic) population or not in each system. Analysis of microsatellite DNA genotypes identified significant differences in the allele frequency distributions of samples collected from riverine versus marsh habitats in each river. Both streams were found to be inhabited by intergrade populations that included hybrids between Northern Largemouth Bass and Florida Bass. Fish in the marsh habitats tended to have more Northern Largemouth Bass alleles than fish in riverine habitats in both systems. Together, these findings indicate the bass in the marsh and river habitats do not exist in panmixia, and that Northern Largemouth Bass genes are more abundant among fish in the marsh than in the river. It is possible that environmental differences between the river and estuarine habitats have led to divergent selection and limited mating between subpopulations within the same river system. Northern Largemouth Bass genes may confer greater fitness than Florida Bass genes in estuarine environments of the northern Gulf Coast, which could explain their greater abundance in these unique habitats.

25785

First Year Survival and Dispersal of Neosho Smallmouth Bass

Shannon K Brewer, Jim Burroughs, Brandon Brown, Robert Mollenhauer, Anthony Rodger and Matt Skoog

Limited information is available on the first year survival and dispersal patterns of stream fishes, especially for genetically-distinct sportfish populations such as Neosho Smallmouth Bass *Micropterus dolomieu velox*. We

measured survival and dispersal of young -of-year Neosho Smallmouth Bass in two Ozark streams during summer 2013 and we examined annual abundance changes from 2012-2016 Mortality over the first growing season in 2013 was determined via snorkel surveys beginning at nest dispersal and continuing bi-weekly through early October Beginning and end of growing season abundance estimates were approximately 17,000 and 600 fish per kilometer in Buffalo Creek and 43,000 and 250 fish per kilometer in Spring Creek Survival from the time fry dispersed the nest until early October was 340% and 056%, respectively for the two streams As expected, abundance estimates were much greater in the spawning channel unit, particularly pools, during the first several weeks following dispersal from the nest Abundances increased in runs, backwaters, and slow riffles as fish grew and overall abundances declined over the summer We observed differential use of low velocity off-channel habitats when discharge increased during particular sampling periods Annual differences in end-of-year recruitment were related to several flow metrics during the spawning season This study suggests habitats perceived as unimportant to Smallmouth Bass may be very important to first-year survival during elevated discharge conditions

25787

Post-Stocking Predation of Black Crappie and White Crappie in Arkansas Reservoirs

Andrew Porterfield and John R Jackson

Supplemental stocking has been widely used by state agencies as a management tool for White Crappie *Pomoxis annularis* and Black Crappie *P nigromaculatus* While previous studies have quantified contribution of stocked crappie to wild populations, little information exists on factors that impact survival of stocked crappie Our goal was to evaluate post-stocking mortality due to predation and changes in spatiotemporal predator relative abundance Seven medium-sized (113-223 ha) reservoirs throughout Arkansas were stocked once at a single location during November or December 2015 Three reservoirs were stocked with Black Crappie and four reservoirs were stocked with White Crappie Fish were marked with calcein in the hatchery and were identified with a BlueStar light Each reservoir was sampled once 13-23 days prior to stocking, once 4-8 hours post-stocking, and once 10-14 days post-stocking using a boat-mounted electrofisher at night Four consecutive 200 m shoreline segments on both sides of the stocking point were sampled All observed predation losses occurred the night of stocking with Largemouth Bass *Micropterus salmoides* and Spotted Bass *M punctulatus* accounting for all but three occurrences Estimated predation losses ranged from 0-5% across the reservoirs Of the bass with crappie in their stomachs, 79% were collected within 200 m of the stocking point Frequency of bass in this section that had consumed crappie ranged from 0-100% across the reservoirs Analysis of bass CPUE data revealed no significant interaction between sample date and shoreline segment, indicating that stocking events did not influence predator movement beyond 200 m

25792

Success, Failure, or Somewhere in Between: Assessing Genetic Restoration of an Endemic Black Bass Population

Nate Smith and Paul Fleming

From 1992 to 2010, Texas Parks and Wildlife Department undertook a long-term stocking program with the aim of restoring the genetic integrity of Guadalupe Bass *Micropterus treculii* in the headwater streams of its namesake river At completion of the program, hybridization with the introduced Smallmouth Bass *M dolomieu* was significantly reduced throughout the study area (From 20 - 100% in the 1990s to 0 - 242% upon cessation of stocking) However, the future stability of the population's genome was uncertain due to persistence of hybrids in the system and variable genetic trends observed in other hybridized populations Now, seven years since the cessation of stocking, three follow-up genetic surveys have been conducted We observed an initial, dramatic increase in hybridization rates one year post stocking in three of the four study stream segments Since then, trends in hybridization rates have been variable among stream segments These data suggest that variable biological and ecological factors among stream segments may affect survival and

reproductive behavior, ultimately structuring the population's genome These results are important for guiding current and future restoration efforts in other streams within its historic range and may help guide similar restoration efforts for other hybridized centrarchids

25799

The Decline of a Fluvial Fish: Species Distribution Models in a Fragmented Riverscape

Andrew T Taylor and James Long

The diverse fluvial fish fauna of the southeastern US faces increasing imperilment, yet contributing factors are often poorly understood or confounded The fluvial-specialist Shoal Bass (*Micropterus cataractae*) has experienced continual declines within its narrow native range, and fragmentation may drive localized range loss Our objective was to identify landscape and riverscape factors contributing recent range losses of the Shoal Bass We developed presence-only species distribution models (SDMs) in Maxent reflecting two distributions: 1) the potential distribution based on natural landscape factors and, 2) the currently restricted distribution based on natural landscape factors as well as presence of non-native congeners, land use, and three different intensities of riverscape fragmentation SDMs had strong predictive performance, as receiver operating characteristic (ROC) area under the curve (AUC) values averaged 0.87–0.94 and 10-fold cross-validation omission rates averaged 0.01–0.03 Results revealed that Shoal Bass potentially occurred throughout most of the larger streams within their native range; however, current restricted SDMs indicated 14%–36% range loss from the potential distribution based on stream segment lengths, with range loss increasing with fragmentation intensity Also as fragmentation intensity increased, the response curves relating presence of non-native congeners to presence of Shoal Bass went from a 1:1 linear trend to a curvilinear response indicating negative effects to presence of Shoal Bass at non-native congener probability of presence ≥ 0.75 Variable contributions suggested that variables like presence of non-native congeners, percent forest cover within 300-m stream buffers, and free-flowing fragment length were important in estimating the restricted range of the Shoal Bass; thus, response curves of these variables should help guide future Shoal Bass conservation efforts Applying similar SDM approaches for other imperiled fluvial fishes should facilitate large-scale predictive conservation planning

25802

Using Non-Target Surveys to Assess Health and Population Genetic Structure of Florida's American Eels

Kimberly Bonvechio, Andy Strickland, Cheree Steward, Justin Hill, Brandon Barthel, PhD and Jessica Carroll

The American Eel stock has been determined by the Atlantic States Marine Fisheries Commission to be in a state of decline Implicated in this decline are factors such as habitat loss and degradation, hydroelectric turbine mortality, commercial harvest, climate change, and disease From February 2014 to May 2016, Florida Fish and Wildlife Conservation Commission researchers teamed up with fisheries projects to gather information about Florida's American Eels Biological, age, condition, and *Anguillicoides crassus* parasite infection data were obtained for 609 American Eels collected from 72 systems throughout every region of the state Combined, specimens ranged from elver- to silver-stage, 0 to 12 years old (freshwater age), and 13 to 80 cm in total length Active parasite infection rates and health indices varied by region and season, although additional efforts are needed to increase sample size for some regions Genetic fin clip samples were also obtained from fish in the Apalachicola River, which empties into the Gulf of Mexico, and St Johns River, which empties into the Atlantic Ocean, to compare population structure between the two coasts We present the full study results and how these data will be used to direct future research and conservation efforts of American Eel in Florida

25803

Smallmouth Bass Fishing in Missouri: Results from the 2011 Angler Survey

Rick Horton

Abstract: In 2011 a mail survey was sent to Missouri resident anglers who reported they had fished for or caught Smallmouth Bass, asking their opinions and to report their 2010 stream Smallmouth Bass fishing activities Eighty-two percent of anglers typically fished for Smallmouth Bass Wade/bank fishing was the most often used method, followed by float fishing Designated public accesses were heavily used by anglers Responding anglers took an average of 102 trips in 2010 and caught an average of 71 and harvested 19 Smallmouth Bass per trip The statewide harvest rate for Smallmouth Bass was 318% Anglers knew Stream Black Bass Special Management Areas (SBBSMA) existed (864%); however, only 123% reportedly fished them in 2010 and reported 10,524 fishing trips Anglers that fished at least one SBBSMA in 2010 reported catching more Smallmouth Bass per trip than anglers who did not Few anglers indicated that they avoided fishing in SBBSMA because of the more restrictive harvest regulations Anglers were about evenly split in preferring a single statewide regulation (368%), or a system with statewide regulations and SBBSMA (359%) Anglers preferred the existing 12" minimum length limit (378%), while others preferred a length limit of 14" (188%) or 15" (233%)

25806

Harvest Evaluation of Smallmouth Bass from Selected Ozark Streams

Rick Horton

Abstract: To assess angler harvest and potential effects of more restrictive harvest regulations for smallmouth bass, 3,027 fish were tagged with reward tags at six sites on five Ozark streams Growth, exploitation, and mortality estimates were calculated for each site Predicted population responses to higher length limits were simulated using Fishery Analysis and Modeling Simulator (FAMS) software Annual exploitation ranged between 5 and 26% Overall growth rates were relatively slow, as mean time to reach 12 inches was 49 years and mean time to reach 15 inches was 78 years Total annual mortality estimates ranged from 37 to 55% Annual natural mortality estimates ranged from 13 to 33% Predicted responses to higher length limits varied considerably Simulations of 18-inch length limits drastically reduced yield and were not considered further Simulations of 14- and 15-inch length limits predicted increases in the number of larger smallmouth bass However, increases at five of the six sites were predicted to be very small Predicted changes at the Current River-Powder Mill site were substantial Simulation results indicated that a 15-inch length limit at the Current River-Powder Mill site would not only increase the number of fish greater than 15 inches, but it would also increase the pounds of fish anglers harvest Under current conditions and regulations, fish at this site are not reaching their full growth potential, a condition called growth overfishing Simulations of the remaining five populations indicated no potential for growth overfishing under current conditions and regulations We recommend engaging stakeholders to determine angler acceptance of increasing the minimum length limit from 12 to 15 inches at the Powder Mill site on the Current River We recommend making no changes at the remaining five sites

25807

Applications of Emerging Fisheries Techniques for Paddlefish

Greg Whitledge, Wyatt Doyle, James Long, Ben Neely and Jason D Schooley

Recent advances in fisheries techniques have provided insights into distribution, abundance, habitat use, and life history for several fish species However, applications of many emerging fisheries techniques to American paddlefish (*Polyodon spathula*) have been limited to date We highlight both recent and potential applications of some new, promising techniques for assessing paddlefish populations, including: hard-part chemistry for identifying sources of recruits (both wild and stocked fish) and reconstructing environmental history of individual fish, advances in sonar technology for habitat mapping and abundance estimation, novel gears for

sampling early life stages, and development of eDNA as a detection tool where traditional fisheries gears are insufficient We also identify potential impediments to applications of these techniques and recommend steps needed to further assess and enhance their applicability to paddlefish management and conservation

25808

Current Status and Distribution of the Strawberry Darter in the Tributaries and Main Stem of the Strawberry River Drainage

Kyler Hecke and Steve Lochmann

The Strawberry Darter *Etheostoma fragi* is endemic to the Strawberry River drainage and was recently elevated to the species level A status survey was conducted during the summers of 2015 and 2016 Sixty-four (32 each summer) sites were sampled within the Strawberry River drainage, 32 on the main stem and 32 on tributaries Sites were surveyed 4 times each throughout each summer using a kick-seine A total of 236 *E fragi* were observed during both summers *E fragi* were observed at 24 of 64 sites, including 15 tributary sites and 9 main stem sites Data was analyzed using the software Presence, which estimates occupancy rate and probability of detection A drainage-wide occupancy rate was estimated to be (mean \pm standard error) 041 \pm 006 and a probability of detection was estimated to be 056 \pm 006 Site-type (main stem or tributary) was used in a second model, where an occupancy of 030 \pm 009 and a probability of detection of 049 \pm 009 were estimated for main stem sites At tributary sites, an occupancy of 048 \pm 009 and a probability of detection of 063 \pm 007 were estimated Occupancy rate appears to be higher in tributaries than the main stem Compared to an occupancy rate based on historical data (077 \pm 011), the current occupancy (041 \pm 006) of sites appears to be lower This data can now be used to determine what conservation measures should be taken to preserve this species

25812

Exploring Constituent Use and Understanding of a Regulations Publication through Focus Group Conversations

Corey A Jager

The Oklahoma Department of Wildlife Conservation (ODWC) publishes the Oklahoma Hunting and Fishing Regulations Booklet each year to provide the public with the Department's interpretation of Oklahoma's hunting and fishing laws Recent content, design and format changes to the Booklet triggered a need to evaluate the Booklet and ensure it remained an effective medium for relaying Oklahoma's hunting and fishing laws to the public ODWC employees organized focus groups to evaluate the Hunting and Fishing Regulations Booklet Nine focus groups—four angler and five hunter groups—were conducted during July and August 2016 The focus groups were distributed geographically to cover five regions of the state Focus groups allowed ODWC employees to discover hunter and angler perspectives and understanding of the Regulations Booklet, as well as hear recommendations for improving the Booklet Specifically, we learned of several Booklet features that were distracting hunters and anglers from critical regulations content Discussions revealed that new rule changes were often overlooked, despite design features that aimed to highlight these changes Conversations also focused in on the Booklet cover, suggesting it appeared more like a magazine than a document with critical information The focus group findings provided information that allowed ODWC staff to identify and prioritize improvements to the Oklahoma Hunting and Fishing Regulations Booklet to aid hunter and angler awareness and understanding of laws Beyond the feedback that was provided, the process of conducting focus groups with hunters and anglers promoted positive and inclusive engagement between the ODWC employees and its constituents

25813

Sociodemographic and Economic Characteristics of Black Bass Anglers Participating in Different Tournament Types on Lake Guntersville, Alabama

Mike Maceina, Patrick Snellings, Terry Hanson, Diane Hite and Steve Sammons

We described sociodemographics and expenditures of black bass *Micropterus* spp anglers participating in eight different tournament types on Lake Guntersville, Alabama. In 2013, we estimated 9,035 anglers fished in 259 tournaments. Anglers primarily were middle-upper aged, Caucasian males, with an annual household income of over US\$75,000, and who participated in tournaments for over 15 years. Fishing quality experience (poor to excellent) was positively related to the number of fish weighed-in. Differences in tournament types among anglers were related to travel distance, expenditures, non-Caucasian participants, resident location, number of times fishing on Lake Guntersville, entry fees, and club membership. Anglers spent US\$45 million (average about US\$500 per tournament for each angler) that generated US\$208,000 in tax revenue over a one-year period. However, expenditures varied by over an order of magnitude among different tournament types. Discrimination of unique tournament types was an important variable in understanding the complex sociodemographic and economic aspects of competitive black bass tournaments.

25818

How Much Harvest Can Trophy Catfish Tolerate: Examining Effects of Hand Fishing

Kristopher Bodine, J Warren Schlechte, Richard Ott Jr, Daniel Bennett and Jake Norman

The legalization of hand fishing in Texas prompted concern for the potential overharvest of catfish. Large (≥ 600 mm) Flathead Catfish *Pylodictis olivaris* are thought to be vulnerable to this angling method, and the potential effects of selectively harvesting large fish are not well understood. In April 2013 we used reward tags to quantify size- and gear-specific exploitation of Flathead Catfish in Lake Palestine, Texas. We tagged 255 fish within three size-groups (457–599, 600–761, and ≥ 762 mm). We also quantified abundance, mortality (total and natural), and growth. Using these dynamic rates, we modeled the effects of exploitation (particularly of size-groups targeted by hand fishing) on the Flathead Catfish population. Observed exploitation was low (32%), and size-specific harvest was less than 5% for all size-groups. Trotlines and hand fishing accounted for 100% of observed harvest (50% for each gear). Our models indicated that maximum sustainable yield would be achieved at 10% to 15% exploitation. Recruitment overfishing and growth overfishing were evident at about 15% to 20% exploitation. When we simulated increased exploitation by hand fishers only (achieved by only increasing exploitation of fish ≥ 762 mm), recruitment overfishing was not evident until 55% exploitation, and growth overfishing never occurred. These results indicate that the current low harvest by hand fishers, and any targeted harvest of fish > 762 mm (regardless of fishing gear), will have little impact on yield or size structure of Flathead Catfish. In most scenarios, the current 457-mm minimum length limit can maintain a sustainable fishery. Undoubtedly, any additional harvest of trophy fish (≥ 762 mm) will reduce trophy fish abundance; however, exploitation of trophy fish (alone) would need to exceed 55% before populations become unsustainable.

25823

Lessons Learned from E-Tournaments in Florida

Allen Martin

Florida Fish and Wildlife Conservation Commission (FWC) staff has worked with bass clubs to introduce the idea of conducting electronic tournaments (e-tournaments) as an alternative to traditional bass tournaments. E-tournaments allow for fish to be weighed and released immediately after being caught rather than being held in a live well and then hauled to weigh-in scales and back to the water. Additionally, e-tournaments would allow bass clubs to have different tournament rules such as counting the weight of all fish caught regardless of size and bag limits.

In 2011, FWC assisted two bass clubs with e-tournaments by attending their tournament and providing kits that included cameras, scales, and data sheets Both events went well, but some obstacles were identified such as technological difficulties and angler trust Most anglers who participated agreed that e-tournaments could be a good format for certain situations, but they were reluctant to switch to an e-tournament format for most tournaments FWC has continued to work with bass clubs and other organizations to minimize the impacts of tournaments on fisheries resources

25824

Stakeholder Driven Process to Update Florida Largemouth Bass Regulations

Allen Martin

Florida Fish and Wildlife Conservation Commission (FWC) staff worked with stakeholders to draft a Black Bass Management Plan (BBMP) in 2010 to guide bass management in the state for the next 20 years Following through with implementation of the BBMP, FWC staff began a review of statewide black bass regulations in 2012

The black bass regulations review process involved extensive stakeholder engagement from the beginning of the process Once initial human dimensions and biological data were collected, the sociological data factored into the decision to change regulations as much or more than the biological data Initial stakeholder involvement was via an electronic survey, a mail-in survey, and open house events Once this data was combined with biological data and regulation changes were proposed, a second round of stakeholder engagement, including surveys and public meetings, was conducted to determine stakeholder support for the proposed changes The data collected from the second round of stakeholder engagement indicated support for the regulation changes and identified areas where angler education was needed A 10 year evaluation of the regulation changes will evaluate the success of the new regulations Like the review process, the evaluation will include both a biological and human dimensions component

25828

Attachment Site Selection and Size-Selectivity of Chestnut Lampreys (*Ichthyomyzon castaneus*) on Rainbow Trout (*Oncorhynchus mykiss*) in Hatchery Raceways in Arkansas

Jeremiah Salinger

In North America, the invasive sea lamprey (*Petromyzon marinus*) has been well-studied due to its high ecological impact at the expense of parasitic lampreys native to the continent The present study attempts to bridge some of that knowledge gap by examining attachment site selection and size-selectivity of the native chestnut lamprey (*Ichthyomyzon castaneus*) on rainbow trout (*Oncorhynchus mykiss*) in a hatchery setting Data were analyzed using a Fisher's exact test and one-tailed relativized t-tests in R v302 Attachment site selection was found to be non-random, with 95% of attachments being dorsal Data for attachment site selection are consistent with those of previous studies of chestnut, western river (*Lampetra ayresii*), Arctic (*Lethenteron camtschaticum*), and European river (*L. fluviatilis*) lampreys, and inconsistent with data from studies of sea, silver (*I. unicuspis*), and Pacific lampreys (*Entosphenus tridentatus*) Chestnut lampreys in this setting were found to be negatively size-selective for host standard length and non-selective for host mass These findings are largely inconsistent with those of previous studies of size-selectivity by parasitic lampreys Avian and/or piscine predation pressure on lampreys may influence attachment site selection, and merits further study Further research into attachment site selection by this species should be done in a field setting, and additionally examine the effect of host species on attachment site selection The negative selectivity exhibited by the chestnut lampreys in this study may be explained by a trade-off between risk of bodily harm to the lamprey from collision with abrasive substrates and maximizing blood meal intake from a host

25829

Calcein Marking: A Non-Lethal Batch Marking Option for Stocking Evaluation

Greyson Farris and Steve Lochmann

Chemical marking provides a mechanism for identifying hatchery fish in stocking programs. Calcein has advantages over other chemicals. We examined salinities for the osmotic induction of White Crappie and Black Crappie. Experiments consisted of a 35-min immersion of five fish in 1 L of solution at salinities ranging from <1 to 50 ppt. Immediate and 24-h mortalities were 0% and 0–13%, respectively for Black Crappie. Similarly, immediate and 24-h mortalities were 0% and 0–27%, respectively for White Crappie. We examined dunking density (kg of fish/L) to maximize efficiency during the marking process. Fish were confined at densities ranging from 0.016–0.250 kg/L in 1 L of water for 7 min. Immediate and 24-h mortalities were 0% and 0–3%, respectively for Black Crappie and 4–23% and 8–23%, respectively for White Crappie. Ninety-six thousand Black Crappie and eighty-six thousand White Crappie were calcein marked during fall 2015 at 40 ppt and 0.25 kg/L. The process took between 7 and 10 h to mark each species. Twenty-four-hour survival of Calcein-marked Black Crappie and White Crappie was 99.5% and 99.6%, respectively. Our calcein marking process is scalable and could be used by natural resource agencies.

25835

Demographic Structure Influences How Environmental Forcing Affects Alewife Recruitment in Lake Michigan

Tiffany Vidal, Brian Irwin and Charles P Madenjian, PhD

Population declines can have broad reaching effects in terms of ecosystem dynamics, conservation efforts, and stakeholder interests. The ability to disentangle the influence of extrinsic sources of mortality from internal dynamics on population fluctuations remains challenging. We were interested in whether recruitment variability was related to the population's age structure, specifically through interactions with the environment. We used time series analysis to investigate whether predation pressure on Alewife *Alosa pseudoharengus* in Lake Michigan would be capable of altering the population's vulnerability to environmental variability. Alewife are an important prey fish for salmonids, which support valuable recreational fisheries. In recent years, reduced Alewife abundance appears to be the norm, yet recruitment success has been highly variable. We hypothesized that age-truncation, resulting from strong predation pressure has reduced the Alewife population's buffering capacity against changing environmental conditions. We show that internal population cycles have been altered with the contraction of the reproducing age classes, which subsequently has resulted in the population tracking environmental variability more closely. Our results suggest that Alewife recruitment is more sensitive to environmental conditions when the dynamics of internal and external forces operate at a similar frequency. An improved understanding of how demography influences population-level responses to environmental conditions has important implications for management of fisheries resources.

25836

Evaluation of a Slot Length Limit on Rainbow Trout in Lake Taneycomo, Missouri

Shane C Bush

Lake Taneycomo was built in 1913 and is Missouri's oldest hydroelectric reservoir. The lake is riverine in nature, 22 miles in length and encompasses 2,080 surface acres. Prior to 1958, Lake Taneycomo supported one of Missouri's best warm-water fisheries. This changed in 1958 when Table Rock Dam, located in the headwater of Lake Taneycomo, began discharging cold hypolimnetic water into Lake Taneycomo. The discharge of cold water changed Lake Taneycomo into a cold-water environment, providing optimal conditions for trout. Rainbow trout were first stocked into Lake Taneycomo in 1958 and brown trout were first stocked in 1980. At present day, 700,000 rainbow trout and 10,000 brown trout are stocked into the lake annually. Lake

Taneycomo is Missouri's largest and most popular trout fishery. It annually receives in excess of 135,000 fishing trips and anglers catch an estimated 600,000 trout annually.

By the late 1960s, largely through the introduction of *Gammarus pseudolimnaeus*, rainbow trout were exhibiting growth rates up to 0.7 inch per month. Large rainbow trout were abundant, and the lake quickly earned a national reputation for producing trophy rainbow trout. By 1986, the *G. pseudolimnaeus* population had declined by approximately 90% and few rainbow trout larger than stocking size were present. This decline was thought to be due to a complex set of factors including high trout stocking rates, low dissolved oxygen, siltation due to development in the watershed, increased abundance of white suckers, and gravel removal. In addition, high angler harvest rates were inhibiting the growth of the stocked rainbow trout.

On March 1, 1997, a 12 to 20-inch slot length limit on rainbow trout and an "artificial lures" only restriction in the upper three miles of Lake Taneycomo was implemented. This regulation was intended to protect a portion of the rainbow trout population from harvest, while allowing for harvest of small rainbow trout that might emigrate into the special regulations area from heavily-stocked areas downstream. Since these regulations were implemented in 1997, the rainbow trout population has increased 10-fold. It is evident that these regulations have had a positive impact on both electrofishing and angler catch rates, as well as the size structure of rainbow trout lakewide.

25840

Assessing Changes in Participation of Fishing Trips By Target Species in Alabama

Jessica Quintana and Wayde Morse

Understanding changes in angler participation is critical to recreational fisheries management. Using angler surveys to identify factors that influence participation, managers can evaluate changes in management before implementation and understand how those changes might impact angler participation and frequency of visitation to a certain waterbody. Using responses from a state-wide angler survey in Alabama, conducted in 2014, we developed demand curves to demonstrate the number of additional trips in response to increased catch rates. This study identified differences in fishing preferences and participation among anglers that targeted four common freshwater species. Angler participation was shown to vary among targeted species as catch rates were increased. Bass anglers indicated, if it were possible to double the amount of fish they currently caught on a fishing trip, they would take the most additional trips per year; whereas crappie anglers indicated taking the least. Crappie anglers, however, indicated catching double that of bass anglers per trip, which helps to explain the difference in additional trips. Positive trends in additional trips and related expenditures were present for all anglers with diminishing returns as more fish are caught. Using these results, managers can evaluate ways to help increase catch rates of certain species and understand angler responses to those changes.

25842

Upstream Passage Plan for American Eel *Anguilla rostrata* at Toledo Bend Hydropower Project, TX-LA, Sabine River, Gulf of Mexico

Arturo Vale III and Kevin Mayes

The American Eel *Anguilla rostrata* is a catadromous fish that spawns in the Sargasso Sea, migrates to coastal and freshwater habitats of North, Central, and South America to grow and mature, then migrates back to the ocean to spawn. Concerns regarding the status of American Eel exist throughout the species' range due to a decline in eel abundance and distribution. This decline is attributed to many factors, including unsustainable harvest, pollution, migration barriers, disease, and changing oceanic conditions associated with climate change. In 2014, the Federal Energy Regulatory Commission issued a license to the Sabine River

Authority for the continued operation of the Toledo Bend Hydropower Project on the Sabine River, Texas and Louisiana Included in this license is a condition to pass American Eel upstream of the project dam This presentation will discuss the Toledo Bend Hydropower Project and review the hydropower licensing process The presentation will also detail the upstream passage plan for American Eel at Toledo Bend; including, plan development and operational details, upstream passage devices, and measures of success A brief review of other passage projects that could support American Eel migration in the Gulf of Mexico will also be provided

25843

Creel Surveying the Blue River: Challenges and Approach

Matt Gamble

The Blue River serves as a wintertime (seasonal) trout fishery in South Central Oklahoma The Oklahoma Department of Wildlife Conservation (ODWC) conducted a creel survey on the Blue River during the 2014-2015 and 2015-2016 trout seasons The goal of the survey was to collect data related to angler success, angler satisfaction, harvest size and various demographic information This survey presented numerous challenges that resulted in unique adaptations to the traditional creel route Two different methods were used and will be discussed (in person interviews and drop cards) We will look at the statistical comparisons between the methods and the implications of these results for future surveys

25844

Paddlefish (*Polyodon spathula*) in Europe: An Aquaculture Species and a Potential Invader

Ivan Jaric, Paolo Bronzi, Gorcin Cvijanovic, Mirjana Lenhardt, Marija Smederevac-Lalic and Joern Gessner

Paddlefish (*Polyodon spathula*) was first introduced to Europe in 1974, when hatched larvae were imported from Missouri to the former USSR Over the following decades, paddlefish was introduced in aquaculture in additional countries throughout Europe, such as Romania, Bulgaria, Hungary, Austria and Germany Main motivation behind its introduction was the potential for rearing in polyculture in natural ponds, as well as in large temperate reservoirs due to its planktivorous feeding Additional drivers were its fast growth, potentially high value of its meat and caviar, and the marketing of live specimens for ornamental purposes However, there is a lack of data on current paddlefish aquaculture status and trends in Europe Furthermore, while there are numerous reports on intentional and unintentional paddlefish introductions across Europe, the actual level of paddlefish naturalization and establishment in the wild, its invasive potential and negative impacts all remain largely uncertain To overcome such data gaps, we reviewed the available literature and conducted a survey among scientists, aquaculture producers and other stakeholders potentially involved in paddlefish as an aquaculture species and potential invader, in order to evaluate its current status in Europe Based on the results obtained, we discuss the potential and main challenges in European paddlefish aquaculture development, and analyze paddlefish invasive potential and risks associated with its naturalization

25845

Predation of Invasive White Perch in Sooner Reservoir: A Possible Biological Control

Nathan Copeland, Ashley Nealis and Bill Wentroth

White perch, *Morone americana*, were first documented in Sooner Reservoir in 2006 by the Oklahoma Department of Wildlife Conservation (ODWC) and the species has been deemed a nonindigenous aquatic species in Oklahoma, due to the impact the species has on the established fishery Previous studies have shown that white perch impact sport fish age-0 year classes and recruitment through competition and predation The catch rate trends for largemouth bass, *Micropterus salmoides*; white bass, *Morone chrysops*; channel catfish, *Ictalurus punctatus*; and hybrid striped bass, *Morone saxatilis* x *M chrysops*, have decreased

as the catch rates of white perch have increased since 2007 In 2011, ODWC began to stock saugeye, *Sander vitreus* x *S Canadensis*, in Sooner Reservoir as a possible answer to the increasing abundance of white perch Diet samples were collected from saugeye, largemouth bass, hybrid striped bass, channel catfish, and blue catfish, *I furcatus*, via monthly electrofishing and gill net samples Diet analysis showed that saugeye consumed the highest number of white perch and ranked highest in foraging success for white perch The size of white perch identified in saugeye diets ranged from 20mm to 98mm and the mean was 55mm A Dunn's multiple comparison was used to test the foraging success of saugeye, hybrid striped bass, and largemouth bass The white perch foraging success for saugeye was significantly different than the foraging success for hybrid striped bass (Adj p-value 00003) and largemouth bass (Adj p-value 0004), but we were unable to detect a significant difference between saugeye length groups

25846

Fishes of a Heavy Metal Contaminated Stream (Tar Creek, Ottawa County, Oklahoma) after Operation of a Passive Treatment System

William Matthews, Robert Nairn, Nick Shepherd, Zachery Zbinden and Aaron Geheber

Mining in the Tri-State Mining District of Oklahoma, Kansas, and Missouri from 1891 to 1971 resulted in massive excavation of huge underground rooms, and extraction of many millions of tons of lead and zinc, amounting to 26% of the total production of these metals for the US After cessation of mining operations, these huge caverns slowly filled with water, until artesian pressure resulted in extrusion of heavily contaminated waters to the surface through bore holes or other exit points Fishes in the Tar Creek watershed, Ottawa County, Oklahoma, have been heavily impacted by this heavy metal contamination such that in some natural stream channels only extremely hardy Western Mosquitofish and a few Green Sunfish survived From 2004 to 2007 we monitored fishes in an Unnamed Tributary (UT) to Tar Creek, Tar Creek proper, and uncontaminated control sites In 2008, a series of passive treatment ponds was installed to treat the contaminated water and remove or reduce heavy metals The passive treatment system decreased concentrations of iron, zinc, lead, cadmium and arsenic by more than 96% and produced an effluent meeting hardness-adjusted, in-stream water quality criteria From 2009 through our most recent samples in 2016 there has been marked improvement of the fish community at sites within the UT to Tar Creek, apparently as a result of the improved water quality provided by the passive treatment system

25847

American Eel (*Anguilla rostrata*) in Rivers of the Caribbean Mainland Drainages: Observations from the Watersheds of the La Amistad World Heritage Site (Costa Rica/Panama)

William McLarney

The least studied portion of the global population of American eel (*Anguilla rostrata*) is undoubtedly that using rivers which flow into the Caribbean from the Mesoamerican mainland, extending over approximately 7,400 km of coastline shared among 9 countries, between the Yucatan Peninsula of Mexico and the mouth of the Rio Orinoco in Venezuela Within this range, during 2001-2016 the Stream Biomonitoring Program of ANAI, active in the Caribbean slope watersheds draining the 15 million hectare La Amistad World Heritage Site in Costa Rica and Panama, documented 414 *A rostrata* occurrences from the Rio Estrella and Rio Sixaola/Telire watersheds, plus a suite of smaller coastal watersheds This amounts to over half of all *A rostrata* records from the mainland Caribbean watersheds, and includes all sizes from partially pigmented juveniles to extremely large adults We find by far the highest numbers of eels in the short rivers of small coastal watersheds with an altitudinal range of less than 200 m However, the largest individuals we have taken are from inland sites on large rivers at up to 300 m altitude As both a diadrome and an IUCN listed Endangered species, *A rostrata* plays an important role in our effort to protect the rivers of La Amistad from construction of large hydro dams We are sharing this research and conservation program with 4 indigenous ethnias whose territories lie directly downstream of the World Heritage Site

25848

Distribution and Community Structure of Fish Species in Large Tributary Streams of the Middle
Chattahoochee River, Georgia and Alabama

David Belkoski and Steven Sammons

We sampled 18 large tributaries of the Chattahoochee River in Alabama and Georgia from Atlanta to Columbus in 2014-2015 to determine species assemblages and community structure. These streams ranged from 3rd to 5th order, with drainages varying from 117 to 991 km². Fish were sampled using 12-20 quadrats from 2-4 areas within each stream. Over the course of the project, more than 5,500 fish were collected, representing 12 families, and number of species collected in each stream ranged from 10-27. Blacktail Shiner *Cyprinella venusta*, Alabama Hogsucker *Hypentelium etowanum*, Redbreast Sunfish *Lepomis auritus*, and Blackbanded Darter *Percina nigrofasciata* were generally the most numerous species in each stream above West Point Reservoir, with Bluefin Stoneroller *Campostoma pauciradii* also locally abundant in some samples. Alabama Hogsucker was less abundant in streams below West Point Reservoir, but abundance of the other three species followed similar patterns to those observed in the streams above the reservoir. Abundance and prevalence of Weed Shiner *Notropis texanus* was higher in streams below West Point Reservoir than in those above it. Cyprinids composed a larger proportion of the fish community in streams above West Point than those below, and average composition of centrarchids was 55% higher in streams below the reservoir compared to those above it. Suckers and catfish composed <10% of the fish community in each stream above and below the reservoir. Diversity indices indicated that species assemblages in these streams were relatively diverse, with no evident upstream or downstream gradient. Neither in-stream habitat nor land use patterns were correlated with measures of diversity, species richness, or evenness. Quadrats appeared to be an adequate means to sample these streams and we were able to collect 95% of the species found with a minimum of 12 samples.

25850

Food Web Structure and Contaminant Trophodynamics of an Atlantic Drainage Large River System

Tiffany N Penland, Casey A Grieshaber, Thomas J Kwak, PhD, W Gregory Cope, Forrest W Sessions and Ryan Heise

Persistent and bioaccumulative contaminants often reach concentrations that adversely impact aquatic life and consumers. We conducted intensive sampling at five sites along the Yadkin-Pee Dee River of North Carolina and South Carolina. Sampling sites spanned a range of diverse physical characteristics, land uses, and influx of point- and nonpoint-source pollution that facilitated longitudinal examination. The objectives of this research were to determine the aquatic food web structure and trophic transfer and accumulation of contaminants within a riverine food web. Major food web components and pathways were determined by stable isotope ratios of representative producers, consumers, and organic matter. Contaminant analyses performed on biotic and abiotic samples revealed that organic and inorganic contaminants were prevalent, including several of ecological and human health concern. Total polychlorinated biphenyls (PCBs) were detected in 32% of biotic samples (mean 0.24 ppm, range 0.01 - 3.33 ppm); total DDTs (a legacy organochlorine pesticide and its metabolites) were detected in 90% (mean 0.014 ppm, range 0.0004 - 0.29 ppm), perfluorooctane sulfonate (PFOS), an emerging global pollutant used in stain resistant fabrics, was detected in 67% (mean 0.032 ppm, range 0.0002 - 0.34 ppm), and mercury was detected in 99% (mean 0.19 ppm, range 0.006 - 1.17 ppm). Our results identify basal resources that support consumers and contaminant pathways and accumulation through the riverine food web, potentially threatening the health of fish and other biota.

25854

Fish Assemblages Associated with Cover in the Mudflats of a Reservoir

Hunter Hatcher, Giancarlo Coppola, Leandro E Miranda, Michael Colvin and Marcus Lashley

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 (eg, 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.

25858

Artificial Propagation of Paddlefish: Contemporary Status

William Shelton, Steven Mims, Kenneth Semmens and Rafael Cuevas-Uribe

Detailed knowledge of the life history of paddlefish is a relatively recent scientific chapter. The foundation was established in Missouri, where there was a significant sport fishery for paddlefish; observations on natural spawning and subsequent techniques for artificial propagation were developed there. Building on this program, in the late 1970's we began a different trajectory, one focusing on aquaculture; it continued over the next three and one-half decades. Managed reproduction through artificial propagation, nursing of juveniles and grow-out for commercial production were components of the program. More detailed techniques such as ploidy manipulation and sperm cryopreservation were also developed. Our present objective is to highlight the improvements in artificial propagation that have been incorporated into hatchery programs. Initially, ovulation was induced with pituitary glands, but today LH-RH_a is used; ovulated eggs were laboriously stripped, but today most hatcheries use the minimally invasive surgical technique (MIST). Nursing of juveniles continues to evolve, primary nursing is now commonly done in tanks during training to artificial diets instead of starting in enriched ponds. These operational hatchery techniques are common to both culture for restoration stocking and food-fish production.

25859

Predation of Juvenile Paddlefish by Some Piscivorous Fishes Found in North America

William Shelton, Rafael Cuevas-Uribe, Steven Mims and Noah Nelson

Paddlefish, *Polyodon spathula*, have been stocked in reservoirs for many years. Vulnerability of stocked juvenile paddlefish to predation has not been well documented. In experiments at Kentucky State University, paddlefish of 265 g average weight, or 21 cm total length (TL) were added (15 paddlefish/pond/week) to ponds with different predator groups, including blue catfish, *Ictalurus furcatus*, flathead catfish, *Pylodictis oliveris* (both species @ 69.5 cm to 90 cm TL), largemouth bass, *Micropterus salmoides* (37 cm to 48 cm TL) or striped bass, *Morone saxatilis* (55 cm to 72 cm TL). Bluegill, *Lepomis macrochirus*, were maintained in the ponds as alternate prey. The resulting models predicted that the catfishes would eat paddlefish up to 62 cm TL, or 69% of the TL of the largest catfish; largemouth bass would eat paddlefish as large as 53.5 cm, although paddlefish were actually eaten only to 44 cm average total length; and striped bass would eat paddlefish as large as 44.5 cm TL, or 62% total length of the largest predator. Paddlefish juveniles are highly susceptible to predation, so they should be pond reared to the largest practicable size, taking into consideration the species of predators in the receiving waters.

25863

Spatial Distributions of Blue Catfish in Lake Dardanelle, and Their Influence on Standardized Electrofishing Protocols

Zach Moran

Fisheries scientists have recently focused on creating standardized low-frequency electrofishing procedures for sampling Blue Catfish *Ictalurus furcatus*. Current procedures do not account for spatial distributions. This can result in inefficient sampling because Blue Catfish are a highly mobile predator that cluster in pelagic habitats. We compared telemetry data from 23 large (774-1040mm) and 20 small (560-700mm) Blue Catfish, to electrofishing data collected via a systematic random sampling design to determine how capture rates were related to the habitats occupied by acoustically-tagged fish. We divided Lake Dardanelle, Arkansas (17,806 hectares) longitudinally into a lacustrine, transition, and riverine section, and collected 8,029 Blue Catfish in 456 samples taken from channel edge, main channel, adjacent flat, and wing dyke habitats. The majority of Blue Catfish were captured on channel edge habitats (N= 3,731), while main channels (N=2,231), and wing dykes (N=1,642) were also significant producers of fish. In proportion to available habitats, Blue Catfish selected for deep (> 6 m) channel edges in the lacustrine and transition zones, and current seams near wing dyke scour holes in the riverine section. We determined that Blue Catfish congregate in habitats that offer relief from high current and sunlight while also providing an abundance of food items. Sampling deep channel edge habitats in lacustrine and transition zones, and wing dykes in the riverine section of Lake Dardanelle led to the highest sampling efficiency of both large, and small fish.

25868

Assessing Angler Use and Opinions at a Seasonal Urban Trout Fishery in Northeast Oklahoma

Chris Whisenhunt and Josh Johnston

The Oklahoma Department of Wildlife Conservation (ODWC), in an effort to provide additional angling opportunities in and around urban areas, manages several small waterbodies in the Close to Home Fishing Program (CTHFP), some of which are also managed as seasonal trout fisheries. In 2012, Veterans Park Pond was added to the CTHFP in a cooperative agreement with the City of Jenks. Through donations from BancFirst and Trout Unlimited Chapter 420, and Sportfish Restoration funding, Veterans Park Pond has been stocked with rainbow trout (*Oncorhynchus mykiss*), December through February for the past three years. We conducted a creel survey from December 2015 to February 2016 to acquire basic angler information and demographics, determine levels of angler satisfaction and success, determine angler opinions on different management strategies, and to gain a better understanding of angler habits in urban areas. We conducted 221 interviews and found that over 90% of anglers lived within a 23 mile radius of the pond and the mean angler satisfaction rating was 3.95 (on a scale of 1 to 5, with 5 being very satisfied). Interestingly, the majority of interviewed trout anglers were more catch oriented than harvest oriented. ODWC spends a significant amount of money to operate multiple seasonal trout fisheries and the CTHFP across the state; therefore, additional creel surveys at other locations should be conducted to get a better understanding of angler opinions and attitudes towards management of those fisheries, so that management strategies can be tuned to better serve our constituents.

25870

Kansas Style - Balancing Fisheries Resource Management with Sociological Desires

Doug Nygren

Kansas has a long history of competitive fishing for a variety of sport fishes. Sometimes these events created controversy that led to action by the department. Agency actions to minimize negative impacts of competitive fishing events have varied by species. They required different approaches to protect the fishery and be

accepted by the angling community as a whole. Issues that have been most contentious are culling, length limits, tournament related mortality, and conflicts with other users. The Kansas Department of Wildlife, Parks, and Tourism understands that economic benefits are associated with competitive angling and welcomes competitive anglers to partake of our resources while at the same time protecting those resources. The author will review past regulatory actions relating to competitive fishing, discuss the differing approaches by species, and recent new regulatory actions for competitive events.

25872

Advanced Fingerling Largemouth Bass Survival and Contribution to Age-0 Cohort 90 Days Post-Stocking

Jeff Buckingham

Supplemental stocking of Largemouth Bass (*Micropterus salmoides*) is a popular management tool for increasing numbers of age-0 bass in a population. Stocking success of fingerling Largemouth Bass is variable and can be impacted by fingerling size. In 2016, hatcheries in Arkansas experimented with different forages (Fathead Minnow, Bluegill, pellet feed) to grow Largemouth Bass fingerlings to an advanced-size (~80 mm). These advanced fingerlings were freeze-branded and stocked into four small Arkansas reservoirs (<700 acres) in September and October 2016. Each forage treatment received a unique brand mark to differentiate between treatments. Reservoirs were sampled via electrofishing 7, 30, 60, and 90 days post-stocking. Survival was estimated using a catch curve. Stocked age-0 bass were on average significantly larger than age-0 wild bass in two of the study lakes at the time of stocking. Fathead minnow treatment bass were significantly larger than the other treatments. The 90 day percent contribution was highly variable amongst study lakes and ranged from 0% to 86%. Average 90 day survival amongst the lakes was 43% and was similar for both wild and stocked bass. Our results will improve stocking strategies of fingerling Largemouth Bass in Arkansas and develop efficient strategies for hatcheries to grow fingerlings to a desired size.

25875

Beginning American Eel Studies in Louisiana and Gulf States

Robby Maxwell

The American eel *Anguilla rostrata* has received increased attention in recent years due to world pressure on United States stocks, construction of passage barriers, and the lack of available life history information. The US Fish and Wildlife Service reviewed the status of the American eel in 2007 and 2015, and found that protection under the Endangered Species Act was not needed. Gulf of Mexico populations of American eel are data deficient compared to Atlantic populations, so we set out to capture specimens from Southwest Louisiana to gather sex, size, age, and genetic data. Using trapping methods similar to Savoie and Casanova (1982), we set traps monthly for a year in Lake Misere and Rockefeller State Wildlife Refuge in Cameron Parish, LA. Though we were able to capture bycatch consisting of preferred prey items, we failed to catch eels in our study traps. We caught only one eel in a "test trap" run parallel to the study. Our failure to catch eels led us to reach out to multiple state and federal agencies in the region. It was discovered that very little interstate communication concerning eels was taking place, and many research goals and methods were overlapping. Failures were being repeated, and successes were not being shared. In early 2016, in conjunction with the University of Texas, we established a listserv to share information about Gulf eel populations. It currently has 49 subscribers, and is growing. With increased communication across Gulf States, hopefully research efforts will proceed more efficiently and effectively in the future.

25876

Catfish Tournaments Today—Connecting Anglers and Agencies

Robert Neumann

In the US, about 7 million anglers fish for catfish, ranking fourth behind black bass, panfish, and trout, according to the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation by the US Fish and Wildlife Service. A national survey of catfish anglers in 2002 reported 14% of catfish anglers participate in tournaments, and that percentage is likely higher today as the prevalence and popularity of catfish tournaments appears to be on the rise since then. Catfish tournaments are diverse in scope, size, and target species (single or multispecies), and range from local derbies and contests to regional and national tournament circuits, with anglers spanning skill levels and ages, from weekend anglers to sponsored professionals. Winnings at local events tend to be relatively small, while prizes at national events include total cash payouts exceeding \$25,000, with winning cash prizes exceeding \$10,000 and new boats. Catfish tournaments are generally conservation oriented and most are live-release with dead fish prohibited. Weigh-in Tournaments can be opportunities for interaction and communication between anglers and fishery managers, angler recruitment, and fishery publicity and marketing. Tournament catches may also serve as sources of biological data, such as marking, tagging, food habits, and age-and growth studies, as well as complement standardized sampling programs.

25884

Population Dynamics of Hybrid Striped Bass in Greers Ferry Lake, AR

Matt Horton, Matthew Schroeder and Tom Bly

Little has been reported on Hybrid Striped Bass (*Morone chrysops* X *Morone saxatilis*) populations in the southeastern United States, including Arkansas, where they have been cultured and stocked as a major sport fish since the 1970s. Greers Ferry Lake, a 13,355 ha multipurpose, United States Army Corps of Engineers reservoir, is home to the 27 lb 5 oz world record Hybrid Striped Bass, caught in 1997. Data collected with multiple gear types, from 2014 and 2015, produced interesting results. Mean relative weight was estimated to be 77. Additionally, relative weights were negatively correlated with the number of Hybrid Striped Bass and number of year classes per 254-mm length group. Growth (length) was almost non-existent after Age-4. Nine age classes, ranging from age-2 to age-12, shared the same 254-mm length group. Fifteen year classes of fish were obtained from the 141 fish collected by all sampling gears, with the oldest being 16 years; one of the oldest, if not the oldest, Hybrid Striped Bass aged in the United States. Total annual mortality was estimated to be 28% with a theoretical maximum age of 13. Relative to other Hybrid Striped Bass populations in the southeastern United States, Greers Ferry's population exhibit slower growth and greater longevity, but share a similar growth trajectory. Hybrid Striped Bass have not been stocked since 2015 due to the overall poor condition of sportfish species and the apparent loss of the Threadfin Shad population. Future management of this species is currently being evaluated in Greer Ferry Lake.

25887

A Simple Optimization Tool to Prioritize Barrier Removal in Streams: Implications for Convergence Among Divergent Conservation Objectives

Ryan A McManamay, Henriette Jager, PhD, Joshua Perkin and Brenda Pracheil

Instream barriers impede fish migration among habitat patches, leading to reduced exchange of genetic information within populations, if not a complete loss of access to habitats essential to sustain fish life histories. The loss of colonization dynamics may be reflected in entire fish communities, with the loss of species or entire functional groups. Not surprisingly, much effort has been devoted to identifying barriers and prioritizing them for removal or creating a means to support fish passage. However, prioritization schemes largely reflect conservation objectives for specific fish species, whose life history requirements are highly divergent from other species. Obviously, the removal all barriers may not be an option due to cost of removal or the services provided by barriers (eg, energy production); hence, optimizing barrier removals that provide convergent solutions among multiple divergent conservation objectives is needed. While complex optimization routines requiring programming experience can be used to find optimal solutions, these tools are typically unavailable to natural resource managers. Herein, we provide a simplified spread-sheet based tool that uses

optimization routines to balance barrier removal for ecological benefit versus monetary cost or cost to energy production We use two basins of varying size (White Oak Creek, TN and Roanoke River, NC) to highlight the diversity of conservation objectives that influence constraints and their subsequent influence on optimization results We then evaluate the potential for convergence (ie, similar barriers prioritized for removal) among those objectives This tool is flexible in that it can represent the unique ecological and geographic contexts present in watershed, while also providing for relatively complex ecological processes representative of unique life strategies represented in the broader fish community The tool was designed for use in Excel making it affordable, and readily accessible to the larger conservation, planning, and assessment communities

25888

Assessing Experimental Gear for Channel Catfish *Ictalurus punctatus* and Crappies *Pomoxis spp* to Increase Sample Size

Sean Kinney

Louisiana Department of Wildlife and Fisheries (LDWF) Inland Fisheries biologists used experimental gear to sample channel catfish *Ictalurus punctatus* and crappies *Pomoxis annularis* and *P nigromaculatus* in two different studies The gear types studied were intended to increase catch rates of both species of fish, and to provide more reliable population data for management decisions Channel catfish were studied on Toledo Bend Reservoir from 2008 to 2010, and were captured using vertically set hoop nets The primary goal was to determine the length at sexual maturity (M50) of both genders of catfish Crappies were collected using tandem lead nets fished on 3 different waterbodies (Toledo Bend Reservoir, Sibley Lake, and Grand Bayou Reservoir) from 2008 to 2011 This gear was being evaluated for potential inclusion into LDWF standardized fisheries sampling protocol Sampling results for both gear types were positive, and lead nets are now included in standardized sampling protocol when assessing crappie populations

25889

Contributions of Mussels and Fish as Biogeochemical Hotspots

Garrett Hopper, Keith B Gido, Caryn C Vaughn, Kiza K Gates and Carla L Atkinson

Mussels and fish are known to generate nutrient hotspots, but whether aggregations of these two disparate consumer groups overlap and interact to influence nutrient dynamics remains unexplored Mussel beds created stable, long-term hotspots that may attract fishes by providing resource subsidies Hence, we asked whether fish biomass accumulates disproportionately at stream reaches with mussel beds compared to reaches without mussel beds? We also compared fish biomass to mussel biomass and asked whether there are differences in their contribution to nutrient cycling within reaches with mussel beds? We estimated fish and mussel biomass at replicate stream reaches containing mussels and reaches without mussels in three rivers in southeastern Oklahoma during summer and fall of 2015 and 2016 We measured nitrogen and phosphorous excretion rates of dominant fish species to compare with previously measured mussel excretion rates Biomass estimates and excretion rates were combined to estimate areal excretion rates of fish and mussel communities In general, fish biomass was distributed more homogeneously than mussels, but mussel biomass exceeded fish biomass at reaches with mussel beds Consequently, mussel areal excretion rates were higher than those of fish However, the ratio of N:P excreted by fishes was lower than that of mussels Future efforts will evaluate the more diffuse occurrences of fishes compared to the aggregated occurrences of mussels towards nutrient hotspots and ecosystem function

25892

Effects of Saugeye Introductions on Southern Reservoir Fish Communities: An Ecosystem Modeling Approach

Dray Carl and Dan Shoup

As fisheries management progresses toward ecosystem-based management strategies, it is increasingly important to identify possible influences of predator introductions on existing fish communities. Frequently, predator-prey balance is assessed with single-species bioenergetics approaches that overlook potential prey limitation due to interactions among piscivores. However, to accurately estimate predator demand and effects of new predator introductions, all piscivores must be considered simultaneously. Saugeye *Sander vitreum* x *Sander canadense* are frequently introduced in southern reservoirs to create new sport fisheries and to provide predatory control of high-density Crappie *Pomoxis* spp populations. These introductions have the potential to disrupt community dynamics through middle-out pathways by consuming large amounts of mesopredators (*Lepomis* spp, *Pomoxis* spp) or negatively influencing native piscivore populations via competition. We used static Ecopath models with data from before and after Saugeye introductions (Arkansas Game and Fish Commission annual cove rotenone sampling) as well as Saugeye introduction simulations (Ecosim) in four Arkansas reservoirs to evaluate community-level influences of stocking Saugeye. Trophic level and biomass changes, mixed trophic impacts, niche overlap indices, and a keystone species index were assessed to identify changes in community dynamics. Modeling is currently ongoing, and results will be discussed during the presentation. Recognizing potential community-level effects of stocking new predator species aids in future management decisions regarding species introductions in southern reservoirs.

25893

The Effect of Permit Costs on Fishing Participation

Richard Melstrom and Taylor Welniak

Many fish and wildlife agencies offer reduced or no cost fishing permits to youth and senior residents. Although this type permit policy may be viewed favorably by youth and senior anglers, it shifts the burden of paying for conservation onto other users and deprives the agency of a potentially important source of revenue. Increased participation among youth and seniors may partially offset this revenue loss, through taxes on their purchases of fishing-related goods, but the effect of fees on participation levels is not well known. This study investigates the effect of reduced permit fees on fishing participation among seniors. Specifically, we test whether state-licensed anglers living in the Oklahoma City metro region are more likely to fish at Oklahoma City lakes after they pass the age of 62 and are no longer required to purchase a City fishing permit. We conduct the test using a quasi-experimental design known as regression discontinuity, a technique used in the social sciences to elicit the causal effects of non-randomized treatments that have arbitrary cut-off conditions. By comparing the propensity to fish among individuals whose ages lie close to either side of the age threshold, it is possible to gauge the effect of permit costs on participation.

25896

Anthropogenic Obstructions to Paddlefish Movement and Migration

Jan Jeffrey Hoover, Paul Bailey, Stephanie R Januchowski-Hartley, John Lyons, Brenda Pracheil and Steve Zigler

Paddlefish have only limited capabilities to overcome structural and hydraulic obstacles in rivers. They share morphological characteristics with "accelerator" (fast-start) species and "cruiser" (sustained high velocity) species, and exhibit moderate to high swim speeds (2-12 body lengths/sec). However, their predominant locomotor behavior (continuous free-swimming in the water column), distinctive form, and large size make them vulnerable to myriad anthropogenic features in rivers. Sources of mortality include entrainment, impingement, and trauma by dredges, water intakes, vessel hulls and propellers, water diversions, and hydroelectric turbines. Dams and weirs impede migrations, and reduce movements needed to fulfill life history requirements including access to spawning, wintering, and feeding habitats. In addition, these barriers concentrate Paddlefish in tailwaters, increasing their vulnerability to angling injuries and boat strikes. Effects of

these anthropogenic features, unlike those of commercial and recreational harvest, are infrequently assessed by fisheries biologists Management options to reduce impacts include: 1) controlling water flows and reducing withdrawals from dams and weirs to create escapable flow fields near entrainment and impingement sources; 2) capturing and transporting blocked or displaced Paddlefish to now inaccessible habitats; and 3) creating functional fishways to enable migrations and dispersal To date, none of these options have been implemented long-term or at large geographic scales We summarize what is known about Paddlefish swimming abilities and behaviors, relative impacts and threats of various anthropogenic modifications to their habitats, especially barriers to movement and migration, and potential management actions to mitigate these impacts

25897

The Status of Atlantic Sturgeon in the Satilla, St Marys and St Johns Rivers

Adam Fox and Douglas L Peterson, PhD

The Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) is an anadromous species that historically occurred along the North American Atlantic coast from maritime Canada to the St Johns River, Florida The species has experienced major population declines due to overharvest and dam construction, and was listed under the Endangered Species act in 2012 Although several populations in the central and northern parts of the range appear to be stable or increase, the status of southern populations is much less certain The objective of this study was to assess the status of the southernmost Atlantic Sturgeon populations in the Satilla, St Marys and St Johns Rivers Our approach to this assessment was twofold: first, we sampled for river resident juvenile sturgeon (an indication of successful recruitment) in the estuary of each river, and second, we used an array of acoustic receivers to detect seasonal use of each estuary by Atlantic Sturgeon migrants from other river systems Sampling with entanglement gears was conducted in the Satilla River in summer 2014-2016, the St Marys in 2013-2016, and the St Johns during the summers of 2014 and 2015 Our receivers array was active in all rivers from 2014-2016 Our results suggest that remnant Atlantic Sturgeon populations persist in the Satilla and St Marys Rivers, but we could find no evidence of an extant population in the St Johns River The telemetry component of this study indicates that all three rivers are frequently visited by migrating Atlantic Sturgeon during the non-spawning periods

25899

Relative Abundance and Habitat Use by Sickle Darters (*Percina williamsi*) in Tennessee

J Brian Alford, PhD, Meredith Harris, Joyce Coombs and Justin Wolbert

During summer 2016, we surveyed historic and new sites in the Emory and Little Rivers for the ESA-petitioned Sickle Darter (*Percina williamsi*) Using snorkeling, backpack electroshocking, and seining techniques, relative abundance was measured as catch per unit effort and density Snorkeling was determined to be the most effective sampling technique, and relative abundance was greater for the Emory River population (72 fish/snorkeler-hr; 78 fish/m²) for Little River (25 fish/snorkeler-hr; 49 fish/m²) In Little Rock Creek (tributary to Emory), the dominant two substrates used by individuals were sand then boulder, whereas in Emory River and Little River it was gravel followed by sand Sickle Darters were observed in low-gradient areas of streams, almost entirely in pool habitats (mean depth was 41-51 cm) with mean current velocities measuring 5-6 cm/s Canopy cover of riparian vegetation measured in the stream by a densiometer averaged 82% at Emory River darter locations, 35% at Little River, and 90% at Little Rock Creek Water quality was considered good at all sites, with total dissolved solids (TDS) less than 63 ppm at all sites Channel margins containing macrophyte beds and small woody debris (SWD) were heavily used by Sickle Darters, and nonmetric multi-dimensional scaling analysis indicated that Common Logperch (*P caprodes*) and Buegill (*Lepomis macrochirus*) exhibited high overlap in habitats where Sickle Darters occurred

25901

Habitat-Specific Population Demographics of Red Snapper and Red Grouper in the Eastern Gulf of Mexico

Mandy Tyler-Jedlund, Theodore Switzer, Jessica Carroll, Brent Winner, Sean F Keenan and Heather Christiansen

Historical studies of population demography of reef fishes in the eastern Gulf of Mexico (EGOM) have typically pooled data across habitats, despite increasing evidence suggesting that abundance, growth, and size/age composition often vary markedly among habitats. Because habitat quality and quantity vary markedly throughout the EGOM, better accounting of habitat-specific demographics may increase the precision and accuracy of estimates of vital population rates. We conducted a two-year study to determine whether size, age, and relative abundance of Red Grouper (*Epinephelus morio*) and Red Snapper (*Lutjanus campechanus*) varied among artificial (eg, barges, chicken coop, and construction materials) and natural (eg, ledges, fragmented, flat) reef habitat types as characterized via supervised classification of side scan sonar imagery. In 2014 and 2015, a total of 1,118 Red Grouper and 870 Red Snapper were collected during fisheries-independent sampling using chevron traps and standardized hooked gears from two Florida regions: the Florida Panhandle and the mid-Florida Peninsula. Red Grouper ranged in size from 142 – 757 mm standard length (SL) and Red Snapper ranged in size from 186 – 731 mm SL. Red Grouper ranged in age from 1 – 23 years, and Red Snapper from 1 – 14 years. Preliminarily, Red Snapper in the Panhandle were smaller (355 ± 108 mm SL; $p < 0.0001$) and younger (28 ± 0.22 years; $p < 0.0001$) on artificial reefs than natural reefs (413 ± 84 mm SL, 59 ± 0.21 years). Results will be presented that further elucidate regional and habitat-associated differences in demography for both species.

25904

Using Angling and Electrofishing to Estimate the Size of a Smallmouth Bass Population in a Regulated River

Seth Mycko, Yoichiro Kanno and Jason Bettinger

Estimating abundance is fundamental to effective fishery management, but can be challenging in a regulated river where fluctuations in stream discharge may influence capture efficiency. In this study, we estimated the number of Smallmouth Bass (*Micropterus dolomieu*) in a 42-km regulated section of the Broad River, South Carolina, based on mark-recapture data from angling and boat electrofishing. Mark-recapture sampling with passive integrated transponder tags was conducted on five separate days between October 20 and November 11, 2015. Angling was used on days with low flow conditions (< 1500 ft³/s) and electrofishing on days with high flow conditions (> 1500 ft³/s). We fit closed population capture-mark-recapture models in the Bayesian hierarchical modelling framework. Individual capture probabilities differed among and within sampling gears, but were generally low (< 5 %). Angling selectively captured smaller individuals than electrofishing. Despite these challenges, we estimated a population of 2,380 Smallmouth Bass (95 % CI: 1,578-3,693) > 200 mm TL in the 42-km study reach. We validated our modelling approach using simulations of two gears potentially selecting different individuals. The assumption of population closure was confirmed by monitoring the movements of eight Smallmouth Bass using radio telemetry. Integrating two gear types into a mark-recapture study can be an effective method for assessing abundance in spatially or temporally heterogeneous habitats where a single sampling method cannot adequately sample the population.

25905

Management and Stock Assessment of American Eel on the US East Coast

Laura M Lee and Bradford C Chase

The American eel is an important resource throughout its range, including the US East Coast where it has supported major commercial fisheries for at least a century. Concern over declines in the species' abundance prompted the Atlantic States Marine Fisheries Commission to adopt an interstate fishery management plan for American eel in April 2000 in order to protect and restore the species. A benchmark stock assessment of American eel along the US East Coast was completed and accepted for management in May 2012. The

assessment indicated that the population was depleted in US waters and concluded that numerous factors have contributed to the stock's condition, which led to the current management regulations. In seeking to improve understanding of American eel abundance and distribution across its range, there are a few fisheries-independent survey approaches currently being employed along the US East Coast. The authors explore these methods and other recommendations to better understand stock structure.

25907

Ecological Significance of Paddlefish Seasonal Migrations and Movements: A Review of Tagging and Telemetry Studies

Sara Tripp, Ben Neely, John Hoxmeier and Mathew P Rugg

Many studies have demonstrated components of Paddlefish movements or migrations between spawning, feeding, and overwintering areas. However, the extent, timing, purpose and potential consequences of these movements have not been summarized. With advances in tagging and telemetry technology, information regarding spatial ecology of Paddlefish populations is increasing. Increased implementation of these techniques has provided new information about migration routes, timing of migration, spawning and nursery locations, interactions with dams and other anthropogenic modifications, habitat use, and the influence of environmental factors on cues to movement and migration. This review paper focuses on synthesizing results of these studies to characterize seasonal movements and migrations of paddlefish throughout their range, identification of knowledge gaps to be addressed in future efforts, and investigation of how this information affects current issues in conservation and management strategies in a broad ecological sense. Given the propensity of Paddlefish to undergo long-distance migrations, understanding spatial and temporal movement patterns will be critical in defining populations and determining the future scope of management to restore these populations and ensure sustainability throughout their range.

25908

Shifts in Habitat Use and Diet of Juvenile Reef Fishes in Seagrass Habitats in Response to Varying Abundance of Juvenile Gag

Kevin Thompson and Theodore Switzer

Indices of abundance typically account for environmental variability, but rarely include variables that represent biotic interactions with other species. We evaluated evidence of species interactions affecting catch data and abundance estimates using data from an estuarine survey of juvenile reef fish on seagrass habitats. We analyzed the catch data for six key reef species (Black Sea Bass, Gag, Gray Snapper, Lane snapper, Hogfish and White Grunt) to examine patterns in catch in space and time across five eastern Gulf of Mexico (GOM) estuaries. Results indicate that Gag, a large-bodied predator which exhibits highly-variable levels of recruitment, affects the abundance and space use of other reef fishes when present in high numbers in southern estuaries. Diet data indicates a number of overlaps in resource use in these species, however this varies by species, estuary, and year. Two species, Gray Snapper and Black Seabass, are particularly affected by periods of high Gag recruitment with significant shifts in numbers and habitat use, and diet data indicate they may be switching foraging patterns to lower risk, and also less valuable prey. These findings are an important consideration when developing ecosystem models for the GOM, but also illustrate the potential for expanding the environmental variables considered when developing single species indices, particularly with interacting species that have highly variable recruitment.

25909

Estimating the Population Size of Degray Lake Hybrid Striped Bass: A Pilot Study

Sean Lusk and Brett Hobbs

Hybrid Striped Bass are commonly stocked into reservoirs around the southeastern United States to serve an important recreational and ecological role. Despite how commonly Hybrid Striped Bass are stocked, few studies have attempted to evaluate the effectiveness of stocking programs for this species. As a preliminary step in evaluating the Hybrid Striped Bass stocking program in Arkansas, we designed a mark-recapture study to estimate the population size of hybrids in DeGray Lake, Arkansas. Our study consisted of two months of marking (January and February 2016) and two months of recapturing (February and March 2016). During each mark and recapture event Hybrid Striped Bass were captured using experimental gillnets and marked using dart tags. Through the duration of this study we marked a total of 341 individuals and captured a total of 698 individuals, of which only one was a recapture. Results of this study provide valuable insight into the effort necessary to refine our estimate of population size.

25910

Assessment of the Lake Eustis Pupfish *Cyprinodon variegatus hubbsi* in Florida

John Benton

The Lake Eustis pupfish *Cyprinodon variegatus hubbsi* has been a listed species in Florida since 1977 due to its limited range. The species inhabits only eight large lakes in the Upper Ocklawaha river basin of central Florida, leaving it vulnerable to environmental change or introduction of a new predator to the system. Previous comprehensive sampling for the Lake Eustis Pupfish was performed in the 1980s. We planned and executed a program to sample all known populations from June through October 2014. The scope of sampling was expanded to other water bodies in the basin that had similar habitat. We mapped the littoral zone in all occupied lakes and classified sediment types in a GIS system, then used that map to allocate 196 randomly selected electrofishing samples within the occupied water bodies. Barge mounted electrofishing was selected as the most practical method for collection and monitoring. We verified the continued existence of the species in all historically occupied lakes and evaluated several methods of capture (seine, Breder trap, mini-fyke net, and electrofishing). Lake Eustis Pupfish were captured exclusively in areas virtually clear of vegetation that had sandy substrates and never collected in areas with muddy or flocculent sediment, or in heavily vegetated sandy habitats. The Lake Eustis Pupfish was found in varying levels of abundance in all water bodies where it has been documented historically, and not found in any other water bodies in the region.

25911

The Role of Propagation in Paddlefish Restoration and Conservation: A Case Study of the Missouri Paddlefish Propagation Program

Christopher Schwinghamer, Quinton Phelps, Sara Tripp, Trish Yasger and Jake Colehour

The propagation of fish for stocking purposes is a common technique used to supplement threatened populations or to improve angling. Many paddlefish populations have declined from historic levels likely due to intense harvest (ie, commercial and recreational) and habitat degradation (eg, dams, floodplain loss). To supplement populations, state and federal agencies began propagating paddlefish and currently propagation programs exist throughout the Eastern United States, Eastern Europe and China. As propagation programs arose, techniques evolved to maximize efficiency by improving fertilization and hatching rate, growth, and survival. Through propagation programs, several populations have been restored and some support quality recreational fisheries. One such program has been successful in Missouri. In the early 1970's, the Missouri Department of Conservation determined that a paddlefish populations could be established in Table Rock Lake and supplementation could build harvestable populations in two other reservoirs, Lake of the Ozarks and Harry S Truman Lake. Stocking began in 1972 to restore populations and maintain recreational harvest opportunities. Currently these three reservoirs support quality paddlefish fisheries and are known for their success throughout the world. Even though paddlefish propagation in Missouri has been fruitful, additional efforts are underway to bolster success, particularly, collaboration with other entities to determine successful approaches that could be adopted. Through collaboration, unique intricacies have surfaced that should be implemented as propagation and restoration programs commence around the world. To this end, many

paddlefish propagation has been successful and will continue to play a role in restoring or creating paddlefish fisheries

25913

Assessment of Smallmouth Bass Spawning Movements and Associated Environmental Conditions in an Intermittent Boston Mountain Stream

Jacob H Martin and Charles J Gagen

Smallmouth Bass (*Micropterus dolomieu*) are popular sportfish and top predators in Arkansas' Boston Mountain streams. In this ecoregion, they frequently occupy headwater streams that are prone to drying during summer. We characterized longitudinal movements of 30 Smallmouth Bass that were captured along the Illinois Bayou and implanted with radio transmitters in March 2016. Tracking continued through June and July (likely spawning months), and ended in August. During this time, we also measured environmental variables, including turbidity, stream discharge, and water temperature. We found no net longitudinal movements that were clearly associated with the likely spawning months. We defined movement as the proportion of individuals that moved over 100 m/week. Movement was at its highest during April and May, when approximately 50% of individuals moved > 100 m/week prior to the presumptive spawning peak. This proportion gradually declined to 13% through July and August. We attributed the reduced movement to reduced surface streamflow in portions of the river which tended to restrict fish to remaining isolated pools. Minimum daily water temperature was inversely correlated to weekly Smallmouth Bass movement ($r = -0.79$, $p < 0.01$); whereas, discharge and turbidity were not significantly correlated to movement in this study. Because discharge and turbidity fluctuate so rapidly during stormflow, determining their effects on fish movement may require more frequent monitoring. Research is ongoing to more precisely estimate the timing of the spawn in this system and assess its relationship to movement and to environmental conditions at this southern portion of the Smallmouth Bass range.

25915

The Native Black Bass Initiative (A Southeast Aquatic Resources Partnership Program)

Jessica Graham and Vance Crain

The Native Black Bass Initiative (NBBI) was created to address the conservation of black basses within their native riverine ranges and to raise awareness of various unique species that were not previously well-studied. Through implementation of this Initiative there have been successful contributions in conservation focusing on protecting and restoring habitat, filling critical research gaps and ameliorating the effects of invasive species. The NBBI has provided adaptive management and coordination that has led to the successful restoration of these species. Under these guidelines, endemic black bass is used as a keystone species of overall aquatic system health, where the preservation of key processes of aquatic life provides benefits well beyond just one species. The guidance, funding and coordination provided by the NBBI shows the success of this initiative and management strategies needed to conserve a species on a landscape level scale.

25918

Catch-and-Release, Commercial Bycatch, and Boat Propellers: Cryptic Mortality of Paddlefish

Phillip Bettoli, PhD, George Scholten and Eric Ganus

Enough evidence exists to conclude that catch-and-release (CR) mortality of paddlefish *Polyodon spathula* snagged in sport fisheries is minimal. Similarly, ample evidence points to minimal post-release mortality of paddlefish captured in gill nets fished for short periods of time so that researchers can implant telemetry tags. Finally, at cool (< 12 °C) water temperatures paddlefish experience low mortality rates in commercial gill nets set overnight; whereas, paddlefish caught at warmer water temperatures (> 18 °C)

experience much higher rates of mortality when caught in overnight gill nets There is some literature on the metabolism and stress response of paddlefish and a more robust literature for other chondrosteans, specifically, sturgeons *Scaphirhynchus* spp and *Acipenser* spp Chondrosteans as a group exhibit low stress responses relative to teleosts and that trait is likely why paddlefish exhibit high post-release survival rates after encountering fishing gear Some studies of commercial fishers targeting roe-bearing paddlefish have reported bycatch rates of males and juvenile females as high as 92% Cryptic fishing mortality of paddlefish arising from fishers targeting other commercial species has received scant attention in the published literature; one study estimated one paddlefish bycatch mortality per 37 hoop nets fished overnight in the Missouri River Similar data may exist in unpublished agency reports based on ride-alongs with commercial fishers targeting other species The spread of Asian carp *Hypophthalmichthys* spp in the Mississippi River basin has prompted aggressive harvest strategies to reduce their numbers, which argues for increased scrutiny of the bycatch of paddlefish in those fisheries A final source of cryptic mortality of paddlefish, boat propeller strikes, was described in one study: paddlefish were a rare component of the fish entrained by towboat propellers, but the injury rate was 100% Propeller strikes are a high-profile concern for endangered fish and sea mammals, but it is not clear yet whether this line of inquiry for paddlefish warrants further study

25920

Multisystem-Scale Length Limits: Making It Easy

Andrew Shamaskin, Michael Colvin and Leandro E Miranda

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 information, and clarify how that information informs management plans Forecasting length-limit regulations contributes meaningful guidance towards weighing decisions within management paradigms However, traditional length-limit models are limited to a single system and by uncertainty and the inherent variation among cohorts within an evaluation Through the development of a quantitative decision model, we demonstrate a consistent way to compare length limits at a multisystem scale and with multiple objectives Using extensions of the Beverton-Holt yield-per-recruit function, coupled with a multiattribute utility function, the model compares length limits with an overall score, and 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

25922

Recreational Fisheries Management of Paddlefish

Gerald E Mestl, Adam Geik, Jason Sorensen and Ryan Hupfeld

Paddlefish are unique among North American freshwater sport fishes, and thus present a unique suite of challenges to those managing recreational stocks They are managed principally for either their flesh or roe or for the experience of hooking, fighting, and landing a trophy up to 130 lbs Because paddlefish are wide-ranging and capable of migrating long distances (>1000 km), interjurisdictional communication between multiple agencies is often necessary for effective management Furthermore, paddlefish status varies considerably from state to state, with some states completely prohibiting take and others allowing liberal harvest year-round While paddlefish can be taken with a regular fishing license in some states, other states require a special permit, tag, or entry into a lottery system Paddlefish anglers are a relatively small but dedicated contingent However, angler opinion of paddlefish varies regionally; in some regions, paddlefish fishing is a highly anticipated seasonal event, while in other areas they are considered just another “rough” fish The authors will examine the different harvest management systems and regulations being used to manage recreational paddlefish fisheries We will highlight their differences, and examine the advantages and disadvantages of these different approaches

25924

Establishment of Genetic Baselines for Bartram's Bass *Micropterus* Sp Cf *Coosae* in Tributaries of the Savannah River with an Assessment of Landscape Factors Influencing Hybridization with Introduced Species

Mark Scott, Jean Leitner, Kevin Kubach, Dan Rankin, Matthew Greenwold and Joseph Quattro

Bartram's Bass *Micropterus* sp cf *M coosae*, endemic to the Savannah basin of South Carolina and Georgia, is hybridizing with introduced Alabama Bass *M henshalli* across the native's range in the upper portions of the drainage Prior work indicates a steady loss of genetically pure Bartram's Bass in Savannah River reservoirs, as fish of hybrid origin amass Further, results to date show an increased occurrence of hybrids in Bartram's Bass native stream habitats over time In this study, we sampled twenty-six sites on eight Savannah basin streams to assess extent of hybridization between Bartram's Bass and introduced Alabama Bass Hybrids were found in 6 of 8 streams sampled Proportions of hybrids varied widely however, from 0 to 100% at individual sampling sites A regression analysis using random forests to predict proportion of hybrids with respect to landscape-level attributes resulted in identification of a suite of predictors explaining almost 72% of variation The most important predictor was human population density within the stream site's drainage area, which was positively related to proportion of hybrids Highest proportions of hybrids were found where population density was $>45/\text{km}^2$, and proportions were lowest when density $< 15/\text{km}^2$ Human population density was highly positively correlated ($r>0.95$) with attributes that are known to negatively affect aquatic habitats, including percent impervious cover and urban land, while human density was negatively correlated with attributes known to positively influence habitat, including percent forest and riparian canopy cover in the watershed Other predictive model terms included mean annual temperature and precipitation A measure of site distance from confluence with a downstream reservoir was not predictive in the model, but we observed that most streams with hybrids exhibit a decreasing cline in the proportions of hybrids and non-native alleles as you move upstream from reservoirs One positive result for Bartram's Bass conservation is identification of some refugium streams that continue to support pure Bartram's bass populations, and the fact that we did not see evidence of hybrid establishment in the upstream areas of the larger rivers sampled (South Fork Broad River, Broad River, Chauga River, and Chatooga River) Bartram's Bass is a species of highest conservation concern in South Carolina's Wildlife Action Plan and a focal species of the National Fish and Wildlife Foundation's Native Black Bass Initiative, with stakeholders pursuing an active program to bring research, education, and outreach activities together to conserve this endemic fish

25925

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

Steven Gratz

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 1571 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 $164,145 \pm 36,184$ 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 \$25 million on their trips for resources (fuel, lodging, food, tournament fees, etc) Fuel for boats and vehicles (\$10 million) and food (\$05 million) were the sources of the majority of the expenditures Anglers targeting bass *Micropterus* spp spent \$17 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

25927

Estimating Absolute Abundance of Largemouth Bass in a Large Florida Lake

Nicholas Feltz, Brandon Thompson and Kim Bonvechio

Evaluations of freshwater sportfish management actions such as stocking and habitat manipulation often rely on tracking fish population size over time Traditionally catch per unit effort has been used to assess temporal trends in freshwater fish abundance; however, given the inherent problems with using relative abundance, managers may choose to track trends in absolute abundance Estimating absolute abundance in large freshwater systems is uncommon and can be costly This study aimed to estimate absolute abundance of Largemouth Bass *Micropterus salmoides* in a large Florida lake using a variety of approaches and then compare each of these approaches We used four techniques to estimate the abundance of Largemouth Bass in Lake Eustis, Florida: 1) traditional mark-recapture, 2) catchability-adjusted electrofishing catch rate, 3) mark-recapture using high reward tagging in angler creel, and 4) population modeling Our main objective was to compare estimates of population size, uncertainty, and required effort for each technique Estimates of adult population size ranged from 16,302 for mark recapture to 68,965 for the high reward tagging method Uncertainty ranged from 11% of the estimate for mark recapture to 114% for the adjusted catchability method Managers need to consider the assumptions, biases, and required effort of each method to select what is appropriate for their system For a large lake where funding is not limited, we recommend the population model is used as it provides an estimate of population size for any age or size group while also collecting critical population dynamics and fisheries dependent information

25929

Factors Influencing Occupancy of Prairie Chub (*Macrhybopsis australis*) within the Upper Red River Basin

Anthony Rodger, Matt Skoog, Trevor Starks and Donald King

An endemic of the upper Red River basin, Prairie Chub *Macrhybopsis australis*, is listed as a Tier I Species of Greatest Conservation Need in Oklahoma Though they have received very little direct attention, this species is a member of the *Macrhybopsis aestivalis* complex, and much of their life history and ecology is assumed to be similar to other *Macrhybopsis* spp within the complex Fragmentation and dewatering are thought to be drivers behind known range reductions in the upper Red River basin The last comprehensive survey of the upper Red River drainage occurred over 25 years ago Our objective was to obtain up-to-date distribution data for the Prairie Chub utilizing an occupancy modeling framework that incorporates imperfect detection In the summer of 2016 we sampled 48 sites throughout the drainage three times each for a total of 144 collections Prairie Chub were detected at 18 sites Preliminary results suggest Prairie Chub may be experiencing on-going range declines in the upper Red River drainage, and statistical analyses will elucidate factors influencing occupancy of Prairie Chub This data will be crucial in directing decision making aimed at conserving this vulnerable Great Plains stream endemic

25930

Black Bass Bed Fishing Research: Have We Lost the Point?

John Hargrove, Mike Allen, Professor, Olaf L F Weyl, Chelsey Crandall and James D Austin, PhD

Angling for adult Black Bass (*Micropterus* spp) as they defend their nest containing eggs or fry is a technique known as bed fishing and has drawn concerns from fishery managers and anglers alike due to the perceived negative impacts on reproductive success and recruitment Historical research efforts quantifying individual and population-level responses to bed fishing have failed to consider scenarios other than male-directed

targeting which may inaccurately reflect actual angler behaviors Survey responses from 440 Black Bass tournament anglers were used to understand the behaviors, motivations, and attitudes associated with bed fishing Responses indicated that tournament anglers most commonly direct few of their trips during the reproductive season towards bed fishing but that larger, female fish were identified as preferential targets The tournament anglers surveyed generally perceived little or no harm associated with bed fishing We compared responses from United States and South African anglers and the only significant differences in perceived impacts, with anglers from the US being less likely to agree that these specialized angler techniques cause population-level harm

25931

Precision of Gizzard Shad Abundance and Size Structure Estimates from Split-Beam Sonar

Garrett Johnson, Dan Shoup and Kevin M Boswell

Current prey sampling techniques for reservoirs (eg, gill net and seine data) are imprecise and time consuming Horizontally-oriented hydroacoustics may be superior for collecting pelagic prey population characteristics However, the precision of echo-integration is unknown and fish target strengths measured from the horizontal aspect vary depending on fish orientation We developed a target strength equation that incorporates fish orientation to better describe the target strength-fish size relationship by ensonifying individual Gizzard Shad of known size at multiple orientations To measure the precision of split-beam sonar prey estimates using this equation, we then simultaneously image groups of fish in reservoirs with a Simrad® ek60 120kHz split-beam echosounder and a Sound Metrics® ARIS 3000 imaging sonar Actual fish counts and size measurements from ARIS data were used to determine the accuracy and precision of echo-integrated estimates from the split-beam system Preliminary results suggest that a parabolic model best describes target strength as a function of total length and orientation Precision results from the field analysis are forthcoming and will be discussed during the talk A model that explains the variation in target strength at different orientations combined with hydroacoustics software that allows users to estimate orientation could increase the accuracy of fish length and biomass estimates from split-beam sonar data, providing more precise prey abundance data with less effort than traditional sampling approaches

25932

Optimizing a Standard Sampling Program for Non-Wadeable Rivers in Alabama to Estimate Species Abundance and Richness of Fish Communities

Jason Dattilo

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 50,000 individual fish representing over 90 species in 24 families

25933

Determining Habitat-Abundance Relationships to Extrapolate Abundance of Harlequin Darters
(*Etheostoma histrio*) Stream-Wide in Northwest Florida

Kate Harriger, John Knight and Mike Allen, Professor

Harlequin Darters *Etheostoma histrio* are small, cryptic Percid fish that are often associated with in-stream wood and flowing water. They are considered imperiled in Florida due to their perceived rarity and restricted range (only found in the Escambia River watershed in Florida). Little is known about their population status, population demographics, and appropriate sampling techniques in Florida. Therefore, the objectives of this study are to 1) determine how darter abundance and habitat are related at a site-level, and 2) use these relationships to extrapolate darter abundance stream-wide. This study was conducted in Big Escambia and Pine Barren creeks from August 2014-September 2016. Both creeks are tributaries of the Escambia River and are clear and wadeable during base flow river conditions. Site-level abundance of darters was estimated in both creeks using mark-recapture and visual snorkeling techniques in 25-m stream reaches (sites). Site abundance of darters was calculated using a closed capture model in program MARK. The amount and complexity of in-stream wood was quantified using side scan sonar technology and ArcMap 10.3. Relationships between site-level darter abundance and habitat were examined using multiple regression analysis. These relationships will be used to predict darter densities at unsampled sites and extrapolate darter abundance to a stream-wide level for both creeks. Results of this study will help biologists better understand the population status and conservation needs of Harlequin Darters in Florida.

25934

Global Estimate of Fish Harvest from Inland Lakes

Mark Rogers, Andrew Deines and David B Bunnell, PhD

The importance of inland fisheries to global food security and human welfare is becoming increasingly clear. The direct assessment of inland fisheries harvests on the global scale is fundamentally hampered by difficulties of assessing numerous remote lakes and the deficit of available monitoring resources. Therefore, the available estimates of global inland fish harvests are highly uncertain and underestimated. We provide a new method for estimating global inland fisheries harvest in lakes based on the ecological relationship between primary production and fishery production in lakes around the world. We compiled a database of 286 lakes for which estimates of commercial, recreational, artisanal, or subsistence harvest as well as fisheries-independent biomass estimates were available from around the world. We used European Space Agency's Medium Resolution Imaging Spectrometer (MERIS) satellite images to estimate chlorophyll concentration for these lakes. Fishery and chlorophyll data were used along with local population data to train a hierarchical Bayesian model for the prediction of fish harvest from global inland lakes. After validation, we predicted fish harvest from an additional 80,000 lakes around the world for which chlorophyll data was also estimated using MERIS data. From these lakes, and extrapolating the harvest to include over 70% of the global lake surface area, suggests total lake harvest to be in excess of 84 million metric tons and account for nearly 75% of the FAO reported capture excluding additions from rivers, wetlands, and very small lake fisheries.

25935

Movement and Habitat Use of Shoal Bass in a Tributary Stream of the Flint River, Georgia

Travis Ingram, Steven Sammons and Adam Kaeser, PhD

Abstract: The Shoal Bass *Micropterus cataractae* is a fluvial specialist that is endemic to the Apalachicola River basin. Numbers are thought to be on the decline throughout its native range due to a variety of factors. The largest intact population is in the Flint River, Georgia where it is known to undergo lengthy migrations to appropriate spawning shoals. To assess the habitat use and movements of shoal bass in a tributary of the

Flint River, thirty shoal bass were implanted with transmitters in the Ichawaynochaway Creek and tracked for one year (April 2015 – April 2016) One shoal bass was harvested by an angler shortly after implantation but all other fish survived for the duration of the study The majority of Shoal Bass preferred moderate depths (< 2 m) throughout the year, although deeper depths were utilized throughout the winter months Flows less than one meter per second were preferred from spring to fall, with faster flows being utilized in the winter Shoal Bass generally favored course, rocky habitat throughout the year with predominately sandy habitat being least favored In general, daily movements were small interspersed with random large movement events No transmittered Shoal Bass migrated from the creek into the Flint River during the study period

25936

Daily Movement and Habitat Selection Patterns of Smallmouth Bass in an Ozark River

Sarah Ettinger-Dietzel, Hope Dodd, Jacob Westhoff and Michael Siepkner

We monitored the 24-h movement patterns of smallmouth bass in an Ozark river during three seasons: summer, autumn, and winter During each season, fish were located every two hours throughout a 24-hr period; habitat data and water depth were collected at each fish location Habitat and depth data were also collected at four randomly selected available points, and discrete choice models were fit to the data to predict habitat and depth selection by smallmouth bass No significant differences in movement across seasons or time of day were evident Across all three seasons, water depth and habitat type were strong predictors of bass locations Throughout our study, water depths used by smallmouth bass ranged from 06 to 37 m Although depth of water used by fish did not differ by time of day, fish used the deeper waters of Big Spring during the winter and intermediate depths during the summer and autumn Smallmouth bass utilized several habitat types; however, bass selected boulders more frequently in all seasons than any other available habitat type Our work provides additional insight into smallmouth bass behavior that will help guide future management

25938

Where to Stock? : Evaluating Lakes Stocked with Florida Largemouth Bass in Oklahoma

Chris Acy, K David Hambricht, Jessica Beyer and Emily Young

Florida Largemouth Bass, *Micropterus salmoides floridanus* (Lesueur 1822), have been introduced throughout the southern United States in an effort to improve trophy bass size and number, although there are conflicting results indicating that pure Florida Largemouth Bass (FLMB) and first generation bass (F1) actually grow larger and faster than northern bass The Oklahoma Department of Wildlife Conservation (ODWC) has stocked FLMB mainly in Oklahoma lakes for over 30 years The 3400 Heating Degree Day (HDD) cline has served as the main criterion for determining which lakes should be stocked with FLMB Using a 6-year data set of genotypic verification in largemouth bass collected from lakes around Oklahoma as well as 30 environmental variables and stocking factors, we aimed to determine which factors best predicted the presence of 3 FLMB alleles and thus verify if the 3400 HDD cline was the best stocking criterion for FLMB The best models (assessed using AIC) had at least 4 variables, signifying that there was not one single best predictor of FLMB success Preliminary results indicated a negative effect of Shoreline Development Index and a positive effect of Secchi depth on Florida largemouth bass success These results will have direct application to the management of important angling resources

25939

Springs As Thermal Refugia: Seasonal Movement and Habitat Use Patterns of Smallmouth Bass in an Ozark River

Hope Dodd, Jennifer Haack-Gaynor and Michael Siepkner

The Ozarks hosts a diverse fish community and endemic species due to karst features creating numerous thermal/physical habitats. Shifts in temperature and flow due to climate or land use change could affect fish abundance/range through reduction of habitat heterogeneity. However, springs may mitigate these effects. In 2011, we examined the use of springs and the timing of movement to/from these habitats by Smallmouth Bass near Big Spring in the Current River, Missouri. We found movement between the spring and the river was driven by temperature. During winter, smallmouth bass inhabited the warmer water of Big Spring, and by March, moved into the river once temperatures were similar to the spring. Most fish moved less than 16 km from Big Spring. Twenty fish moved downstream of the spring with the largest movement of 51 km. Ten fish moved upstream of the spring with four moving more than 53 km. When river temperatures dropped below that of Big Spring in autumn, fish began returning to the spring. Our data suggests that springs act as winter refugia for Smallmouth Bass and possibly other centrarchids. It is critical that springs be protected to maintain thermal habitat heterogeneity needed for native fishes in Ozark rivers.

25940

Analysis of Factors Influencing Rock Bass Population Dynamics in a Missouri Ozark Stream

Joshua G Ward and Craig P Paukert

There has been an increasing interest in the management of rock bass (*Ambloplites rupestris*) in Missouri Ozark streams since the 1980's, and intensive management of rock bass in the Meramec River started when biologists observed increased mortality, decreased size structure, and few fish >200mm, and angler surveys suggested overexploitation. The Missouri Department of Conservation initiated a 200mm minimum length limit on Meramec River rock bass in 2008. Our objectives were to determine if rock bass abundance, size structure, growth, and mortality differed after the implementation of the minimum length limit. We also explored the influence of river discharge on year-class strength and recruitment. Rock bass abundance, growth and mortality did not differ before (2002-2005) and after (2010-2012) the minimum length limit regulation. However, year class strength decreased with increased high mean annual river flows, and decreased with greater variability in mean spring and fall flows, suggesting environmental factors such as river flows and recruitment may be affecting the utility of the length limit. Future rock bass management may need to consider the relationship between river flows, recruitment, and length limits.

25941

Climatic Variable Selection Across Space and Time: Development of a Pacific Salmon Migration Timing Forecast Model

Ben Staton, Troy M Farmer and Matthew J Catalano, PhD

Climatic variables are often related with biological quantities for the purpose of prediction or forecasting, however arbitrary periods are often chosen (eg, the average daily value for the month of February) based on *a priori* assumptions of system function. This approach is straightforward to implement, but may be subject to various pitfalls, namely a better window may exist or the optimal window may change over time. Additionally, climatic variables vary over space and some areas may perform better at prediction than others. Herein, we address these issues in the development of a run timing forecast model for Kuskokwim River Chinook salmon, located in western Alaska. Four environmental variables (land-based air temperature, gridded sea surface temperature [SST], gridded sea ice cover [SIC], and the Pacific Decadal Oscillation [PDO]) were chosen to inform the forecasting tool based on relationships that have been observed in other stocks in the region and availability at the required time (ie, before June 10). Temporal selection of predictors was conducted using a "sliding window algorithm" which evaluates all possible time periods for predictive ability. The spatial structure of SST and SIC was maintained by applying model-averaging across grid-specific relationships. All models were evaluated in a hindcasting framework starting in 1995. Preliminary results suggest that a climatic variable forecast model is preferable over a historical average (null) model. The sliding window algorithm and model-averaging were intuitive solutions to this complex variable selection problem as

they provided objective and performance-driven selections as opposed to arbitrarily selecting spatiotemporal windows

25942

Effect of Flow Variation on Hatch-Date Distributions and Daily Incremental Growth of Juvenile Black Bass in Two Southeastern Rivers

Steven Sammons, Laurie Earley and Matthew Goclowski

We examined the effects of flow variation on juvenile dynamics of fluvial specialist and habitat generalist species of black bass (*Micropterus* spp; Centrarchidae) in two southeastern USA rivers, one unregulated and one regulated by a hydropower dam Successful hatching in both rivers generally occurred when water levels became low and stable; however, hatching distributions were more consistent among years between species and reaches in the unregulated river compared to the regulated river Black bass hatching distributions were usually unimodal, with little evidence of spawning disruption, except for the generalist species in the reach of the regulated river with the highest flow variation Daily growth of black bass in the unregulated river was inversely correlated to flow variation in 3 of 4 comparisons, mostly driven by the generalist species, which experienced reduced growth when exposed to higher variation In contrast, black bass growth in the regulated river was inversely related to flow variation in only one reach Results from this study have demonstrated that variable flows resulting from either natural or anthropogenic sources have less of an impact on early-life dynamics of black bass than has been reported for other, less adaptable species

25943

A Review of Establishing and Maintaining Paddlefish Populations By Stocking

Brent Bristow and Jason D Schooley

Like many wide-ranging and migratory freshwater species, the American paddlefish (*Polyodon spathula*) has faced population declines, habitat fragmentation, and range reduction due to dams In fourteen states, paddlefish have been stocked to restore locally extirpated populations or to mitigate for habitat losses resulting in recruitment failure The Mississippi Interstate Cooperative Resource Association (MICRA) Paddlefish and Sturgeon Committee created a database in 1995 to house hatchery release and tagging data for paddlefish among 28 range states Historic (pre-MICRA) stockings were sparsely documented in the literature, although a more robust record of stocking data can be found beginning in 1988 The MICRA database reports the release of more than 27M paddlefish into 34 river systems within the Mississippi, Missouri, Ohio, and Gulf basins since 1988 Average total length at release was 296 mm (range 43 – 718 mm) and release size has trended upward through time Stocking events have largely been focused on the fringes of the species range Ohio (52%), Missouri (421%) and Gulf (391%), whereas the core of the range (Mississippi River) has only received 137% of stocked fish Thorough treatments of establishing and maintaining paddlefish population by stocking have been discussed in earlier documents; this paper endeavours to continue the discussion through the most recent trends

25944

Twenty-Five Years of Guadalupe Bass Management: Integrating Population, Habitat, and Watershed Approaches to Conserving and Promoting a Riverine Bass Fishery

Preston Bean, Timothy Birdsong, Megan Bean, Gary Garrett, Stephan Magnelia, Nathan Smith, Paul Fleming, Marcos J De Jesus and Dijar Lutz-Carrillo

Due to declines in Guadalupe Bass populations resulting from habitat degradation and hybridization with Smallmouth Bass, Texas Parks and Wildlife Department developed the "Guidelines for the Management of Guadalupe Bass" in 1991 In the ensuing 25 years, actions to achieve conservation objectives for Guadalupe

Bass have included stocking Guadalupe Bass fingerlings to reduce hybridization rates, conducting research to fill critical data gaps, restoring and protecting habitats in priority watersheds, and garnering support for conservation and restoration activities from diverse stakeholder groups In this presentation we highlight specific conservation efforts and results, discuss progress in achieving previously defined objectives, and discuss future actions and strategies for conservation identified in the recently developed Rangewide Management Plan for Guadalupe Bass

25945

Paddlefish Caviar: Trends in Global Value and Modern Tools to Safeguard Resources

Steven Fain, Deb Hahn, Brandon Brown, William Hintz and Marie Maltese

With the collapse of the Caspian and Black Sea sturgeon fisheries following the break-up of the Soviet Union in 1991, law enforcement investigations in the mid-western US encountered increased poaching of American paddlefish caviar throughout the Mississippi River basin In 1992, American paddlefish were included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Continued poaching pressure and increasingly limited stocks have led management agencies and the caviar industry to look for ways to increase paddlefish production through hatchery propagation and aquaculture Genetic surveys with nuclear microsatellite and mitochondrial markers have found that paddlefish exhibit modest but significant genetic structure with the consistent distinction of Tombigbee River, Mermentau River, Arkansas River and upper Missouri River populations in independent assessments At minimum, these four drainages include source populations for unique broodstocks and preliminary genetic testing has successfully linked questioned animals back to these sources Such tests suggest the eventual capability to sort wild from aquaculture sourced caviars and identify the geographic scope of poaching operations Additional surveys within principle drainages at high resolution with larger microsatellite panels and genotyping by sequencing methods may identify additional structure for cataloguing the genetic description of brood stocks, and provide a baseline for safeguarding genetic variation for sustained propagation Further, transcriptome characterizations of related sturgeon species have identified potential sex markers and extensive single-nucleotide polymorphism Similar applications may identify novel variation for forensic testing of paddlefish These developments will be discussed with respect to American paddlefish and the caviar trade

25946

Arkansas and the Bass Tournament Angler: What Have We Done for You Lately?

Colton Dennis

The Arkansas Game and Fish Commission (AGFC) has a long and successful history of working cooperatively with bass tournament anglers As early as 1990 the AGFC began collecting volunteer tournament weigh-in information which provides general bass catch and effort statistics from tournaments statewide Information collected is compiled for the use of both the fishery manager and the bass tournament director The AGFC also maintains a loaner program for tournament organizers who currently use our live-release boat and five live-release trailers located around the state Tournament anglers were instrumental in the development of live-release equipment by contributing necessary funding Since the 1990's, tournament anglers have been a source for pre-spawn Largemouth Bass broodstock for our nursery ponds and supplemental stocking program Most recently, bass anglers have played a vital role in the construction of four tournament weigh-in facilities by providing 25% in matching funds or in-kind labor towards the development of these facilities The AGFC's positive working relationship with bass tournament anglers continues to be instrumental in achieving various bass conservation efforts around the state

25948

Utility of Mining of Diverse Historic and Current Data Sources for Insights into Distribution and Ecology of American Eels in the Gulf of Mexico and Its Tributaries

Dean Hendrickson

Compilation of basic occurrence records of American Eel in Texas revealed not only a general paucity of data, but also biases of different sources, and overall, inaccessibility of many different sources of useful records. Methodical searching, mining, normalization and basic data cleaning across a diversity of resources provided a much better picture of temporal and spatial occurrences of the species than had readily available sources. Similar data mining and sharing by all researchers and managers could greatly improve overall understanding of the species in the GoM and its tributaries, and help focus monitoring and research efforts.

25949

Recruitment of American Eel (*Anguilla rostrata*) in Northeast Florida

Eric Johnson, Kim Bonvechio, Kelly Smith, Courtney Hackney and Clark Morgan

The American Eel (*Anguilla rostrata*) is a catadromous species of both ecological and economic importance to the western north Atlantic. Eel populations have been declining throughout their range prompting concerns over population and conservation status. We estimated annual glass eel recruitment (catch-per-unit-effort; CPUE) to assess historic trends in abundance and to examine the relationships between eel recruitment and environmental drivers at various temporal and spatial scales. Glass eels were collected in northeast Florida at a single fixed station at the Guana Dam in the Guana-Tolomato-Matanzas (GTM) National Estuarine Research Reserve on dark flood tides during winter from 2001-2016. Overall, we observed a significant decline in eel CPUE from a period of higher, but variable, abundance in early years (2001-2004) to a sustained period of low abundance from 2005 to present. At a local scale, recruitment was negatively correlated with both discharge and water temperature. The relationship between lunar phase and CPUE was variable among years, with increased CPUE associated with new moons in some years, but not in others. At an oceanic scale, CPUE was generally higher in years with increased primary productivity in the Sargasso Sea (Bermuda Atlantic Time-series Study; BATS). Further, we observed a highly significant relationship between annual CPUE and eel size (total length) in a given year which may result from faster growth and increased survival in years of high food availability. These results contribute to a growing literature on American eel early life history and recruitment dynamics, and are useful for agencies seeking to more effectively manage this important fishery species.

25950

Potential Paddlefish *Polyodon spathula* Entrainment and Passage in a Regulated Stream

Chelsea Gilliland, Michael Colvin, J Wesley Neal and Peter J Allen

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 gate at one of two outflows. A large population of Paddlefish persists in the 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 potentially impassable. In this study, we examined minimum stream flow requirements to allow passage of the largest Paddlefish present. To determine maximum size, we caught 63 Paddlefish using multifilament gill nets. Captured fish ranged from 1,011 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 cross-sectional 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 prevent Paddlefish entrainment, promote downstream fish passage, and inform future experimental flow released

25952

Genetic Management of the North American Paddlefish: Case Studies and Recommendations for Maintaining Diversity

Michael Schwemm, Edward Heist, PhD, Anthony Echelle, Allison Asher and Thomas Turner

River modification, non-native species, contaminants, climate change, fish passage and trade-offs associated with stocking are typical challenges facing fishery resources, not only among acipenseriforms, but freshwater fishes in general Understanding the resultant fluctuations in demography and their consequences on genetic variation has become an increasingly important consideration for long-term sustainability The relative ease of employing genetic markers appropriate to address these goals permits managers to evaluate past and ongoing genetic consequences of management actions The North American Paddlefish has both declined and persisted over much of its former range due to a combination of threats and its unique life-history Here, we present examples from the paddlefish fishery of the Arkansas and mainstream Mississippi rivers that exemplify genetic consequences of past and ongoing management, and thus afford a perspective on the future management of the species

25953

USFWS Status of At-Risk Aquatic Species

Cindy Williams

On September 1, 2016, the US Fish & Wildlife Service announced a seven-year work plan for ESA listing and critical habitat decisions This plan is intended to improve effectiveness and implementation of the ESA and provide for best possible conservation of our nation's imperiled wildlife, known as at-risk species In the southeast, three Service programs are cooperating in the conservation of at-risk species: 1) Ecological Services is conducting status assessments and making recommendations for listing species, 2) Fish and Aquatic Conservation (FAC) assess populations, and utilize unique skills from the Fish Technology and Health centers, and 3) National Wildlife Refuges assist with acquiring data on at-risk species as well as managing those species that occur on NWR lands

FAC, formerly known as the Fisheries Program, is composed of 2 subunits: National Fish Hatcheries (NFHs) and Fish & Wildlife Conservation Offices (FWCOs) The NFHs maintain ark populations, develop propagation techniques and life history requirements, and work with the FWCOs and the Fish Technology Center to assist with the development of cryopreservation techniques and genetic management plans FWCOs conduct habitat and population assessments to guide federal trust species management Additionally, the Southeast Region FAC, through its region wide fish habitat and fish passage programs, has developed a Regional Aquatic Habitat Team to implement conservation delivery associated aquatic habitat fragmentation and overall aquatic habitat condition Active involvement in several key components of Strategic Habitat Conservation position the FAC program to improve information gathering for at-risk species and quickly deliver conservation actions such as habitat improvement and species propagation, if appropriate Examples of successful projects will be presented

25954

American Paddlefish Condition in the Lower Missouri River, before and after the Bigheaded Carp Invasion

Duane Chapman, Wyatt Doyle, Jason Goeckler and Joseph Deters

Crustacean zooplankton declines of 50- 90% after the introduction of Silver Carp and Bighead Carp (together, the bigheaded carps) have been widely reported in the literature Crustacean zooplankton are generally thought to be a primary food of American Paddlefish Previous research has shown that growth of paddlefish in ponds was adversely affected by bigheaded carps, and also that condition of Gizzard Shad, another native planktivore, declined in the Lower Missouri and Illinois Rivers after the invasion of bigheaded carps We compare condition of American Paddlefish collected from the Missouri River (data extracted from multiple sources) before and after the bigheaded carp invasion, and we also examine condition of bigheaded carps from the Lower Missouri River over the years since their invasion Through time, condition in bigheaded carps has declined substantially, suggesting that increasing populations may have over-exploited available planktonic resources In contrast, American Paddlefish do not seem to have suffered a similar decline in condition We provide testable hypotheses as to how American Paddlefish are able to retain condition in the presence of a large population of bigheaded carp

25955

Atlantic and Shortnose Sturgeon Recruitment in the Savannah River, Georgia

Alex Cummins and Douglas L Peterson, PhD

Atlantic and Shortnose Sturgeon were once abundant along the Atlantic Coast of North America; however, overfishing and habitat loss have resulted in major population declines and both species are now listed under the US Endangered Species Act Quantified recruitment data are desperately needed to evaluate species recovery for many populations of both species, particularly in the Southeastern US The objective of this study was to quantify annual recruitment of both Atlantic and Shortnose Sturgeon in the Savannah River, Georgia, by estimating annual abundances of age-1 juveniles over a 4-year period During the summers of 2013–2016, we used entanglement gears to sample juveniles of both species throughout the Savannah River estuary Ages of captured juveniles were determined using length-frequency histograms that were verified with fin ray cross sections from a subsample of the captured fish Annual abundances were then estimated with Huggins closed-capture models in RMark Our results showed that the Savannah River contained 528 age-1 Atlantic Sturgeon in 2013, 616 in 2014, 623 in 2015, and 924 in 2016 Over this same period we estimated annual cohorts of age-1 Shortnose Sturgeon to be 81 in 2013, 270 in 2014, 245 in 2015, and 28 in 2016 These findings suggest the Savannah River populations of both species are likely the 2nd largest within the Southern Atlantic Future estimates of annual recruitment for both species will provide quantified information regarding population trends as well as helping to identify key environmental variables affecting recruitment in the Savannah River system

25960

Over Winter Survival and Habitat Use of Gulf Sturgeon in the Apalachicola River, FL

Nathaniel Hancock, Andrew Marbury, Adam Kaesar and Douglas L Peterson, PhD

The Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) is listed as threatened due to the impact of chronic overfishing and habitat degradation that occurred throughout the 20th century Although recent studies have provided important information about critical habitats in natal rivers, marine habitat use in the Gulf of Mexico are poorly characterized The objectives of this study were to define marine habitat use and to quantify overwinter survival of age-1 Gulf Sturgeon in the Apalachicola drainage During the summers of 2014 and 2015, we captured and tagged 10 age-1 juveniles with sonic transmitters and monitored their seasonal movements using a passive acoustic receiver array deployed throughout the Apalachicola Bay and Estuary These juveniles out-migrated to the Apalachicola Bay during September and November once water temperatures had dropped below 25°C Acoustic detections of tagged fish obtained during their return

migration in spring, combined with annual recaptures of tagged juveniles revealed that overwinter survival was 89 and 78% in each respective year Telemetry data also revealed that a variety of migration routes were used by young juveniles, including the mainstem Apalachicola River, two distributaries, and the intracoastal waterway These findings suggest that seasonal patterns of juvenile migration and overwinter habitat use are relatively consistent among years and likely mediated by seasonal changes in environmental conditions Future studies are needed to better understand the critical linkages between overwinter habitat use and juvenile survival within the Apalachicola population

25961

Population Responses of Shovelnose Sturgeon *Scaphirhynchus platyrhynchus* in the Arkansas and Red River Basins to Landscape Characteristics

Josh Johnston, Shannon K Brewer and Thomas A Worthington

Abstract- Shovelnose Sturgeon once persisted throughout the Mississippi River basin westward to New Mexico Due in large part to habitat fragmentation, the species is now extirpated in New Mexico and relic populations in the Arkansas and Red rivers of Oklahoma make up the southwest extent of the species range, though relative success in each of the basins appears to differ Little is known about these populations, but understanding factors related to their current distributions may facilitate conservation or recovery options We compiled available occurrence records for Shovelnose Sturgeon from 1997 to 2016 within the two basins from museum collections, species databases, state agencies, angler reports, and recent collections from the Arkansas River, Oklahoma Using a vector-based approach within MaxEnt, we developed three models to estimate the current distribution in: 1) the Arkansas River basin, 2) the Red River basin, and 3) both basins combined We limited our predictions to fourth-order and larger streams Variables included in the models included structuring variables (climate, soils) and factors that describe available habitat, fragment length for egg and larvae drift, and anthropogenic disturbance The results of these models will guide future management strategies for Shovelnose Sturgeon, as well as identify the ecological conditions necessary to promote species persistence at the western extent of their range

25962

Movements and Demography of Blue Sucker in the Lower Colorado River, TX

Matthew R Acre, Timothy Grabowski, PhD, Dakus Geeslin and Allison Pease

Alteration of flow regime, eg, timing, duration, flashiness, and magnitude of discharge, has serious implications to fluvial specialists inhabiting large rivers that have evolved flow-dependent life histories Blue Sucker *Cyprinella elongatus*, is one such species that is considered vulnerable throughout its range due to its habitat requirements and life-history traits However, the relationships between stream discharge and habitat use and recruitment in Blue Sucker have not been thoroughly examined, particularly in the southern portions of its range The primary objectives of this research were to assess effects of varied streamflow levels, regulated by water releases from upstream reservoirs, on Blue Sucker movement, habitat use, and recruitment in the lower Colorado River downstream of Austin, Texas Radio telemetry was used to characterize movement of Blue Sucker in response to river discharge changes Results suggest large scale movements are related to season and flow regime prior to a relocation event Furthermore, home range and minimum displacement are correlated with riffle density Additionally, fin-ray sections (n = 58) taken from specimens during mark-recapture efforts were used to estimate age, and associate relative year-class strength with historical flow regimes Preliminary results suggest the population in the lower Colorado River has had limited recruitment, and stronger cohorts appear to be associated with years with higher discharge This work will provide critical information regarding conservation and protection of Blue Sucker in Texas, and inform water management policy decisions affecting the lower Colorado River with implications to instream flows and freshwater inflows to coastal bays and estuaries

25968

Use of Innovative Trawling Methods (Butterfly Skimmer and Surface Trawl) for Paddlefish Monitoring

Wyatt Doyle

As gear development efforts have increased to target Asian Carp, new trawling techniques have been developed that have application to paddlefish population monitoring. Over the course of several years while sampling for Asian Carp in tributaries of the Missouri River, numerous paddlefish have been detected from age-1 to adult sizes in a Butterfly Skimmer (electrified and non-electrified) and a surface trawl. Some additional work has shown success in detection of paddlefish in small reservoirs suggesting these novel trawls could be incorporated into a State monitoring gear suite to aid in assessing year class strength or assisting in overall capture of adults. Gear description and application of use are described along with length frequency of captured fish as a picture to what might be possible if fully incorporated into a reservoir sampling strategy.

25970

Independent Effects of Temperature, Dissolved Oxygen, and Swimming on Survival of Angler-Caught Largemouth Bass

Kevin R Keretz, Harold L Schramm Jr, Colin P Dinken and Peter J Allen

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 that require release of angled bass. Yet, the independent effects of water temperature, live well dissolved oxygen, and angling stress on survival have not been measured. This controlled laboratory study measured the effect of ambient temperature (17, 21, 25, 29 and 33 °C) and simulated angling (1 and 3 min forced swimming) on 5-day survival of caught-and-released Largemouth bass >300 mm and the survival of Largemouth Bass >300 mm in simulated tournament conditions at different ambient and live well (LW) temperature differentials (ΔT of -4, 0, and +4 °C), LW dissolved oxygen (DO) concentrations (2, 55 and 85 mg/L), and different levels of angling stress. Survival of caught-and-released Largemouth Bass was 100% at ambient temperatures ≤ 29 °C and ranged from 70-100% at 33 °C after 1 min of forced swimming; survival was significantly lower at 29 °C but not at 25 °C after the 3-min swim. Survival of fish subjected to a 1-min swim and held in LWs for 8 h with LW DO ≥ 55 mg/L (80-100% saturation) 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 $\Delta T = +4$ °C. Survival decreased in fish subjected to a 3-min swim and held in LWs for 8 h with LW DO 80-100% saturation at an ambient temperature of 29 °C but not at 25 °C. Following the 3-min swim at 29 °C, fish survival was significantly higher at LW $\Delta T = -4$ °C. Survival following all LW DO treatments was $\geq 80\%$ at ambient temperatures ≤ 29 °C, significantly decreased at 33 °C, and was 30% at 33 °C and 2 mg/L DO. 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 ≥ 55 mg/L when the fish are landed quickly and handled carefully. Largemouth Bass survival decreases when fish are subjected to longer swimming stressors.

25973

An Alternative Format for a Professional Bass Fishing Tournament: The Story of the Toyota Texas Bass Classic

Dave Terre and Lenny Francoeur

The Toyota Texas Bass Classic (TTBC) was a world championship fishing event established to promote the conservation efforts of the Texas Parks and Wildlife Department (TPWD). Ten pioneering events (2007-2016) were made possible through a partnership between Gulf States Toyota, professional anglers and TPWD. They employed a "catch-weigh-immediate release" (CWIR) format where bass caught during the tournaments were weighed by trained on-board judges and immediately released; different than typical stage weigh-in practices.

Events leveraged new partnerships and communication opportunities for TPWD They featured outdoor expos, music entertainment and generated funding to support programs CWIR provided TPWD opportunity to promote managed fisheries without exempting tournament anglers from size and bag limit restrictions Events showcased fishery management practices on three reservoirs (Fork, Conroe, and Ray Roberts) and promoted the benefits of proper fish care and handling The TTBC's drew over 200,000 on-site spectators, were nationally televised, and were economically significant A single 3-day event in 2008 had a statewide and local area economic impact of \$2,965,963 and \$1,725,109, respectively Events generated \$25 million to support TPWD outreach programs Funds grew TPWD's small urban lake stocking program (Neighborhood Fishin'), reaching an estimated 50,000 new anglers per year Our CWIR format provided a foundation for similar practices developed and used by Major League Fishing; an exciting new tournament fishing series In 2016 the TTBC merged with the Bassmaster BASSFest, creating a new Bassmaster Elite Series event called the Toyota Bassmaster Texas Fest to benefit TPWD This new event holds promise to expand TPWD's reach to anglers on Texas fishing opportunities, CWIR format, and fisheries management programs, while continuing to fund important department programs

25976

A Path to Partnership Among Fishery Groups

Robert Cartlidge

How to engage\retain anglers making them lifetime license buyers has been widely discussed for decades The Bass Federation, INC (TBF) has participated in many of those, in our opinion there are a few keys to success

The current "Buzz" or emphasis is on College, High School and youth fishing While these programs are not "new" they are assisting in "bridging the gap" in license sales after years of investment and effort by all to get it to this point and it is the main reason why TBF was the first to found or co-found these programs nationwide in the fishing industry more than a decade ago

We attempted to lay a ground work for others to follow not only for our own future membership growth but for the growth of our industry and to spur a growth in people who have a love for the "out of doors" However, we would caution not to overlook the adult segment which also has great growth potential left

The 8 keys to success in getting and keeping people in the outdoors, specifically competitive fishing in our opinion is to; **1) Make it fun, 2) Make it easy, 3) Make it affordable** - hold costs down, it does not have to be about money! **4) Build relationships\Know your audience** – make it a family affair and the link between competitive fishing and fisheries managers should be a PERSONAL relationship **5) Feed, nurture, support the competition side-** Competitive events and the competitive nature needs to be fed and supported, both for the anglers and for the resource **6) Invest in competitive infrastructure\build partnerships** - We can do more together **7) Promote the Resource** - The number one goal of any fisheries, resource, or land manager should be to get people to use that resource otherwise your job is not necessary! **8) "They" is "us"** - We have met the enemy, it is "Us"

Keeping people fishing year after year and buying multiple fishing licenses year after year in multiple states is not easy, competitive fishing organizations are experts at it and no one does it better, managing fish, fisheries and resources is not easy but fisheries professionals are experts at that and no one does that better, **IF** we can join together each bringing expertise and resources each group has the resources themselves will benefit from it

25977

Growth, Mortality, and Density of Smallmouth, Largemouth, and Spotted Bass in Three Northeastern Oklahoma Streams: The Beginning of a Long-Term Monitoring Project

Matt Skoog, Anthony Rodger, Trevor Starks and Donald King

The Oklahoma Department of Wildlife is responsible for managing sport fish populations in streams across Oklahoma. Smallmouth *Micropterus dolomieu*, Largemouth *Micropterus salmoides* and Spotted Bass *Micropterus punctulatus* are (herein all species combined are referred to as BB) are among the most popular sportfish in streams in northeastern Oklahoma. Collecting growth, abundance, and mortality data will allow for the evaluation and recommendation of regulations. Initial BB monitoring surveys were conducted in Baron Fork, Illinois River, and Sallisaw Creek of northeastern Oklahoma. Boat or barge electrofishing was used to collect all species of BB which were then weighed, measured and aged using otoliths. Visual surveys were conducted when water clarity was sufficient, and the counts were used to calculate densities of BB. The results of the initial year of this project were compared to historical data collected in the early to mid-1990's. Initial results of this monitoring project, though highly variable, suggest that growth rates at present for Smallmouth Bass are comparable to historical surveys, annual mortality has slightly declined, and densities are slightly higher. Smallmouth Bass growth rates were highest in Illinois River, intermediate in Baron Fork, and lowest in Sallisaw Creek. Total annual mortality rates were similar for all three streams. Spotted Bass were most common in Sallisaw Creek, while Largemouth Bass were most common in the Illinois River. Results of this continued monitoring effort will allow for improved management of BB populations in northeastern Oklahoma streams.

25980

Distribution and Movement of Columbia River Redband Trout, *Oncorhynchus mykiss gairdneri*, in an Intermittent Southern Idaho Stream

Sarah Walsh, Chris Walser, Matthew Campbell and Helen Neville

The Columbia River Redband Trout *Oncorhynchus mykiss gairdneri* is native to the Columbia River Basin east of the Cascades. The genetic structure of many Redband Trout populations in this region has been negatively affected by introgression with hatchery stocks and by isolation due to migration barriers. The objective of our research was to describe Redband Trout distribution, movement patterns, and evaluate the potential effects of a road culvert on trout movement in Dry Creek, a tributary of the Boise River, characterized by seasonal fluctuations in temperature and flow. In summer 2015, Redband Trout were collected throughout Dry Creek via electrofishing. Fin clips were taken from 243 individuals. Genetic analyses of fin clips were conducted at the Idaho Department of Fish and Game, Fish Genetics Laboratory in Eagle, Idaho. Each fish was genotyped at 186 single nucleotide polymorphisms (SNPs). Genetic analyses using the program Colony identified 24 trout families (three or more full-siblings). No full siblings were observed on opposite sides of the culvert. One family of young of year fish was found below the culvert—providing new evidence that lower reaches of Dry Creek are used for spawning. Mean distance of trout within families was 424 m. The continued monitoring of this population will assist efforts to design an effective watershed management plan.

25985

Catchment Scale Determinants of Nonindigenous Minnow Richness in the Eastern United States

Stephen Midway, Brandon Peoples, Tyler Wagner, PhD and Tyrell DeWeber

Understanding the drivers of biological invasions is critical for preserving aquatic biodiversity. Stream fishes make excellent model taxa for examining mechanisms driving species introduction success because their distributions are naturally limited by catchment boundaries. In this study, we compared the relative importance of catchment-scale abiotic and biotic predictors of native and nonindigenous minnow (Cyprinidae) richness in 170 catchments throughout the eastern United States. We compared historic and contemporary cyprinid distributional data to determine catchment-wise native/nonindigenous status for 152 species. Catchment-scale model predictor variables described natural (elevation, precipitation, flow accumulation) and anthropogenic

(developed land cover, number of dams) abiotic features, as well as native congener richness Native congener richness may represent either biotic resistance via interspecific competition, or trait preadaptation according to Darwin's naturalization hypothesis We used generalized linear mixed modeling to examine evidence supporting the relative roles of abiotic and biotic predictors of cyprinid introduction success Native congener richness was positively correlated with nonindigenous cyprinid richness and was the most important variable predicting nonindigenous cyprinid richness Mean elevation had a weak positive effect, and effects of other abiotic factors were insignificant and less important Our results suggest that at this spatial scale, trait preadaptation may be more important than intrageneric competition for determining richness of nonindigenous fishes

25986

Summertime Management and Conditions of Live Wells By Black Bass Club Tournament Anglers in Florida

Jared Militello

The effects of catch and release angling associated with competitive black bass tournaments, most notably the physiological effects and associated mortality of hooked fish, have been at the center of research for the last several decades However, few studies have focused specifically on documenting angler live well management practices, which inherently will vary based on an individual's knowledge, preferences or even boat specifications Live well management procedures result in different live well water quality environments, some of which may exacerbate sub-lethal stressors and mortality during times of prolonged confinement The current study examined live well operation by black bass anglers from small club tournaments during stressful summertime conditions Prior to launch, HOBO temperature data loggers were placed in angler's live wells at 14 different tournaments representing all geographic regions of Florida Additionally, the same loggers were placed at two reference locations (pelagic and release sites) within the lake to serve as a baseline for comparing temperature regimes Anglers were instructed to operate their live wells as they normally would over the course of the fishing day, and then prior to weigh in a short interview survey was conducted, and end of day water quality parameters were measured before live well water was emptied Mean live well temperature across all tournaments was 29.53°C (± 2.28 SD), while mean lake temperature across all tournaments was 30.52°C (± 1.38 SD) Tournament anglers who only used the flow through operation throughout the day had higher mean live well temperatures ($30.05^{\circ}\text{C} \pm 1.75$ SD) compared to those who strictly used just their water recirculation system ($28.49^{\circ}\text{C} \pm 3.13$ SD) Initial results indicate a statistically significant difference between temperatures at the lake level ($p = 0.0001$), but no significant difference was found between temperatures in live wells and two lake locations ($p = 0.0809$) Although results show that live well temperatures were not elevated compared to in-lake temperatures, further analyses must be conducted to look at the effects of live well operations on other water quality parameters such as dissolved oxygen and ammonia levels, in order to provide best management practices to club anglers who participated in this study

25992

Using Cohort Age Analysis to Understand Spawning Patterns in Atlantic Sturgeon

Hudman Evans Jr, Adam Fox, Katherine Brinson, Nathaniel Hancock, Alex Cummins and Douglas L Peterson, PhD

The Atlantic Sturgeon is an anadromous fish that historically occurred along the Atlantic coast of North America The species experienced major population declines during the 20th century, resulting in its 2012 listing under the Endangered Species Act Although assessment of spawning runs is essential to evaluating species recovery, the timing of spawning is still unknown for many populations Recent telemetry studies suggest that dual spawning runs may occur in some rivers, and some researchers have suggested that bimodal length-frequency distributions in juvenile populations provide corroborating evidence of dual spawning Unfortunately, age analyses of juveniles are largely lacking so interpretation of length-frequency data of juvenile cohorts is ambiguous The objective of this study was to determine the length-at-age relationship of co-occurring juvenile cohorts of Atlantic Sturgeon within the South Atlantic distinct population

segment During the summers of 2015 and 2016, we sampled juvenile Atlantic sturgeon in the Ogeechee Georgia, where previous studies had documented a bimodal distribution in the juvenile population Cross-sections of pectoral fin rays obtained from a random subsample of 44 juveniles (TL range: 210 to 432 mm) were examined to estimate the age of each of individual based on the number of annuli present Results indicated that all juveniles within the smallest mode of the length-frequency distribution (<325 mm TL) had zero annuli, while those >325 mm had a single annulus Comparisons of these data with similar length-frequency data from other South Atlantic rivers suggest that only one annual spawning run occurs within the South Atlantic DPS

25993

Development of Techniques for Assessment of Population Characteristics of the Diamond Darter

Austin Rizzo, Donald Brown, Stuart A Welsh and Patricia Thompson

Population monitoring is an essential component of endangered species recovery programs An effective monitoring design is needed for the federally endangered Diamond Darter *Crystallaria cincotta* to improve our understanding of its distribution and population trends To accomplish this, research is needed to determine if survey efforts can be improved by increasing the probability of detection The primary objective of this study was to determine if there are seasonal and diel patterns in Diamond Darter detectability during population surveys In addition to temporal factors, we also assessed habitat variables that might influence detection We used *N*-mixture models to estimate site abundances and relationships between covariates and detectability The results of this study will allow researchers and agencies to maximize detection probability when surveying populations, resulting in greater monitoring efficiency and likely more precise abundance estimates

Length measurements are an integral part of age/length data used for fish population studies For those species that are rare, threatened, or endangered, using a nonintrusive method to obtain measurements may be imperative in allowing for continued study of the organism We used photogrammetric techniques to obtain length measurements of the Diamond Darter We also evaluated the photogrammetric technique on two surrogate darter species, where total length and body length were obtained from direct and photogrammetric measurements

Together these projects have been useful in the assessment of the population characteristics of the Diamond Darter This information will be beneficial for future management and conservation efforts of this federally endangered fish

25996

Florida's Bass Tournament Permitting System: The Evolution, Benefits, and Partnership Efforts to Better Manage Fisheries

Eric Johnson

The Florida Fish and Wildlife Conservation Commission (FWC) first instituted a permitting system for competitive black bass tournaments in 1975 to identify intensively fished resources and determine if tournaments needed to be regulated Data collected from permitted tournaments provided valuable information to researchers and managers The permitting system and tournament monitoring were discontinued in 1982 after biologists concluded that competitive angling had little effect on Largemouth Bass populations A second tournament permitting system began in 1992, concurrent with a change in the statewide daily bag and size limits for black bass Agency staff again required permits and catch data for bass tournament organizers and results indicated minimal impacts on bass fisheries Since that time, bass tournament organizers that apply for a voluntary permit have been allowed to exempt their participants from bass size regulations on most public waters, provided specific rules are followed The tournament application and reporting process have become

more efficient with advances in technology and can now be completed online Electronic tournament data is very inexpensive and has been used to evaluate fishing effort, success, and trends in quality-sized bass FWC staff have always recognized the importance of bass tournaments and the value of tournament data in helping to manage fisheries resources throughout the state Agency partnerships with tournament representatives have benefitted relations with stakeholders like anglers; encouraging angler support for management programs such as Florida's new statewide black bass size regulations

26001

New Approaches to Management of Commercial Paddlefish Fisheries

Steven J Rider, Dennis Riecke, Darrin Hardesty and Jeffrey Quinn

The overexploitation of sturgeon species worldwide for caviar has resulted in fishery closures with several of these species being listed under the Endangered Species Act (ESA) With these closures, attention has shifted to Paddlefish (*Polyodon spathula*) for the production of caviar State fish and wildlife agencies are increasingly being pressured to open and extend commercial paddlefish fisheries in their respective jurisdictions State fisheries agencies in Alabama, Arkansas, and Mississippi have introduced new and diverse management strategies for the long-term conservation of their Paddlefish fisheries High vulnerability to overharvest has prompted the agencies opening new fisheries to establish regulations which exert a high level of control over these fisheries These diverse management approaches include: regulations to limit harvest frequency, alternating opening seasons for a particular water body, limited time and area openings, harvest quotas, high length limits, gear restrictions, and closed zones Effort has been restricted through the use of limited entry and high license fees In order to understand the fisheries better and increase regulation compliance, states have used mandatory and expanded reporting of comprehensive catch and biological data by harvesters, mandatory attendance at regulation meetings, and increasing penalties and points for violations Effective management requires the ability to be flexible and adaptive to change regulations over time Each state has tailored its regulations to their political and biological situation We contrast the less regulated Arkansas fisheries with highly regulated fisheries in Alabama and Mississippi and provide pros and cons of the different approaches

26002

Multi-Jurisdictional Management of a State-Managed Fish: MICRA Moving Forward

Kirk Hansen and Greg Conover

Paddlefish historically occurred in 24 Mississippi River Basin states Population status, classification, and state management practices vary widely throughout the basin The migratory nature of this large river species has long been recognized as a challenge to the state-by-state management strategies and the range-wide sustainability of the species Interjurisdictional paddlefish management has increased substantially over the last several decades, expanding from small local collaborations to broader sub-basin level partnerships The formation of the Mississippi Interstate Cooperative Resource Association (MICRA) Paddlefish/Sturgeon Committee in the early 1990s provides an important forum for information exchange and development of basin-wide, interjurisdictional paddlefish management strategies The states have developed or discussed detailed, collaborative paddlefish management plans for the Upper Mississippi River, Lower Mississippi River, Ohio River, and Missouri River sub-basins

Paddlefish caviar remains in high demand in both domestic and international markets The US Fish and Wildlife Service works with the commercial harvest states for the export of paddlefish roe/caviar which are protected as Appendix II species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Interjurisdictional management of commercial fisheries is an area of concern and a high priority for MICRA along with assisting commercial harvest states to develop range-wide management objectives and targets It is critical for the agencies to develop sufficient resources to intensively assess and

monitor population metrics basin-wide through data collection and modeling for management of sustainable populations Looking forward, other long-term concerns include potential impacts of aquatic invasive species and climate change

26004

A Hydroacoustic Evaluation of the Santee-Cooper Lakes and Implications of the Dynamics of Threadfin Shad Abundance to the Food Web

James Bulak, Barbara Taylor and Donald Degan

A combination of hydroacoustics and gill netting was used in the summer and fall of 2013-2015 in lakes Marion and Moultrie to define the abundance, growth, and migration of pelagic fishes < 200 mm TL Results showed that threadfin shad *Dorosoma petenense* was the dominant species in the system, numerically accounting for 80% of the experimental gill net catch, which was used to define species composition Young of year blueback herring *Alosa aestivalis* and American shad *Alosa sapidissima* each comprised between 5 and 10% of the catch The average annual biomass of fishes was estimated at 87 kg/ha, but was as low as 28 kg/ha in 2014 and as high as 170 kg/ha in 2015 A large fluctuation in the abundance of threadfin shad, perhaps due to an abnormally cold winter, appears to have the ability to affect the overall fish population of lakes Marion and Moultrie Current food web and bioenergetic evaluations indicate that plankton levels are relatively low, benthos dominate the biomass, especially in upper Lake Marion, and plankton abundance is not sufficient, by itself, to support the threadfin shad population

26007

Hydrologic Factors Associated with Detection and Occupancy of Riparian Areas By Asian Swamp Eel in the Chattahoochee River System, Georgia

Jeffery Johnson and James M Long, PhD

Asian swamp eels (*Monopterus albus*) were recently discovered in backwater marsh areas of Bull Sluice Lake, an impoundment of the Chattahoochee River, Georgia *Monopterus albus* has notoriously difficult to sample in this environment where this introduced population occupies a dynamic hydrologic environment influenced by releases for hydropower production We used occupancy modeling to estimate detection and occupancy probabilities under variable habitat and sampling conditions Abiotic and biotic model covariates were collected at sampling locations and incorporated in a suite of 4 detection and 27 non-collinear occupancy models Top models included hydrologic covariates for both detection and occupancy Mean detection probability was 0.174 ± 0.039 and increased with water depth and temperature ($p < 0.05$) Two sub-global models of occupancy showed no evidence of lack-of-fit ($p > 0.42$), and permutations of these models showed probability was influenced by vegetation, depth, substrate, distance from invasion point, and mean and variance of water temperature Geostatistical interpolation methods were used to estimate covariates in areas not sampled, which allowed occupancy probabilities to be back-transformed from model averages to the entire riparian area of the study site This study demonstrates the importance of considering hydrologic factors when determining detection and occupancy probability of introduced species

26011

Historical Environmental Data May Assist in the Determination of Timing of Sampling, Brood Stock Collection, Hatchery Pond Preparation, Plankton Abundance, and Stocking

Steve O'Donnell

Effective real-time environmental data sources which influence annual ecological succession are underused in the management of fishery resources Reduced sampling variability, improved efficiency in brood stock

collection and hatchery production, and enhanced angler satisfaction may be obtainable if these data sources are fully used Predicting the timing of ecological succession using historical data should provide managers with information which could lead to a better understanding of the two to three week window of variability often observed in our data sets Patterns of obtaining a quality sample or a successful brood collection effort may be predicted based on current measurable weather patterns The initial phase of this project is to identify and understand the relationships between current environmental conditions and their effect on annual ecological succession Placement of tidbits in 13 reservoirs during 2016 provided water temperature data to assess possible significant geographical and physiological differences between reservoirs Weekly mean water temperature differences of seven degrees were observed in potential walleye brood stock lakes between northwest and southeast lakes during 2016 Five degree mean weekly water temperature differences were observed in two similar reservoirs in southwest Oklahoma Base line water temperature, plankton abundance, and hatchery production date, should prove useful for predicting future sampling success, brood stock collection, hatchery production, and optimize stocking success If ecological succession correlations are identified, models by reservoir and hatchery could be developed

26014

Food Habits of Introduced Flathead Catfish in a Chesapeake Bay Tributary

Jason Emmel

The flathead catfish *Pylodictis olivaris* is a large, highly piscivorous predator native to the central United States Many introduced populations have become established as the result of deliberate stocking and unauthorized introductions Management agencies are addressing concerns about the negative impacts on imperiled species, native fish communities, and traditional fisheries often associated with the introduction of this apex predator We studied the trophic relations of introduced flathead catfish in the tidal James River, Virginia to 1) quantify predation of imperiled species 2) identify spatial and temporal patterns in prey utilization and 3) produce a comprehensive description of diet to inform future management decisions A total of 731 stomachs were examined between 2013 and 2015 and 27 prey categories were identified White perch *Morone americana* occurred most frequently (362%) and comprised the greatest percentage by weight (339%), followed by gizzard shad *Dorosoma cepedianum*, representing ~28% by frequency of occurrence and weight *Alosa* spp (including imperiled shad and herring species) occurred in >16% of stomachs during spring, but were only consumed by large individuals Trophic level (421) and omnivory index (032) values are consistent with literature and support previous assertions that flathead catfish are specialized apex predators We present the first comprehensive diet description of flathead catfish in the tidal James River Our findings further our understanding of the trophic role of introduced predators and provide a benchmark reference for future fisheries management and conservation in Virginia

26016

Distribution and Aquaculture Status of American Paddlefish in China

Hong Ji and Bangxi Xiong

A total of 3,000 American paddlefish (*Polyodon spathula*) larvae was first introduced into China from the United States in 1988 Importation of fertilized eggs has continued In 2001, successful spawning of broodstock raised in China was achieved in Hubei Province Now, paddlefish is cultured in more than 10 provinces in China, such as Hubei Province, Sichuan Province, south area of Shannxi Province, which are located in Yangtze River basin, also Guangdong Province, which is located in Zhujiang River basin Feeding habits of paddlefish are similar to that of bighead carp, a traditional fish species produced by Chinese aquaculture Therefore, Chinese fish farmers rear paddlefish as a substitute species of bighead in their production systems Usually paddlefish fingerlings (10cm TL) are cultured to market sizes (06-075 kg) in ponds or cages in reservoirs Because of the limited supply of fingerlings and lack of equipment to catch paddlefish from large bodies of water, reservoir ranching as a production system has not been well developed Also, concerns over hybridization between American paddlefish and Chinese paddlefish in Yangtze River have limited

development of the ranching model for paddlefish In ponds, paddlefish are reared in poly-culture as either the primary species stocked at 2,400-4,800 fish/ha or as a secondary species to grass carp and stocked at 900-3,600 fish/ha In 4x5x25m net cages suspended in reservoirs, the stocking rates are 15-40 fish/m² if prepared diets are fed Stocking rates are reduced to 1-5 fish/m² for fish fed natural zooplankton diet which is promoted by addition of light There is no artificial diet designed for paddlefish culture, therefore extruded feeds for snakehead with a protein level of 39-44% are used Paddlefish in China are cultured primarily for meat rather than roe Acceptable market size can be reached within six months on prepared diets; whereas, it takes one year on natural diet Paddlefish are usually marketed live, as no processing industry has developed Due to its characteristic of low tolerance to hypoxia, long distance transportation of live market size paddlefish is relatively limited A few paddlefish are also raised and marketed as an aquarium fish There are currently four large paddlefish hatcheries in China, located in Hubei Province and Sichuan Province, with smaller facilities newly established Total production is approximately 10M paddlefish fingerlings per year Therefore, the short supply and high price of fingerlings are still the major factors limiting the expansion of paddlefish production in China

26017

A Review of Factors Affecting Natural Reproduction and Recruitment of Paddlefish: Hypotheses and Lessons from Acipenseriformes

Dennis Scarnecchia, Steven McAdam and Jason D Schooley

Successful paddlefish management is strongly predicated on understanding paddlefish recruitment and factors leading to strong and weak year classes This review is designed to update current knowledge based primarily on paddlefish studies, but also with reference to results from sturgeons Paddlefish studies in North Dakota indicate that although reproduction, as evidenced by age-0 fish at least 100 mm fork length in August, have occurred in most years over the period 1992-2016, successful recruitment has been much less reliable, leading to episodic recruitment and only two strong year classes over that period Similar episodic, although less extreme, has been documented in Oklahoma, with only 2 or 3 strong year classes over the period since the late 1990s Studies in other localities often suggest more regular and consistent recruitment pattern, although a cautious interpretation is required in that migrations of fish of different stocks may mask irregular recruitment Preliminary investigations have implicated higher river discharges in spring and higher reservoir levels as providing more favorable recruitment conditions Sturgeon studies have also implicated higher discharge as contributing to more successful reproduction and recruitment Studies have also indicated that increases in fine sediments are associated with lower reproductive success Because paddlefish and sturgeon use reservoir habitat differently, factors specifically limiting reproductive success and recruitment in sturgeon and paddlefish may also differ in some cases Future studies would also benefit from distinguishing factors affecting reproductive success to age-0 from those affecting recruitment, ie, where recruits have a high probability of contributing to the future harvestable population

26018

Paddlefish Life History: Advances and Applications in Design of Harvest Management Regulations

Dennis Scarnecchia, Jason D Schooley, Kenneth M Backes and Aaron Slominski

In the past decade, advances in our understanding of paddlefish life history have provided additional insight into what is needed for sustainable harvest management of this long-lived species Recovery of known-age fish in some stocks has enabled stock assessment biologists and managers to not only validate ages of individual fish, but to begin to validate the entire life histories A framework for potentially recruited paddlefish life history can be broken into five stages: 1) immature, 2) maturing, 3) somatic growth and reproduction, 4) prime reproduction, and 5) senescence to death These stages involve measureable changes in growth in length and weight, gonadosomatic index (GSI), gonadal fat storage (GFBs), reproductive periodicity, natural mortality rates, and, in some cases, fish migrations Stages 2-5 are typically initiated at younger ages for males than for females As a result of metabolic demands on paddlefish, the species tends to progress

through these life history stages more rapidly in southern stocks, inhabiting warmer waters, than in northern ones, inhabiting colder waters Lifespans in more northern stocks tend to be 2-3 times longer than southern stocks Natural mortality is also typically lower in northern stocks These differences necessitate fundamentally different harvest management strategies among stocks Regardless of the stock, however, in the prime reproduction stage, somatic growth is slow or negative, as energy is routed more strongly into reproduction GSI is at a maximum; the period of gonadal recrudescence (ie, spawning interval) is minimized, and GFBs are completely depleted in females Consistent with recommendations for other long-lived freshwater and marine species, harvest management strategies should be planned to retain some prime spawning females in the population In many localities, paddlefish management has been developed based on minimum size limits This approach can provide some conservation benefits, but should optimally be pursued at levels adequate to retain larger, older fish (especially females) in the population In addition to these biological considerations, the ecological consideration of sporadic or episodic recruitment in many stocks makes steady-state harvest models unrealistic, and necessitates harvest to be appropriately matched to recruitment rates, or events

26019

Evaluation of Alizarin Red S as a Long-Term Chemical Mark in the *Pomoxis* Genus

Bryant Haley and J Wesley Neal

The ability to identify the origin of a fish has long been an integral part of hatchery programs – particularly in the evaluation of hatchery stocking efforts Accurate assessment of stocking effectiveness requires that hatchery fish can be discerned from wild-spawned fish Marking large groups of juvenile fish presents significant challenges due to their small size and the number of individuals Batch-marking using chemical immersion is often the most viable option A popular choice is the broad-spectrum antibiotic oxytetracycline (OTC) Increasing concerns about the level of antibiotics in our water has led to a desire for alternatives Alizarin red s (ARS) has seen limited use in finfish marking, and no literature currently exists on its effectiveness in the *Pomoxis* genus We tested at the effectiveness of ARS in marking juvenile white crappie and assessed the retention of the mark

26022

Seasonal Habitat Use of Adult Pallid Sturgeon in the Lower Mississippi River

Dylan A Hann, Patrick Kroboth, Michael Colvin and Harold L Schramm

Previous research identified selected habitats and preferred water depth and current velocities based on telemetry detections throughout 3 years for the endangered Pallid Sturgeon *Scaphirhynchus albus* in the lower Mississippi River (LMR) The LMR has an annual vertical fluctuation of up to 18 m and an annual temperature fluctuation of up to 28°C; thus, Pallid Sturgeon may occupy different habitats during various river stages as availability (eg, wetted area) changes and water temperatures vary throughout the year Pallid Sturgeon habitat probability of use was explored in regards to water temperature and river stage using a Bayesian Discrete Choice framework Two study sites in the LMR with the same habitat diversity were monitored monthly from 2009 through 2015 Water temperature had little influence on the probability of habitat use by Pallid Sturgeon, but main channel detections decreased and wing dike or secondary channel detections (depending on site) increased with increasing river stage Consideration of river stage in further investigations of Pallid Sturgeon habitat use and selection will lead to a better understanding of environmental conditions affecting management and conservation of this endangered large-river species

26023

Conservation Efforts for Yazoo Darter (*Etheostoma raneyi*), a Headwater Species Endemic to North Mississippi

Angeline Rodgers, Amy Carson, James D Austin, PhD, Walter Bolton, Daniel Drennen and Richard Campbell

The Yazoo River Basin is the largest in Mississippi, draining an area of about 35,000 square kilometers in all or parts of 30 counties. The outlet of the basin is at the Mississippi River with the confluence of the Yazoo River north of Vicksburg. In addition to four major flood control reservoirs, many streams within the basin have been modified by channelization, construction of diversion canals, snagging and clearing and construction of impoundments on headwater streams. Stream habitat is vulnerable due to the numerous man-made alterations and also the natural soil erodability. The Yazoo Darter (*Etheostoma raneyi*) is a small, headwater species endemic to the Yocona and Little Tallahatchie River sub-basins in the upper Yazoo Basin of north Mississippi. While currently not on the federal endangered species list, it is considered an at-risk species and efforts are underway to implement conservation actions to improve habitat. The majority of land within the Yocona River drainage is privately owned agricultural land, while the Little Tallahatchie River drainage occurs largely on public land, which provides numerous collaborative opportunities with a variety of partners. Over the past few years there has been considerable research on the species, including genetic effects of habitat fragmentation and population isolation. Using these baseline data, several projects – road crossing improvements, dam removals and conservation efforts on private lands - are underway to maximize success for the Yazoo Darter, along with several petitioned and state-listed species.

26039

Tournaments benefits go both ways

Gene Gilliland

Bass tournaments and other competitive fishing events have a long history of working cooperatively with state fish management agencies to accomplish a variety of management goals. Many of the first cooperative projects were designed to evaluate the impacts of bass tournaments on populations. As concerns over negative impacts waned, agencies began looking at tournaments as partners to help collecting information in times of limited budgets and manpower. Project scopes expanded as agency biologists found willing partners in tournament organizations. Examples of these projects include collection of catch and length/weight data to supplement state sampling programs. Tournament catches may be used to provide additional data on recruitment, growth and mortality. Other examples of where tournaments can assist agencies include stocking fish, installation of habitat structures, collecting fish for genetic analysis, collecting fish for tagging, mark/recapture studies, population estimates or exploitation studies. Fish can be secured for radio telemetry studies, pesticide/metals analysis and most recently, data to provide information on the financial impact to local and regional economies. Cooperative projects help the agency but help build positive relationships with tournament organizers and their anglers. The anglers gain a sense of being part of the management team and feel as if they are making a contribution to programs that directly benefit their fishing success.

26040

Effects of Tournament Handling Practices on the Physiological Response of Atlantic Tarpon Relative to Tarpon from the Catch-and-Release Recreational Fishery in Boca Grande Pass, Florida

Kathryn Guindon, David Westmark, Jessica Carroll and Christopher Gardinal

Atlantic Tarpon (*Megalops atlanticus*) are the targets of many competitive saltwater fishing events. Boca Grande Pass, located in southwest Florida, hosts a world-renowned Tarpon fishery that is economically valuable to the state and supports several tournaments each year. Tarpon from a tournament held in Boca Grande Pass that required Tarpon to be towed from the point of capture to a weigh-scale on the beach were sampled in the summer of 2010, to evaluate the physiological changes that occurred in plasma lactate and glucose concentrations in response to the angling and weigh-in procedures. Values were compared to those measured in Tarpon from the recreational fishery during the summer of 2009. Tournament Tarpon had significantly higher plasma lactate ($220 \text{ mmol/L} \pm 94 \text{ SD}$ ($n=21$)) than Tarpon caught and released in the recreational fishery ($106 \text{ mmol/L} \pm 49 \text{ SD}$ ($n=29$)) indicating an increased utilization of anaerobic activity during tournaments. Tournament Tarpon also experienced a higher hyperglycemic response than non-tournament fish with plasma glucose concentrations that increased from $1121 \text{ mg/dL} \pm 330 \text{ SD}$ ($n = 31$) to

1761 mg/dL \pm 535 SD (n=23) after weigh-in Tournament procedures that involved catch-and-release angling combined with towing and weigh-in caused significant physiological disturbance in Atlantic Tarpon beyond that experienced by routine catch-and-release fishing in the recreational fishery Sharing these results with anglers, tournament participants and resource managers helped change Tarpon handling practices in Florida
26041

Finding Mutual Benefit: Competitive Fishing Tournaments and Fisheries Management Agencies

Hal Schramm and Gene Gilliland

Fishing tournaments became a conspicuous use of fisheries resources with the development of black bass *Micropterus* spp Tournaments in the 1960s The size, frequency, and visibility have steadily increased and spread to other fish species; but black bass tournaments remain a focal issue Many among the fisheries management community as well as the tournament sector were concerned about the impact of concentrated effort by skilled anglers on black bass populations, and tournaments transitioned to a live-release format With survival increased, much of the concern about adverse effect on black bass populations has passed Tournaments have potential benefits, such as ancillary monitoring of fish population and angling trends, a multi-media communication channel with anglers, economics, and angler recruitment; but there appears to be limited effort to seize or enhance these benefits This symposium will look to the future to share and discuss strategies for effectively using fishing tournaments and the tournament sector to benefit management of fisheries resources

26042

Effects of Temperature, Dissolved Oxygen, and Swimming on Survival of Angler-caught Largemouth Bass

Kevin R Keretz, Harold L Schramm, Colin P Dinken and Peter J Allen

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 that require release of angled bass Yet, the independent effects of water temperature, live well dissolved oxygen, and angling stress on survival have not been measured This controlled laboratory study measured the effect of ambient temperature (17, 21, 25, 29 and 33 °C) and simulated angling (1 and 3 min forced swimming) on 5-day survival of caught-and-released Largemouth bass >300 mm and the survival of Largemouth Bass >300 mm in simulated tournament conditions at different ambient and live well (LW) temperature differentials (ΔT of -4, 0, and + 4 °C), LW dissolved oxygen (DO) concentrations (2, 55 and 85 mg/L), and different levels of angling stress Survival of caught-and-released Largemouth Bass was 100% at ambient temperatures \leq 29 °C and ranged from 70-100% at 33 °C after 1 min of forced swimming; survival was significantly lower at 29 °C but not at 25 °C after the 3-min swim Survival of fish subjected to a 1-min swim and held in LWs for 8 h with LW DO \geq 55 mg/L (80-100% saturation) was 85-100% at ambient temperatures \leq 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 $\Delta T = +4$ °C Survival decreased in fish subjected to a 3-min swim and held in LWs for 8 h with LW DO 80-100% saturation at an ambient temperature of 29 °C but not at 25 °C Following the 3-min swim at 29 °C, fish survival was significantly higher at LW $\Delta T = -4$ °C Survival following all LW DO treatments was \geq 80% at ambient temperatures \leq 29 °C, significantly decreased at 33 °C, and was 30% at 33 °C and 2 mg/L DO Results indicate high survival can be attained for caught-and-released Largemouth Bass at temperatures \leq 33 °C and for tournament-handled Largemouth Bass at temperatures \leq 29 °C and LW DO \geq 55 mg/L when the fish are landed quickly and handled carefully Largemouth Bass survival decreases when fish are subjected to longer swimming stressors

26044

Paddlefish: Ecological, Aquacultural, and Regulatory Challenges of Managing a Global Resource

Jason D Schooley and Dennis Scarnecchia

Unlike other members of Acipenseriformes, the American Paddlefish (*Polyodon spathula*) is afforded no species-level, federal protection and therefore is managed wholly by the states. The unique life history characteristics of Paddlefish such as large size, long lifespan, late maturation, and episodic recruitment provide inherent challenges for state managers while other factors such as commercial value (for roe as caviar) and high migration potential stress the need for interjurisdictional coordination to safeguard this resource. The Mississippi Interstate Cooperative Resource Association (MICRA) provides a forum for information sharing among state managers, although individual state recreational and/or commercial management strategies are variable. Major milestones have changed the landscape for Paddlefish in the last ten years requiring enhanced management strategies. Global restrictions on sturgeon caviar trade have thrust Paddlefish to the forefront of the sustainable caviar conversation both domestically and abroad while key strides have been made in captive ranching and aquaculture technology as an alternative to wild harvest. Harvest pressures persist on both recreational and commercial fronts, but research, management, and conservation measures are often constrained by limited availability of funding. Several recreational harvest states on the fringe of the species range now derive funding from state-run roe harvest programs which provide valuable data for stock assessment. Commercial harvest states at the core of the range face challenges in effectively monitoring stocks with minimal budgets for inland commercial fisheries. Interstate collaboration and invasive species concerns remain a focus within MICRA while new research findings and advancements in genetics, physiology, aquaculture, and monitoring techniques offer promise for the sustainable utilization of Paddlefish as a global resource.

26097

Influence of hydrology on the age-specific abundance and growth of freshwater drum and gizzard shad from lotic and lentic habitats in Oklahoma

John Datillo, Shannon K Brewer and Daniel E Shoup

Environmental conditions influence fish production. Riverine fishes rely on seasonal flow fluctuations, whereas reservoir species have different amounts of cover available when water levels fluctuate. The age and growth distributions of these populations are differentially affected by flows and there are likely tradeoffs to managing water to benefit each system. We sampled fishes in summer and autumn 2016 to: 1) calculate catch curve residuals as an index of year class strength and 2) calculate annual growth rates. We constructed length-at-age keys and applied them to length-frequency data. The oldest Gizzard Shad *Dorosoma cepedianum* sampled (n=3,143) from southeast Oklahoma was age six with the majority (>95%) younger than age three. The oldest Freshwater Drum *Aplodinotus grunniens* sampled (n=176) was 20 years old with the majority (>55%) younger than age four. Preliminary results from the study site in northeast Oklahoma suggests these species live longer and grow larger at this site (Gizzard Shad: age seven, n=340; Freshwater Drum: age 32, n=91); however, the majority of the drum (>60%) were > age 10. We will correlate year class strength and annual growth rate with hydrology from the corresponding years to examine effects of water-management actions on fisheries.