

PROGRAM AND ABSTRACTS  
OF THE 37<sup>th</sup> ANNUAL MEETING OF THE  
MISSISSIPPI CHAPTER OF THE  
AMERICAN FISHERIES SOCIETY

THE FRANKLIN CENTER  
MISSISSIPPI STATE UNIVERSITY  
16 – 18 FEBRUARY 2011



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### Distinguished Guests

Dr. Don Jackson, Past President, American Fisheries Society  
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### Banquet Speaker

Bubba Hubbard, Director, Strawberry Plains Audubon Center, Holly Springs, MS

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**MISSISSIPPI CHAPTER OF THE AMERICAN FISHERIES SOCIETY  
PROGRAM OVERVIEW**

**WEDNESDAY – 16 FEBRUARY 2010**

- 6:00 – 7:30 MEETING REGISTRATION** **Holiday Inn Express**
- 7:00 – 10:00 SOCIAL** **Holiday Inn Express**

**THURSDAY – 17 FEBRUARY 2011**

- 7:00 – 8:00 MEETING REGISTRATION** **Franklin Center**

***\* INDICATES STUDENTS COMPETING FOR STUDENT AWARD***

- 8:00 – 10:30 SESSION I: FISHERIES**  
Moderator: Cliff Hutt, MS State University
- 8:00 – 8:15 MARINE RECREATIONAL INFORMATION PROGRAM.**  
**Matt Hill, Buck Buchanan, and Dale Diaz**
- 8:15 – 8:30 A NEW TOOL FOR THE FISH BIOLOGIST.**  
**Daniel Aboagye\* and Peter J. Allen**
- 8:30 – 8:45 THE COMMERCIAL PADDLEFISH FISHERY IN MISSISSIPPI 2007-2010.** **Garry Lucas**
- 8:45 – 9:00 EFFICACY OF TRAWLING FOR YOUNG-OF-YEAR GULF STURGEON.** **James P. Kirk, W. Todd Slack, Steven George, and K. Jack Killgore**
- 9:00 – 9:15 SAMPLING SHAD IN TROPICAL RESERVOIRS: EXPERIMENTAL GILL NETS VERSUS FRAME TRAWLS.** **J. Wesley Neal, Milton Muñoz-Hincapié, and Marie Prchalova**
- 9:15 – 9:30 TEMPORAL COMPARISONS OF ELECTROFISHING EFFICACY FOR LARGEMOUTH BASS IN PUERTO RICO.** **Nick Peterson\* and J. Wesley Neal**
- 9:30 – 9:45 EFFECT OF TURTLE EXCLUDER DEVICES (TEDS) ON COMMERCIAL CATCH OF BLUE CRABS CALLINECTES SAPIDUS IN MISSISSIPPI.** **Darcie Graham, Harriet Perry, Dyan Gibson, John Anderson, Guillermo Sanchez, Traci Floyd, and Bill Richardson**
- 9:45 – 10:00 BREAK**

**10:00 – 12:00 SESSION II: POPULATIONS**

Moderator: Glenn Parsons, The University of Mississippi

**10:00 – 10:15 OIL, CURRENTS AND FISH IN THE GULF OF MEXICO.**

**Donald R. Johnson, and Harriet Perry**

**10:15 – 10:30 BLUEFIN TUNA (*Thunnus thynnus*) LARVAE FROM THE GULF OF MEXICO: COLLECTIONS TAKEN DURING THE DEEPWATER HORIZON OIL SPILL. Jim Franks, B. Comyns, Eric Hoffmayer, Donald Johnson, D. Ko, R. Hendon, R. Waller, and M. Blake**

**10:30 – 10:45 OCCURRENCE OF STONECAT (*Noturus flavus*) AND FRECKLED MADTOM (*Noturus nocturnus*) IN THE LOWER MISSISSIPPI RIVER. Steven George, and W. Todd Slack**

**10:45 – 11:00 ASIAN CARP IN A MISSISSIPPI RIVER BACKWATER: OPPORTUNISTIC INVASIONS FOR RAPID GROWTH. Larry Southern\*, and Jan J. Hoover**

**11:00 – 11:15 CRAPPIE RECRUITMENT RELATIVE TO FLOODPLAIN INUNDATION IN MISSISSIPPI FLOOD CONTROL RESERVOIRS. Jonah Dagele\*, and L.E. Miranda**

**11:15 – 11:30 ASSESMENT AND ALLEVIATION OF LARGEMOUTH BASS (*Micropterus salmoides*) CROWDING IN CERRILLOS RESERVOIR, PONCE, PUERTO RICO. Cynthia N. Fox\*, and J. Wesley Neal**

**11:30 – 11:45 HOW SUSCEPTIBLE WERE WHALE SHARKS (RHINCODON TYPUS) TO THE DEEPWATER HORIZON OIL SPILL? A REVIEW OF THEIR OCCURRENCE AND DISTRIBUTION IN THE NORTHERN GULF OF MEXICO. Eric Hoffmayer, Jennifer McKinney, James Franks, Jill Hendon, and William Driggers**

**11:45 - 12:00 DISTRIBUTION MODELING: WHALE SHARKS AND OTHER APPLICATIONS. Jennifer McKinney\*, Eric Hoffmayer, Richard Fulford, and Wei Wu**

**12:00 – 1:00 LUNCH**

**Franklin Center**

- 1:00 – 3:00**      **SESSION III: PHYSIOLOGY**      **Franklin Center**  
Moderator: Jim Franks, Gulf Coast Research Laboratory
- 1:00 – 1:15      **A COMPARISON OF FACTORS AFFECTING SWIMMING PERFORMANCE IN CRAPPIES, *Pomoxis annularis* and *P. nigromaculatus*. Caleb Gaston\*, and Glenn Parsons**
- 1:15 – 1:30      **THERMAL INFLUENCES ON JUVENILE CHANNEL CATFISH (*Ictalurus punctatus*) GROWTH, FEEDING, AND METABOLISM IN MISSISSIPPI FARM PONDS. Michael Arnold\*, and Peter J. Allen**
- 1:30 – 1:45      **THE EFFECT OF DIFFERENT LARVAL DIETS AND SALINITY ON PRODUCTION OF COCAHOE MINNOWS. Paul R. Picard, and Peter J. Allen**
- 1:45 – 2:00      **EFFECTS OF TEMPERATURE AND SALINITY ON HATCH SUCCESS, DEVELOPMENT AND SURVIVAL OF BIGMOUTH SLEEPER, *Gobiomorus dormitor*, LARVAE. Karina Olivieri\*, and J. Wesley Neal**
- 2:00 – 2:15      **THE EFFECTS OF INCREASED SALINITY ON THE PHYSIOLOGY OF JUVENILE ALLIGATOR GAR. Daniel E. Schwarz\*, and Peter J. Allen**
- 2:15 – 2:30      **EVIDENCE OF CUMULATIVE STRESS EFFECTS ON BLOOD PARAMETERS IN A SMALL COASTAL SHARK SPECIES. Jill Hendon and Eric Hoffmayer**
- 2:30 – 2:45      **SPECIFICITY AND SENSITIVITY OF A REAL-TIME POLYMERASE CHAIN REACTION TO *Flavobacterium columnare*. G. Derek Gibbs\*, Michael Mael, Matthew Griffin, and Mark Lawrence**
- 2:45 – 3:00**      **BREAK**
- 3:00– 5:30**      **SESSION IV: HABITAT**  
Moderator: Larry Bull, MS Dept Wildlife, Fisheries, and Parks
- 3:00 - 3:15      **SURROUNDING LAND USE AS A MANAGEMENT TOOL. Ted Alfermann\* and Leandro E. Miranda**
- 3:15 – 3:30      **CLASSIFICATION OF MISSISSIPPI RESERVOIRS BASED ON FISH HABITAT. Rebecca Krogman\* and Leandro E. Miranda**
- 3:30 – 3:45      **RANKING SECONDARY CHANNELS FOR RESTORATION USING AN INDEX APPROACH. K. Jack Killgore, Jan J. Hoover, Ron Nassar, and Bradley Lewis**

- 3:45 – 4:00 **MISSISSIPPI'S NEAR SHORE REEF HABITAT AND MONTORING.**  
**James Sanders and Kerwin Cuevas**
- 4:00 – 4:15 **GULF STURGEON (*Acipenser oxyrinchus desotoi*) OF THE PASCAGOULA RIVER: POST-KATRINA ASSESSMENT OF SEASONAL USAGE OF THE LOWER ESTUARY.** Jeanne-Marie Havrylkoff, Paul O. Grammer, Mark S. Peterson, and William T. Slack
- 4:15 – 4:30 **MOVEMENTS OF GULF STURGEON (*Acipenser oxyrinchus*) IN THE LOWER PASCAGOULA RIVER ESTUARY.** Paul O. Grammer, Jeanne-Marie Havrylkoff, Mark S. Peterson, and William T. Slack
- 4:30 – 4:45 **MACROHABITAT USE OF PALLID STURGEON IN THE LOWER MISSISSIPPI RIVER.** Nathan Kuntz\* and Harold L. Schramm
- 4:45 – 5:00 **MOVEMENT AND HABITAT US OF PALLID STURGEON IN THE LOWER MISSISSIPPI AND ATCHAFALAYA RIVERS.** Jason R. Herrala Herrala\* and Harold L. Schramm
- 5:00 – 5:15 **NEKTON ASSEMBLAGE RESPONSE TO ANTRHOPOGENIC ALTERATION OF SALT MARSH HABITAT IN COASTAL MISSISSIPPI.** Michael Lowe\*, Mark S. Peterson, and Brock C. Houston
- 5:15 – 5:30 **IMPORTANCE OF BACKWATER HABITATS TO FISH ASSEMBLAGES IN NORTHWEST MISSISSIPPI FLOOD CONTROL RESERVOIRS.** Skyler Wigen\* and Leandro E. Miranda
- 5:30 – 6:00 **POSTER PRESENTATIONS** **Franklin Center Lobby**

**EFFECT OF HYDROLOGY ON FLATHEAD CATFISH GROWTH IN TWO IOWA RESERVOIRS.** Tyler Stubbs, Nathan M. Kuntz, and Randall D. Schultz

**CARBON AND NUTRIENT DYNAMICS IN HIGH INTENSITY ZERO EXCHANGE SHRIMP (*Lipopenaeus vannamei*) RACEWAYS.** John Francis and Kevin Dillon

**TOMBIGBEE RIVER FISHES BEFORE AND AFTER THE TENNESSEE-TOMBIGBEE WATERWAY.** Matt E. Roberts, Daniel S. Millican, Michael T. Calloway, Gray Turnage, Kyle Strongin, Ronald Altig, Christopher P. Brooks, William T. Slack, and Christopher M. Taylor

**7:00 – 10:00 BANQUET**

**Franklin Center**

**Chapter Awards**

**Speaker – Bubba Hubbard – “*Perspective from a Career – Fins to Feathers*”**

**Auction**

**Student Raffle**

**FRIDAY – 18 FEBRUARY 2011**

**8:30 – 11:00 MS BUSINESS MEETING**

**Franklin Center**

# ORAL PRESENTATIONS

*(Sorted Alphabetically by Presenter)*

## A NEW TOOL FOR THE FISH BIOLOGIST

**Daniel Aboagye\***, Department of Wildlife, Fisheries and Aquaculture, Mississippi State University, Box 9690 Mississippi State, MS 39762, [daboagye@cfr.msstate.edu](mailto:daboagye@cfr.msstate.edu)

**Peter J. Allen**, Department of Wildlife, Fisheries and Aquaculture, Mississippi State University, Box 9690 Mississippi State, MS 39762.

One of the fundamental ways that fishes respond to stressors (i.e., handling, low dissolved oxygen, extreme temperatures and toxins) is by metabolic changes which facilitate the fight or flight response and aid in the combat of disease. Metabolomics, the study of the products of metabolic processes, is a tool that can be used to understand the physiological responses of fishes to stressors and predict their state of health. One of the aims of this relatively new scientific field is to identify novel biomarker profiles that are characteristic of specific stressors. Using nuclear magnetic resonance (NMR) spectroscopy, an instantaneous profile of metabolites, which are small metabolism by-products, is generated. These metabolites are a unique chemical fingerprint of specific cellular processes, and are products of the physiological responses to specific stressors or effects of diseases. The profile generated is then examined for patterns and analyzed using multivariate statistical techniques to reveal the subset of metabolites that change most significantly, potentially identifying diagnostic biomarker profiles. For fishes, this technique holds great potential for understanding the effects of stressors and understanding normal processes in healthy individuals. Currently, we are examining the effects of hypoxia, disease and chemical toxicants in a number of species, including channel catfish (*Ictalurus punctatus*), alligator gar (*Atractosteus spatula*) and red snapper (*Lutjanus campechanus*). Through these analyses, a better understanding of the processes that are affected by stressors in fishes can be obtained, and management recommendations can be provided to resource and hatchery managers.



## **SURROUNDING LAND USE AS A MANAGEMENT TOOL**

**Ted Alfermann\***, Department of Wildlife, Fisheries and Aquaculture, Box 9690, Mississippi State University, Mississippi State, MS 39762, USA, talfermann@gmail.com

**L. E. Miranda**, Mississippi Cooperative Fish and Wildlife Research Unit, Box 9691, Mississippi State, MS 39762, USA

Degradation of oxbow lakes in the Mississippi Alluvial Valley (MAV) has largely occurred as a result of deforestation since settlement in this region began in the 19<sup>th</sup> century. Centrarchid species dominate the recreational fisheries of this region and effects on their composition are of particular concern. We examined surrounding land use of oxbow lakes in the MAV in relation to their centrarchid assemblages. Percentage land composition within 50 m, 500 m, 1000 m, and 5000 m buffers was calculated for 53 lakes in Mississippi and Arkansas using ArcGIS software. Fish were collected using daytime electrofishing from 2006 to 2010. Lakes were chosen using a targeted approach to provide diverse land-use compositions, as well as physical and chemical differences. Centrarchid assemblages among lakes varied from a dominance of a few tolerant species to multiple moderately-tolerant species, depending on land cover (principally agriculture, forest, wetlands). The presence/absence and percentage composition of centrarchid species varied depending on the relative composition of agriculture, wetlands, and forested land use. Our results suggest approaches for emphasizing selected aspects of centrarchid assemblages, and for prioritizing management and restoration of selected oxbow lakes.

**THERMAL INFLUENCES ON JUVENILE CHANNEL CATFISH *ICTALURUS PUNCTATUS* GROWTH, FEEDING, AND METABOLISM IN MISSISSIPPI FARM PONDS**

**Michael B. Arnold\***, Department of Wildlife, Fisheries, and Aquaculture, Mississippi State University, Box 9690, Mississippi State, MS 39762-9690, USA, marnold@cfr.msstate.edu

**Peter J. Allen**, Department of Wildlife, Fisheries, and Aquaculture, Mississippi State University, Box 9690, Mississippi State, MS 39762-9690, USA

Shallow, earthen ponds, which are typical of channel catfish (*Ictalurus punctatus*) production systems, are directly influenced by ambient air temperature. However, while many studies have focused on the influence of low, winter temperatures on juvenile channel catfish, few have been conducted to determine the influence of high, summer temperatures. Therefore, we examined the effects of three daily, cyclic thermal regimes (23 to 27°C, 27 to 31°C, and 31 to 35°C), which mimic natural pond conditions, on aspects of juvenile channel catfish bioenergetics. In the first experiment, the effects of temperature on food consumption rate, food conversion efficiency, and specific growth rate were measured. Current studies are examining temperature effects on aerobic metabolic rate. Preliminary results have found that the 27 to 31°C treatment group had significantly greater food consumption, growth, and feed conversion than the other treatment groups, possibly due to greater metabolic efficiency at those temperatures. This research will aid in the understanding of physiological and behavioral responses of channel catfish to high, summer temperatures, and be used to provide management direction for aquaculturalists and natural resource managers.

## **CRAPPIE RECRUITMENT RELATIVE TO FLOODPLAIN INUNDATION IN MISSISSIPPI FLOOD-CONTROL RESERVOIRS**

**Jonah D. Dage**\*, Mississippi State University College of Forest Resources; Department of Wildlife, Fisheries and Aquaculture; P.O. Box 9690, Mississippi State, MS 39762; [jdage@cfr.msstate.edu](mailto:jdage@cfr.msstate.edu)

**Leandro E. Miranda**, USGS Mississippi Cooperative Fish and Wildlife Research Unit, P.O. Box 9690, Mississippi State, MS 39762

Crappies *Pomoxis* spp. evolved in river systems as floodplain specialists, thriving in backwaters and temporally inundated habitats, adeptly roaming in and out of these environments to spawn. Flood-control reservoirs typically exhibit large annual draw-downs where exposed areas resemble a natural floodplain. In these reservoirs, the amount of floodplain habitat available for spawning depends on timing and magnitude of water level rises. We estimated the amount and cover types of inundated floodplain at various water levels and assessed the effects of inundation on crappie recruitment in flood control reservoirs in northwest Mississippi. Land cover types were classified into four broad categories including mudflats, herbaceous vegetation, shrubs, and forests. Recruitment of age-0 crappies was indexed with trap-net samples taken in late summer of 2009 and 2010. Relations between age-0 abundance and land cover were tested using regression procedures. Percent composition of herbaceous vegetation, shrubs, and forests increased with water level, whereas mudflats decreased. Age-0 crappie abundance was directly related to vegetative land cover and inversely related to extent of mudflats during the mid-March to mid-May spawning period. The management of rule curves to include biologically significant flooding may be a useful management strategy for promoting crappie recruitment in reservoirs where substantial sections of the floodplain can be inundated.

**ASSESSMENT AND ALLEVIATION OF LARGEMOUTH BASS *MICROPTERUS SALMOIDES* CROWDING IN CERRILLOS RESERVOIR, PONCE, PUERTO RICO**

**Cynthia N. Fox\***, Department of Wildlife, Fisheries, and Aquaculture, Mississippi State University, Box 9860, Mississippi State, MS 39762-9690, cnfox21@yahoo.com.

**J. Wesley Neal**, Department of Wildlife, Fisheries, and Aquaculture, Mississippi State University, Box 9860, Mississippi State, MS 39762-9690.

Cerrillos Reservoir is a relatively new impoundment in Puerto Rico and is one of only two reservoirs that has been stocked with pure Florida largemouth bass. First stocked in Cerrillos Reservoir in 1997, largemouth bass quickly reached carrying capacity, and within 3 years relative weight dropped from above 100 to about 80 and the population began to display characteristics of an overcrowded population. Thus the largemouth bass size structure is composed of mostly small slow-growing bass less than 350 mm. This condition is most likely the result of limited harvest and low productivity of the reservoir. A protected slot limit (36-51 cm) was implemented on this reservoir in 2003 to encourage harvest of smaller bass, to protect the fast-growing intermediate bass and allow for occasional harvest of a trophy bass. However, several factors, including limited angling effort and angler unwillingness to remove small bass, have not adequately reduced the abundance of small bass or eliminated the growth bottleneck. To be successful, fisheries management policies must be based on sound biological data, but also must have the potential to achieve the desired population-level effect while simultaneously generating support and compliance among the angler base. Our proposed research will provide an integrated dataset on largemouth bass population dynamics, diet habits, and a suite of management options based on the best available information. These data will be used to refine harvest regulations and other management of this important largemouth bass fishery.

**BLUEFIN TUNA (*THUNNUS THYNNUS*) LARVAE FROM THE GULF OF MEXICO:  
COLLECTIONS TAKEN DURING THE DEEPWATER HORIZON OIL SPILL**

**Jim Franks, Eric, Hoffmayer, Donald Johnson, Read Hendon, Richard Waller, and Mae Blake**, Center for Fisheries Research and Development, Department of Coastal Sciences, Gulf Coast Research Laboratory, The University of Southern Mississippi, Ocean Springs, Mississippi, jim.franks@usm.edu

**Bruce Comyns**, Center for Fisheries Research and Development, Department of Coastal Sciences, Gulf Coast Research Laboratory, The University of Southern Mississippi, Ocean Springs, Mississippi

**Dong-Shang Ko**, Naval Research Laboratory, Stennis Space Center, Mississippi

Atlantic bluefin tuna (*Thunnus thynnus*) larvae were collected from the Gulf of Mexico (GoM) Loop Current (LC) western and northern boundaries during May 2010. Sampling was conducted with funding from the NMFS Southeast Area Monitoring and Assessment Program (SEAMAP) in support of NMFS development of fishery independent indices of spawning biomass of bluefin tuna in the Western North Atlantic Ocean. More than 350 larvae were identified in surface neuston net (0.333 mm mesh) collections taken along transects aligned perpendicular to the LC boundaries. These findings further confirm the Loop Current boundary region and associated oceanographic features (e.g., eddies) as larval bluefin habitat, as previously documented by GCRL larval bluefin collections taken during May 2003 - 2009. Peak spawning period for bluefin tuna in the Gulf is April-May, which in 2010 occurred concurrently with the Deepwater Horizon oil spill. Considering the depressed status of Western Atlantic bluefin stocks and the proximity of the spill to eastern Gulf bluefin spawning grounds, the potential for deleterious impacts from the spilled oil to bluefin life stages, critical habitats, and recruitment success was (is) of paramount concern. This presentation provides an overview of the 2010 bluefin larval collections (some taken from oil-impacted waters) and outlines future research utilizing the 2010 collections.

## **A COMPARISON OF FACTORS AFFECTING SWIMMING PERFORMANCE IN CRAPPIES, *POMOXIS ANNULARIS* AND *P. NIGROMACULATUS***

**Caleb J. Gaston\***, Department of Biology, University of Mississippi, PO Box 1848, University, Mississippi 38677, [cjgaston@olemiss.edu](mailto:cjgaston@olemiss.edu).

**Glenn R. Parsons**, Department of Biology, University of Mississippi, PO Box 1848, University, Mississippi 38677.

Crappies, *Pomoxis spp.*, are among the most sought after sport fish in the southeast. Both species have been successfully introduced in oxbow lakes, reservoirs and slower sections of streams throughout the United States, but the white crappie, *P. annularis*, predominates in warmer, shallower and more turbid waters. We are using an acclimatization procedure to examine the swimming performance of both species with emphasis on the effects of turbidity and seasonal variation in photoperiod and water temperature. Swimming performance testing will be conducted in each of the four seasons and at conditions approximating the photoperiod and water temperature at the time of collection. Early results of testing indicate that the two species have similar critical swimming speeds in the summer ( $P=0.178$ ) and that there is no difference between diurnal and nocturnal critical swimming speeds within species (black crappie  $P=0.33$ , white crappie  $P=0.32$ ). Laboratory swimming performance results will be compared with field observations of movements. White crappie ( $N=40$ ) and black crappie ( $N=15$ ) at Sardis Lake have been fitted with radio transmitters and locations are recorded on a weekly basis. Interesting variation in movement patterns has been observed.

**OCCURRENCE OF STONECAT, (*NOTURUS FLAVUS*), AND FRECKLED MADTOM, (*NOTURUS NOCTURNUS*), IN THE LOWER MISSISSIPPI RIVER**

**Steven G. George**, USACE Engineer Research and Development Center, 3909 Halls Ferry Road, ERDC-EE-A, Vicksburg, MS 39180-6199,  
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**William T. Slack**, USACE Engineer Research and Development Center, 3909 Halls Ferry Road, ERDC-EE-A, Vicksburg, MS 39180-6199.

Previous records of stonecat, (*Noturus flavus*), from the lower Mississippi River are represented by three collections in the early 1970s and these records have generally been reported as transient or accidental occurrences. Records of freckled madtom, (*Noturus nocturnus*), in the Lower Mississippi River are also rare with only two collections from waters bordering Arkansas and Tennessee. From January 2003 to May 2010, the ERDC Fish Ecology Team conducted fish surveys in the lower Mississippi River and collected a total of 156 stonecat (12-188 mm TL) using trotlines and trawls from New Madrid, MO (RM 903) to Natchez, MS (RM 358). Freckled madtom (n = 28; 16-98 mm TL) were collected from Caruthersville, MO (RM 845) to White Castle, LA (RM 197) with trawls only. Stonecats and freckled madtoms were collected over a variety of microhabitats, which included dike tip, flooded island, natural bank, secondary channel, riprap bar, flooded sandbar and flooded willow. Predominant substrata were sand, gravel, and riprap. The presence of gravid individuals and YOY for both species during June and July provides evidence of spawning and additional support that these species are residents of the lower Mississippi River.

## **SPECIFICITY AND SENSITIVITY OF A REAL-TIME POLYMERASE CHAIN REACTION TO *FLAVOBACTERIUM COLUMNARE***

**G. Derek Gibbs\***, Mississippi State University, College of Veterinary Medicine, 240 Wise Center Drive, P.O. Box 6100, Mississippi State, MS 39762, dgibbs@cvm.msstate.edu

**Michael J. Mauel**, and **Matthew J. Griffin**, Mississippi State University, College of Veterinary Medicine, Thad Cochran National Warmwater Aquaculture Center, 127 Experiment Station Road, P.O. Box 197, Stoneville, MS 38776

**Mark L. Lawrence**, Mississippi State University, College of Veterinary Medicine, 240 Wise Center Drive, P.O. Box 6100, Mississippi State, MS 39762

*Flavobacterium columnare*, the causative agent of Columnaris disease, infects a wide variety of freshwater and brackish water fishes. The gram-negative bacterium has been linked to significant losses in commercial fish species, particularly farm-raised channel catfish *Ictalurus punctatus* in the southeastern United States. Using modifications to previously established protocols, we designed oligonucleotide primer and probe combinations specifically targeting a 203 bp nucleotide region of the chondroitin AC lyase gene (GenBank AY912281). Following primer optimization, the linear dynamic range was established for two separate isolates. There were no significant differences between the two isolates, suggesting limited variation in copy numbers of the target gene. For both isolates, the assay was found to be highly repeatable and reproducible, with a coefficient of variation between runs of  $\leq 3.0\%$ , indicating an acceptable level of precision. The linear dynamic range for both isolates covered 6 orders of magnitude ranging from 50 to 0.0005 ng of genomic DNA. The specificity of the assay was determined against 5 taxonomically or ecologically relevant isolates; *Flavobacterium johnsoniae*, *Pseudomonas aeruginosa*, *Aeromonas salmonicida*, *Edwardsiella tarda*, *Edwardsiella ictaluri*. There was no amplification of the target sequence for any of these non-target organisms. Further research includes determining the relationship of cfu/ml to genomic DNA and establishing the usefulness of the assay in detecting representatives from two genomovars of *Flavobacterium columnare*. The development of this assay lays the foundation for future projects utilizing real-time polymerase chain reaction (qPCR) for the detection of columnaris in comparative susceptibility experiments and epidemiological studies quantifying the agent in pond water.



## **EFFECT OF TURTLE EXCLUDER DEVICES (TEDS) ON COMMERCIAL CATCH OF BLUE CRABS *CALLINECTES SAPIDUS* IN MISSISSIPPI**

**Darcie Graham**, Center for Fisheries and Research Development, The University of Southern Mississippi, Gulf Coast Research Laboratory, 703 E. Beach Drive, Ocean Springs, MS 39564, darcie.graham@usm.edu

**Harriet Perry, Dyan Gibson, John Anderson, and Guillermo Sanchez.** Center for Fisheries and Research Development, The University of Southern Mississippi, Gulf Coast Research Laboratory, 703 E. Beach Drive, Ocean Springs, MS 39564.

**Traci Floyd and Bill Richardson.** Mississippi Department of Marine Resources, 1141 Bayview Ave., Biloxi, MS 39530.

Bycatch of diamondback terrapins in traps has been a concern in all states harvesting blue crabs. Fishery dependent studies on the effectiveness of bycatch reduction devices in reducing terrapin mortality and the effect of these devices on harvest of blue crabs are limited. In this study, the effect of Turtle Excluder Devices (TEDs) on the commercial catch of blue crabs, *Callinectes sapidus*, in Mississippi was examined. Commercial crab traps were equipped with a 2 x 6 inch rectangle of stiff wire attached to each access funnel in the trap. Traps with TEDs were randomly mixed with standard crab traps in the trap lines of three cooperating fishermen. Project personnel accompanied fishermen on trips twice a month to collect biological data on harvested crabs and catch information. Current data cover the period June 2007 to December 2010. Mean carapace width of crabs collected in standard traps was 148 mm; mean carapace width of crabs collected in traps with TEDs was 151 mm. On average, the TED traps collected fewer non-harvestable crabs (ovigerous females and sublegal crabs) than did standard traps; however, these differences were not statistically significant. Catch per unit effort (CPUE) was calculated as crabs·trap<sup>-1</sup>·day<sup>-1</sup>. Overall CPUE for standard traps was 5.33, whereas overall CPUE for TED traps was 4.86. Catch per unit effort of legally harvestable crabs was 3.85 in standard traps and 3.59 in traps with TEDs. There was no significant difference between the CPUE in standard traps and traps modified with TEDs.

## **MOVEMENTS OF GULF STURGEN (*ACIPENSER OXYRINCHUS DESOTOI*) IN THE LOWER PASCAGOULA RIVER ESTUARY**

**Paul O. Grammer**, Department of Coastal Sciences, The University of Southern Mississippi, 703 E. Beach Drive, Ocean Springs, MS 39564, paul.grammer@usm.edu

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Ongoing work in the lower Pascagoula river estuary aims to elucidate patterns in juvenile and subadult Gulf sturgeon (*Acipenser oxyrinchus desotoi*) movements in relation to benthic prey abundance and sediment composition. During the first year of a three year study, fish in the Pascagoula River were tagged in the summer holding area in late summer and during their fall outmigration in 2010. A total of 20 individuals were captured (ranging from 41-158 cm, 0.16-23.6 kg) and these late juvenile, subadult and adult age-classes were externally fitted with Vemco v13 acoustic tags. The movement of tagged Gulf sturgeon is being monitored by an acoustic array consisting of 20 Vemco VR2W receivers, distributed throughout the lower Pascagoula River estuary. Initial telemetry data shows Gulf sturgeon spending more time near the mouth of the Pascagoula River's western distributary. These findings support observations made by previous telemetry studies in the area, which are assumed to be driven by habitat differences that exist between the East and West distributaries. Furthermore, benthic and sediment samples were collected from 105 stations systematically positioned around and between the acoustic array to quantify spatial-use of the estuary by Gulf sturgeon relative to benthic prey and sediment composition metrics. GIS interpolations of the benthos and sediment composition will greatly expand what is known about the habitat preferences of Gulf sturgeon within the lower Pascagoula River estuary.

## **GULF STURGEON (*ACIPENSER OXYRINCHUS DESOTOI*) OF THE PASCAGOULA RIVER: POST-KATRINA ASSESSMENT OF SEASONAL USAGE OF THE LOWER ESTUARY**

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We had the opportunity to determine the within-river routes that Gulf sturgeon, *Acipenser oxyrinchus desotoi*, take from 2008 to 2010 through the lower Pascagoula River which splits at river kilometer 23 into two distinct distributaries. We sampled 60 d over 11 months throughout a two year period with a total effort of 81,947 net-meter-hours. Eight Gulf sturgeon were captured ranging in size from 81 – 196 cm TL and weight ranged from 3.6 – 52.6 kg. Using an array of automated telemetry receivers, ultrasonic tagged Gulf sturgeon movements were monitored within the lower river and associated estuary. We made several novel observations during this study. First, Gulf sturgeon movements through the area are dissimilar between and among size classes, as some fish followed the most parsimonious route while others moved in more complex patterns. Gulf sturgeon appear to prefer the eastern distributary upriver from Bayou Chemise as the primary travel corridor between freshwater habitats and marine feeding grounds. The western distributary mouth was more highly utilized by Gulf sturgeon during seasonal migrations upriver from offshore. Second, interpolated maps of sediment composition and macrofaunal abundance revealed that the western distributary may possess both abiotic and biotic characteristics most commonly reported for Gulf sturgeon relocations by researchers in this and other systems. This area may represent the closest nearshore foraging habitat available to Gulf sturgeon of the Pascagoula River watershed as the eastern distributary mouth has been altered from natural edge to hardened surfaces. Finally, comparisons of catch-per-unit-effort between this project and a previous study on this population detected a decrease in Gulf sturgeon catch by an order of magnitude in the post-Katrina population. The Pascagoula watershed likely offers the greatest possibility for the survival of the Gulf sturgeon within Mississippi and the natural western distributary should not be altered, as has happened to the eastern distributary, if this threatened population is to fully recover. A newly begun study has shown a noticeable increase in juvenile Gulf sturgeon catch suggesting resiliency in this endangered population.

## **EVIDENCE OF CUMULATIVE STRESS EFFECTS ON BLOOD PARAMETERS IN A SMALL COASTAL SHARK SPECIES**

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This study investigated the effects of capture and handling on the secondary stress response of Atlantic sharpnose sharks, *Rhizoprionodon terraenovae*, from the northern Gulf of Mexico. Male sharks were captured by rod and reel during the summer months of 2001 and 2002. Sharks were stressed by either a single or a repeated capture and handling event. Single sampled sharks (n=33) were reeled in at 0, 15, 30, 45, or 60 minutes after hooking, and were bled via caudal venipuncture. Repeatedly sampled sharks (n=10) were reeled in immediately after hooking to obtain an initial blood sample, were released while still on the line, and sampled again at 15 minute intervals for 60 minutes. All sharks were measured (total length, cm), weighed (kg), and released after the final blood draw. The secondary stress parameters analyzed were plasma lactate, glucose, osmolality, and hematocrit. Repeatedly sampled sharks exhibited heightened levels, as compared to single sampled sharks, for lactate ( $p < 0.05$ ) and osmolality ( $p < 0.05$ ) at all times except 0, and for glucose at time 60 ( $p = 0.85$ ). Concentration levels asymptoted for all parameters and protocols except repeatedly sampled lactate levels which remained linear and could be an artifact of the previous handling event. Maximal concentration differences of 216.5%, 9.8%, and 42% occurred at time 60 for lactate, osmolality, and glucose levels, respectively. Hematocrit levels were consistent for both stress protocols at all time points ( $p > 0.05$ ). These data indicate that stressors can result in cumulative effects for this small, coastal shark species and emphasizes the need for awareness when health/population assessments are being made.

## **MOVEMENT AND HABITAT USE OF PALLID STURGEON IN THE LOWER MISSISSIPPI AND ATCHAFALAYA RIVERS**

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A considerable amount of work has been done on long-term and system wide movements of pallid sturgeon, but little is known about short-term (<72 h) movements and habitat preference of pallid sturgeon *Scaphirhynchus albus*, which was listed as federally endangered in 1990. To learn more about these movements and habitat use, we tracked adult pallid sturgeon surgically implanted with ultrasonic transmitters in the Atchafalaya River. Active tracking occurred monthly and an array of acoustic receivers was used to passively monitor short-term movements. Results to date indicate that pallid sturgeon moved long distances (up to 300 miles in the Atchafalaya River) during 1-4 year periods and exhibited various patterns of movement, but movement during 18-72-h time periods is usually less than 2 km. Pallid sturgeon were detected most often near water control structures (63% of all detections) and least often in the outside bends of the main channel (7% of all detections). Additionally, water temperature, river stage, and change in river stage were all found to be not significantly related to short-term movements. Information provided by movement and habitat preference of pallid sturgeon should provide information that can be directed toward habitat conservation and restoration efforts.

## **MARINE RECREATIONAL INFORMATION PROGRAM (MRIP)**

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The Marine Recreational Fisheries Statistical Survey (MRFSS) has come under increased opposition as to its effectiveness as a reliable estimator of catch and effort. The National Research Council (NRC) was asked to conduct a review of the current marine recreational fishery survey methods and concluded that the current surveys should be redesigned to improve their effectiveness, appropriateness of sampling procedures, applicability to various kinds of management decisions, and usefulness for social and economic analyses. The NRC recommended a range of research projects as a part of the MRIP to improve these current surveys. One of the high priority projects was the creation of the National Angler Registry which requires anglers to purchase a federal fishing license. This will supply the survey with a known universe of saltwater anglers as opposed to the current method which relies on random digit dialing. States are given the opportunity to become exempt from this license for their anglers if they provide the National Marine Fisheries Service (NMFS) with a complete saltwater angler list. Mississippi anglers are currently exempt from this license as the State of Mississippi has entered into an agreement with NMFS to provide them with the required information.

**HOW SUSCEPTIBLE WERE WHALE SHARKS (*RHINCODON TYPUS*) TO THE DEEPWATER HORIZON OIL SPILL? A REVIEW OF THEIR OCCURRENCE AND DISTRIBUTION IN THE NORTHERN GULF OF MEXICO.**

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Since whale sharks, *Rhincodon typus*, inhabit northern Gulf of Mexico (nGOM) waters during spring – fall of each year, considerable concern was expressed regarding their well-being following the Deepwater Horizon oil spill that occurred in the region during the spring and summer of 2010. Other than historical anecdotal accounts of whale shark sightings in the nGOM, some dating back to the 1930's, little was known about their seasonal occurrence and distribution, biology, and ecology in the region until the Gulf Coast Research Laboratory (GCRL) initiated the *Northern Gulf of Mexico Whale Shark Research Program* in 2003. One of the program's primary objectives is to document the distribution of whale sharks in the nGOM via reports of sightings provided by collaborating fishers and offshore petroleum industry personnel. To date, over 400 sightings have been reported with approximately one third of those involving aggregations of up to 200 individuals. The program is documenting that whale sharks are abundant in the nGOM and their seasonal occurrence is highly predictable. Additionally, satellite tagging data and photo identifications have established connectivity between whale sharks in the nGOM and the Caribbean Sea. This presentation summarizes current knowledge on whale sharks in the nGOM and addresses the topic of potential impacts to whale sharks from the Deepwater Horizon oil spill.

## **OIL, CURRENTS AND FISH IN THE GULF OF MEXICO**

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The Deepwater Horizon (DWH) oil spill in the northern Gulf of Mexico occurred in late April and extended to mid-July, 2010. Uncertainty in where the estimated 5 million barrels of oil would go and its effect on fisheries marked much of the frustration in predictions and preparations for damage assessments. In this talk, we present a synopsis of currents in the Gulf, along with their effects on the oil dispersion and their concomitant influence on many aspects of fisheries. In the deep basin the Loop Current and its spin-off cyclones and anticyclones affect the distribution of larvae and eggs of many species as well as establish important temperature and nutrient rich environments which are important to spawning. Over the continental shelves of the northern Gulf, evolutionary timing and location of spawning have taken advantage of relatively systematic patterns of seasonal wind driven currents. Interactions between the deep basin and continental shelf waters create 'storm' like events which affect fisheries and oil dispersion.



## **RANKING SECONDARY CHANNELS FOR RESTORATION USING AN INDEX APPROACH**

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Over 100 secondary channels exist in the Lower Mississippi River, most of which have closure dikes in the upper reaches or throughout the channel. Recent environmental engineering practices in Corps Districts have recognized that many secondary channels can be re-connected without comprising navigation benefits. To accommodate the planning process, an index-based method was applied to prioritize restoration of secondary channels in the lower Mississippi River. Three indices were developed. First, an Index of Habitat Quality incorporated metrics derived from remotely-sensed data that considered geomorphic, structural, and hydraulic features of secondary channels. The second index, referred to as the Cost Index, estimated the relative cost of restoring flow based on number of dikes in the secondary channel requiring removal or notching. A linear relationship between number of dikes and cost was assumed, with the index ranging from 0.1 (highest cost; highest number of dikes) to 1.0 (no dikes present in the secondary channel). The third index, a Priority Index, ranked the secondary channel according to the product of the habitat and cost indices. Based on the Index of Habitat Quality, an optimum secondary channel consists of high abundance of gravel usually in the upper reach, greater than 4 habitats, greater than 74% riparian forest cover surrounding the channel, and levees set back greater than 1.4 miles. The Priority Index resulted in a range of 0.1 to 0.9, with high scoring values indicative of secondary channels that should be targeted for conservation. This approach will be expanded to all secondary channels in the lower Mississippi River.

## **EFFICACY OF TRAWLING FOR YOUNG-OF-YEAR GULF STURGEON**

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As part of the operation of the Jim Woodruff Lock and Dam in the Apalachicola River, Florida, the U. S. Army Corps of Engineers was tasked to develop methods to measure recruitment of age 1 Gulf sturgeon, *Acipenser oxyrinchus desotoi*. Hence, we explored the feasibility of sampling young-of-year (yoy) Gulf sturgeon using modified balloon trawls during 2009 and 2010. Three yoy sturgeon (57 - 120 mm total length) were captured during June 2009 in the Brothers River near the mouth of the Apalachicola River system. No yoy were captured during 2010. Total effort expended was 323 hauls totaling 293 river km. While this gear type has been remarkably efficient for sampling yoy *Scaphirhynchus* (i.e., pallid and shovelnose sturgeon) in the Mississippi River system, it was much less effective in the Apalachicola River. The reason that trawling was not successful may have been low population size - which has been estimated at less than 1,000 individuals. Over 60 juvenile Gulf sturgeon were captured during routine netting by USFWS personnel during the summer of 2010. As a consequence, future efforts to measure Gulf sturgeon recruitment will focus on capturing juveniles by netting and back calculating the year of spawning.

## **CLASSIFICATION OF MISSISSIPPI RESERVOIRS BASED ON FISH HABITAT**

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During fall 2010, Mississippi fisheries biologists completed a survey concerning fish habitat for reservoirs throughout the state. The survey questions covered numerous habitat attributes, including availability, water quality, water regime, and degradation processes. The survey also asked about the fish community, recreational fishery, and the tailwater. The survey yielded data for 28 reservoirs ranging from 168 acres to 35,820 acres. Nonmetric multidimensional scaling was applied to partition reservoirs with similar habitat characteristics and to identify key habitat attributes responsible for the partitioning. Cluster analysis was applied to classify reservoirs, and the results were compared to existing classification systems (i.e., river basins and ecoregions). Analyses indicated that Mississippi reservoirs can be classified into unique groups based on fish habitat characteristics, with each group deserving different fishery expectations and management approaches.

## **MACROHABITAT USE OF PALLID STURGEON IN THE LOWER MISSISSIPPI RIVER**

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Little was known about the habitat use of pallid sturgeon *Scaphirhynchus albus* when listed as an endangered species. The objectives of this study were to assess seasonal macrohabitat use in the lower Mississippi River. Fish were captured using trotlines from September 2008 - November 2010, implanted with acoustic transmitters, and actively tracked May 2009 - November 2010 in a 37 km stretch of the lower Mississippi River near Lake Whittington. A total of 64 fish were tagged; 39 were detected at least once and 26 were detected 2 - 13 times. Habitat use varied with hydrographic period, as well as, temperature period. Inside bend sandbar, main channel, and outside bend habitats were used most frequently. Downstream island tip and secondary channel habitats had increased use during higher water stages; wing dike, main channel and outside bend habitats were used more frequently during lower water stages. There was no clear effect of temperature on habitat use. Understanding habitats used by pallid sturgeon will aid in the conservation and restoration of habitats for future recovery and management actions.

## NEKTON ASSEMBLAGE RESPONSE TO ANTHROPOGENIC ALTERATION OF SALT MARSH HABITAT IN COASTAL MISSISSIPPI

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In order to meet the demand of the growing population in Mississippi's coastal zone (up 85% since 1960), the coastal landscape is continually modified by the accumulation of man-made structures and impervious surfaces. Though the cumulative impacts of such landscape-level changes are not always immediately apparent, an emergent property is the conversion from a homogenous landscape into a mosaic of smaller habitat patches nestled within a framework of lower quality, man-made structures (i.e., fragmentation). Using a GIS-based approach (FRAGSTATS), we were able to identify replicates of three habitat-types along a gradient of alteration in both the Pascagoula River and Biloxi Bay estuaries; completely fragmented (CF), partially fragmented (PF), and intact natural (IN) salt marsh habitats with tidal creeks of similar size and creek order. In May of 2010, nekton (i.e. fish and decapods crustaceans) were collected weekly in each creek using a modified block net design. While there were neither estuary nor habitat-level difference in either species richness or diversity (Inverse Simpson's Index), detailed multivariate analyses based on nekton abundance showed that while nekton assemblages were similar between estuaries they were markedly different among habitat types. Intact natural and CF habitats were significantly different from each other and both were similar to PF. These habitat-specific differences were driven by daggerblade grass shrimp (*Palaemonetes* spp.), gulf menhaden (*Brevoortia patronus*), and brown shrimp (*Farfantepenaeus aztecus*), which were several times more abundant in IN than either PF or CF habitat types. Species such as Gulf killifish (*Fundulus grandis*), spot (*Leiostomus xanthurus*), southern flounder (*Paralichthys lethostigma*), and blue crab (*Callinectes sapidus*) were also abundant in all habitats but did not show a numerical response to alteration. Traditional wisdom holds that "more marsh equals more nekton." However, all creeks in this study were similar sized. Previous work in the Pascagoula estuary has shown that key benthic infaunal invertebrates were absent in altered salt marsh habitats. These species are common prey items in nekton diets and indicate that the impacts of anthropogenic alterations may be manifested trophically. Future directions for this project include 1) detailed analysis of the benthic community structure, biomass, and diversity, 2) quantitative description of spot, gulf killifish, and southern flounder diets, and 3) analysis of the trophic relationships in each habitat-type from primary producers through upper level consumers using carbon, oxygen, and sulphur stable isotopes.

## **THE COMMERCIAL PADDLEFISH FISHERY IN MISSISSIPPI, 2007-2010**

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The Wildlife Commission closed the state to commercial harvest of paddlefish in May 2007. The fishery was re-opened to residents in December 2008 with regulations that possibly make the Mississippi commercial paddlefish fishery one of the most tightly regulated fisheries, anywhere. Special permits are needed to harvest paddlefish for roe and all harvested paddlefish have to be tagged with harvest reported within 24 hours. Harvest is regulated by restricting the number of harvesters, imposing a 37 inch (EFL) minimum length limit, establishing refuges within open zones, and limiting seasons to 60 days. The MDWFP's aspirations for the paddlefish commercial fishery are to a) Give Mississippians opportunity to benefit from lucrative caviar trade; b) Develop Mississippi identified product(s) produced from a sustainable paddlefish population; c) Reduce waste from summer mortality of paddlefish from incidental catch in commercial gear; and d) above all, conserve paddlefish so that future generations have opportunity to utilize the resource. Three persons participated in the fishery each year for the 2008-2009 and 2009-2010 seasons. During the first season only border waters with Arkansas were open; 55 paddlefish were caught with 13 males and 13 females harvested that produced 73 lbs. of eggs (raw wt.). The next year paddlefish were harvested from border waters with AR and the Sunflower River. 1,163 paddlefish were caught; 5 males and 170 females were harvested with 602.14 lbs. of eggs (processed wt.). 58 % of the roe was sold as a product packaged for retail sale identified as originating from Mississippi. For the current season, 8 persons are permitted to harvest paddlefish from 5 zones - AR border waters, Sunflower River, Coldwater River, Bear Creek, and Moon Lake. As of January 1, 287 paddlefish have been harvested during the current season. Processing industries have been set up in several delta locations that employ 8 persons to process roe and flesh. The first special nongame gross fish harvest season on Moon Lake was open from December 6 to 10, 2010 to persons with Paddlefish harvest permits. The harvesters set an average of 32 gill nets each day with an average of 4,100 yards of netting. The harvest was dominated by paddlefish of which 468 were harvested, the majority being females with eggs. Harvesters released an additional 819 captures; most were legal size paddlefish that did not have eggs. 24% of those released captures were too short for harvest. The harvested paddlefish were large; harvested lengths were 37-49 inches (EFL) with the mode at 43 inches. Harvest weight of paddlefish was estimated at about 28,000 pounds, and 2,363.5 pounds of caviar was produced from egg sacs that weighed 5,739 pounds. There was 2,844 pounds of other nongame gross fish harvested, dominated by bigmouth buffalo and blue and flathead catfish.

## DISTRIBUTION MODELING: WHALE SHARKS AND OTHER APPLICATIONS

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Species distribution modeling is a useful tool in studying cryptic species or when traditional field sampling is not a viable option. The model will predict suitable habitat based on the associations between known presence records and spatially continuous predictor variables. Due to their protected status, understanding the critical habitat of whale sharks (*Rhincodon typus*) is essential for proper management. This study describes the probable distribution of whale sharks in the northern Gulf of Mexico using two algorithms designed for predicting species distribution, Maximum Entropy (MaxEnt) and Ecological-Niche-Factor-Analysis (ENFA). Models were developed using sightings locations with feeding animals (>2 individuals) for the temporal period of June through September of 2008 and 2009 with the following predictor variables: bathymetric slope, distance from physical features and remotely sensed sea surface temperature, chlorophyll concentrations and sea surface height anomalies. Cohen's kappa and the area under the receiver operating characteristic curve (AUC) were used to evaluate model performance with an external testing dataset. Kappa values ranged from 0.28 – 0.69 and AUC values ranged from 0.73 – 0.80, indicating that the predicted distribution had a fair to substantial agreement with the testing data. Distance to continental shelf edge, petroleum platforms and chlorophyll were the predominant contributors to model output. These predicted associations are ecologically meaningful, in that whale sharks may be exploiting regions of high food availability (ie. upwelling along the shelf edge increases primary productivity), or mechanistic caused by observer bias on or near petroleum platforms. The spatial distribution of suitable habitat is dynamic; therefore, it is recommended that this approach be expanded over a longer study period in order to delineate long-term trends in distribution and consistent areas of high suitability. This study demonstrates the advantages of combining multiple modeling approaches when studying a species' ecological preference. This approach can be applied to terrestrial, marine and freshwater species; the target species and study objective will dictate the age class, spatial and temporal scale modeled.

## **SAMPLING SHAD IN TROPICAL RESERVOIRS: EXPERIMENTAL GILLNETS VERSUS FRAME TRAWLS**

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Standardized sampling protocols of freshwater fishes have recently become a national focus among state agencies throughout the United States. In the U.S. territory of Puerto Rico, threadfin shad are the most important prey species for highly targeted reservoir sport fish species including largemouth bass. However, standardized sampling protocols have yet to be established for threadfin shad in these tropical reservoirs. Our objective was to compare active trawling versus passive gillnetting for sampling threadfin shad in tropical freshwater reservoirs. We compared a 3x3-m fixed frame fry trawl (10 m long; 10, 6, and 4 mm mesh in the main body and cod end, respectively) with epipelagic (0-1.5 m depth) and mesopelagic (1.5-3.0 m depth) experimental gillnets. Gillnets were constructed with 5, 6.25, 8, 10, 12.5, 15.5, 19.5 and 24 mm bar mesh in 2.5 m long panels. Reservoirs were divided into upper and lower longitudinal sections, and the trawl was towed for two minutes at three fixed sites per reservoir section at a depth sampling 0-3 m. Gillnets were standard overnight sets. Trawling caught 10x more shad than gillnets with less than 1% bycatch, and displayed no size selectivity except for shad larger than 90 mm. Gillnets revealed significant size selectivity, variable catches, and 23% bycatch. The most abundant size classes of shad caught with trawling and gillnetting ranged between 20-30 mm and 50-80 mm, respectively. Gillnets underestimate shad abundance for multiple size groups, and trawls underestimate shad abundance in the largest length classes. Gillnets were unable to catch the most abundant sizes of shad in all reservoirs, however, experimental mesh size was too large to accurately sample smaller shad (i.e., 20-30 mm). Whereas shad larger than 90 mm represent less than 1% of the total population, preliminary data indicate that trawling is preferred over gillnetting for sampling threadfin shad in Puerto Rico Reservoirs.



**EFFECTS OF TEMPERATURE AND SALINITY ON HATCH SUCCESS,  
DEVELOPMENT AND SURVIVAL OF BIGMOUTH SLEEPER, *GOBIMORUS  
DORMITOR* LARVAE**

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The bigmouth sleeper *Gobiomorus dormitor* is a poorly known fish species found in tropical coastal habitats throughout the Caribbean and the southernmost tip of the United States. It is typically considered to be obligatorily diadromous, thought to require both fresh and salt water at different stages of its life cycle. However, landlocked populations have been identified, including in Carite Reservoir, Puerto Rico. Management of native euryhaline species in Puerto Rico has been hindered by the presence of dams that impede upstream migrations. The landlocked bigmouth sleeper population presents an opportunity to establish native freshwater fisheries above other dams in Puerto Rico, but hatchery propagation will be required. Previous studies have had limited success with artificial propagation and rearing of bigmouth sleeper. We hypothesized temperature and salinity affected hatch success, larval development and survival rates in those studies. In the current study, our objectives are to 1) Determine and compare hatch success of bigmouth sleeper eggs at different temperatures and salinities, 2) Measure and compare larval development, growth and yolk sac consumption at different temperatures and salinities, and 3) Determine survival rates of bigmouth larvae at different temperatures and salinities. Fertilized bigmouth sleeper eggs (n=100) will be hatched at three different temperature (23, 26, 29°C) and five salinities (0, 3, 6, 9, 12 ppt), with three replicates for each treatment. Larvae will be sampled on 24 hour increments post hatch. This study will determine the effects of temperature and salinity on the hatching success, survival and larval development of bigmouth sleeper yolk sac larvae. Our research will provide insight into the possibility of successfully rearing bigmouth sleepers for conservation and management purposes.

## **TEMPORAL COMPARISONS OF ELECTROFISHING EFFICACY FOR LARGEMOUTH BASS IN PUERTO RICO**

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Largemouth bass *Micropterus salmoides* are the primary sport fish in Puerto Rico reservoirs. The majority of management efforts directed at this species utilize electrofishing practices; however, little attention has been given to maximizing electrofishing efficacy in Puerto Rico. The objectives of this study were to 1) evaluate differences in diel and seasonal electrofishing catch rates and diet composition for largemouth bass, and 2) provide sampling recommendations for reservoirs in Puerto Rico. Diel electrofishing (i.e., day: 0900-1500 h and night: 2100-0300 h) for largemouth bass was conducted every three months for three years in Lucchetti Reservoir, Puerto Rico. Night sampling produced greater catch-per-unit effort than day sampling; however, no seasonal differences in overall catch were observed. Occurrence of empty stomachs was greater during night than day sampling, with no differences observed among seasons. Mean proportion body weight consumed for all prey was higher for day than night samples, and comprised primarily threadfin shad during all seasons and non-fish during fall. If management objectives target high catch rates of largemouth bass, nighttime electrofishing is preferred. However, day sampling provides more identifiable diet data, although 24-h sampling is necessary for consumption estimates. Future sampling efforts with electrofishing in Puerto Rico should carefully consider sampling objectives when designing sampling protocols.

## THE EFFECT OF DIFFERENT LARVAL DIETS AND SALINITY ON PRODUCTION OF COCAHOE MINNOWS

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For many years Mississippi has been one of the leaders in aquaculture, producing food fish such as channel catfish *Ictalurus punctatus*, hybrid striped bass *Morone saxatilis* x *M. chrysops*, and tilapia *Tilapia spp.* In recent years, market pressures have resulted in stagnant pond bank prices while at the same time input and transport costs have risen dramatically. These negative market pressures have resulted in reduced production and fallow ponds. Many aquaculture hatcheries are idle because the demand for fingerlings has correspondingly decreased. Cocahoe minnows *Fundulus grandis*, widely accepted by anglers, are commonly found in most marinas along the Northern Gulf Coast because they can be used for most sport fishes. *F. grandis* is a hardy species tolerating a wide variety of bait bucket conditions and quickly adapting to changes in salinity. With market demand for these fish often exceeding supply, the potential benefit of farming this species is obvious. This project will investigate two important components of successful production: 1) practical diets for larvae and 2) low level salinity limitations for effective fingerling production in ponds. The relative effectiveness of four different larval diets will be tested including 1) a commercially available catfish fry diet, 2) a commercially available brine shrimp (*Artemia spp.*) replacement diet, 3) a microbound microparticulate larval diet, and 4) newly-hatched brine shrimp nauplii. Each of these diets will be independently fed to four-day old *F. grandis* larvae for 10 days. At the conclusion of the larval feeding trials, fingerling minnows will be stocked at a density of 125,000 /hectare into ponds containing water of different salinities, 0 parts per thousand (ppt), 2 ppt, and 4 ppt. Survival and growth will be compared to determine minimum acceptable pond water salinities for production. Information derived about culture techniques will provide growers with a foundation to achieve commercially viable culture of this species.

## **MISSISSIPPI'S NEAR SHORE REEF HABITAT AND MONITORING**

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**Kerwin Cuevas**, Mississippi Department of Marine Resources, 1141 Bayview Avenue, Biloxi, MS 39530

Mississippi has three Breakwater structures developed with concrete rubble and 65 near shore low profile reefs spread throughout the three coastal counties in marine waters of the three coastal counties. These reefs encompass approximately 170 hectares of water bottom. The reefs range in size from 2 to 8 hectares. Materials used for low profile reef construction were crushed concrete and limestone. Since August 2005 there have been over 200 deployments of material for a total of 32,900 cubic meters. Crushed concrete was used for 20 reef sites and limestone was used at 30 reef sites. An average of 690 m<sup>3</sup> was deployed around public piers, harbor jetties and harbor walkways. In addition to reef development around piers, low profile reefs accessible to both wade fishermen and small boat anglers were created along Mississippi's coast. An averaged 690 m<sup>3</sup> of material was also used to develop these reefs. Three reefs, one in each county, were sampled with a 230 meter 5 panel monofilament gill net. The panels consist of 50 mm, 64 mm, 76 mm, 89 mm and 102 mm stretch mesh. The net was deployed monthly on each reef for one hour. Captured fish are identified to species, enumerated, measured to nearest millimeter, and sexed. Physical monitoring is conducted on all reefs by side scan sonar or poling in waters to shallow to side scan.

## **THE EFFECTS OF INCREASED SALINITY ON THE PHYSIOLOGY OF JUVENILE ALLIGATOR GAR**

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**Peter J. Allen**, Department of Wildlife, Fisheries and Aquaculture, Box 9690, Mississippi State University, Mississippi State, MS 39762, USA

Alligator gar (*Atractosteus spatula*) are euryhaline fish that once occurred from Veracruz, Mexico to Illinois and Ohio, USA, but have been declining in the last few decades. Because alligator gar are found in the Gulf of Mexico and surrounding estuaries, they undergo physiological changes allowing them to survive in saline water. However, the extent of their hypo-osmotic abilities are not well understood. Therefore, the goal of this study is to determine: 1) how an increase in salinity affects the growth rates of two different ages of alligator gar, 2) what ionic and osmoregulatory changes occur in juvenile alligator gar in response to increasing salinities, and 3) the metabolic costs of these changes. To this end, two different age groups (2 and 10 months post hatch) of juvenile alligator gar will be exposed to 4 different salinities (0, 8, 16, and 24 ppt) for a 30-day period. For growth determinations, dry and wet weight gain and food conversion efficiency will be compared between treatments. For an understanding of ion- and osmoregulatory capabilities, measurements of drinking rate, plasma ionic concentrations and gill and tissue  $\text{Na}^+$ ,  $\text{K}^+$ -ATPase activities will be made and the corresponding aerobic metabolic rates measured. Early results show that the 2 month post-hatch alligator gar do not differ in their growth rates between salinities, indicating that they are fairly euryhaline from an early age. However, results of other portions of the study are still being analyzed. This research will provide an understanding of the hypo-osmotic capabilities of juvenile alligator gar, which can be used by resource managers to direct conservation and management plans for this species.

## **ASIAN CARP IN A MISSISSIPPI RIVER BACKWATER: OPPORTUNISTIC INVASIONS FOR RAPID GROWTH**

**Larry Southern\***, Mississippi State University, Starkville, MS 39759, lws73@msstate.edu

**Jan Jeffrey Hoover**, U.S. Army Engineer Research and Development Center, Vicksburg, MS 39180

Bighead carp (*Hypophthalmichthys nobilis*) and silver carp (*H. molitrix*) are often abundant in backwaters of the lower Mississippi River, but their movements and growth in these habitats are not well-documented. Field studies at Forest Home Chute, a backwater near Vicksburg, MS suggest that fluctuations are due principally to in-migrations of young-of-year fish and out-migrations of large sub-adults during periodic connections to the river. Visual counts of jumping fish and collections using a variety of gear were conducted seasonally in a 3 km reach from 2005-2010. This reach is occasionally connected by a culvert to a lower reach which itself is periodically contiguous with the river. Numbers of fish observed ranged from < 10 to more than > 170. Ages of fish, determined from annual rings on pectoral rays, were 0 to 12 years (confirmed by concurrent counts of rings on accessory ray), but most were < 4 years. Data indicate that most carp apparently entered the Chute as young-of-year or Age I-II fish, remained for 1-3 years (depending on hydrograph), and then returned to the river (during high water). Demographic differences, however, between the two species were substantial: bighead carp exhibited a wider range of ages, were typically older, and grew faster and larger than silver carp. Age specific movements by the two species, then, may differ with bighead carp entering at older ages than silver carp, and remaining for longer periods of time. Use of backwaters as nurseries by either species of carp is risky, however. Fish in smaller or more remote waters are stranded and die during annual or near-annual droughts. Fish in larger and more proximate waters, can spend years growing and developing in a benign and productive environment, until such time that the backwater re-connects with the river. These habitats apparently promote accelerated growth of carp. Growth documented in Forest Home Chute is higher than that established for populations in the Middle Mississippi River and in Asia, probably due to elevated fish metabolism in the warmer water and to greater availability of planktonic prey.

## **IMPORTANCE OF BACKWATER HABITATS TO FISH ASSEMBLAGES IN NORTHWEST MISSISSIPPI FLOOD CONTROL RESERVOIRS**

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**Leandro E. Miranda**, USGS Mississippi Cooperative Fish and Wildlife Research Unit, P.O. Box 9861, Mississippi State, MS 39762

Water level manipulation in flood control reservoirs can potentially produce a hydrologic regime similar to that of a natural river-floodplain system. When water levels are allowed to rise, terrestrial habitat is flooded and wetland habitats may become connected to the main reservoir. Wetlands are generally scarce along the body of the main reservoir but may abound in the upper reaches, where they are often referred to as backwaters. The flooding of backwaters creates spawning habitat for many fish species whose life histories have been shaped by the flood pulse of large rivers. The influence of backwater habitats is important to managing the fishery of the main reservoir. We compared fish assemblages between coves in the body of the main reservoir and backwater habitats in three large flood-control reservoirs in northwest Mississippi. Fish assemblage censuses were made in late-winter and spring with electrofishing and collections were described using various species richness and diversity indexes, guild classifications, and multivariate ordinations. Our results show that fish assemblages differ between the two major habitat types as many species utilize the backwater habitats for important life history stages. Thus, management of reservoirs to maintain diverse fish communities and enhance specific fisheries cannot ignore backwater habitats available in the upper reaches of the reservoir but often not included in reservoir management plans.

# POSTER PRESENTATIONS

*(Sorted Alphabetically by Presenter)*

## **CARBON AND NUTRIENT DYNAMICS IN HIGH INTENSITY ZERO EXCHANGE SHRIMP (*LIPOPENEAUS VANNAMEI*) RACEWAYS**

**John H. Francis**, Department of Coastal Sciences, The University of Southern Mississippi, 703 East Beach Drive, Ocean Springs, Mississippi 39564, John.Francis@eagles.usm.edu

**Kevin Dillon**, Department of Coastal Sciences, The University of Southern Mississippi, 703 East Beach Drive, Ocean Springs, Mississippi 39564

Traditional pond shrimp farming is often associated with negative impacts on ecosystems due to the high nutrient loads to surface waters and ground waters. Zero exchange high intensity raceways offer a low environmental impact since no water is released from the facility, preventing the introduction of excessive nutrients to soils and nearby surface waters. By developing carbon and nitrogen budgets and flux estimates of nutrients pools within raceways, optimal conditions for successful shrimp farming can be evaluated. Nitrite build up is a major problem within high intensity raceways as nitrite is toxic to shrimp at high concentrations. Excess nitrite buildup is caused by incomplete nitrification, a two step process ( $\text{NH}_4 \rightarrow \text{NO}_2 \rightarrow \text{NO}_3$ ). Dissolved organic carbon (DOC), Total dissolved nitrogen (TDN), particulate carbon, particulate nitrogen, ammonium, nitrite, nitrate, and phosphorous were collected once a week from four separate raceways over a 16 week grow out period. Over the 16 week grow out cycle DOC fluctuated from week to week and ranged from 1807 to 7165  $\mu\text{M}$ . TDN increased over time in all tanks except tank 9 and ranged from 2310 to 16912  $\mu\text{M}$ . Particulate carbon and nitrogen varied from week to week with carbon ranging from 2309 to 83007  $\mu\text{M}$  and nitrogen ranging from 476 to 15921  $\mu\text{M}$ . The C:N ratio for particulate matter was fairly consistent in all tanks, ranging from 3.91 to 5.59 which suggests that heterotrophic zooplankton make up the majority of particulates. In all but one tank ammonium decreased from initial concentrations of 50 – 60  $\mu\text{M}$  to concentrations of less than 10  $\mu\text{M}$ . Nitrite concentrations initially increased to relatively high concentrations (500 - 700  $\mu\text{M}$ ), and then decreased dramatically followed by continual low concentrations, typically <10  $\mu\text{M}$ . Nitrate concentrations were low initially (5 - 20  $\mu\text{M}$ ) then as nitrite concentrations decreased and remained low, nitrate gradually increased over the weeks to over 15000  $\mu\text{M}$ . Soluble reactive phosphorus (SRP) makes up over 90% of the total phosphorus measured in the tanks and tended to initially increase then gradually decrease over the grow out period with concentrations ranged from 77 to 645  $\mu\text{M}$ . The sequential uptake of ammonium and nitrite followed by high concentration of  $\text{NO}_3$  suggest that nitrification was occurring in all the tanks but to different degrees. The factors limiting nitrification are currently being investigated.



## **TOMBIGBEE RIVER FISHES BEFORE AND AFTER THE TENNESSEE-TOMBIGBEE WATERWAY**

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**Michael T. Calloway**, US Fish and Wildlife Service, 5970 Avalon Drive, Suite 313, Muskegon, MI 49444

**Gray Turnage**, Department of Biological Sciences, Mississippi State University, P.O. Box GY, Mississippi State, MS 39762

**Kyle Strongin**, Department of Biological Sciences, University of South Carolina, 631 Sumter Street, Columbia South Carolina, 29208

**Ronald Altig**, Department of Biological Sciences, Mississippi State University, P.O. Box GY, Mississippi State, MS 39762

**Christopher P. Brooks**, Department of Biological Sciences, Mississippi State University, P.O. Box GY, Mississippi State, MS 39762

**William T. Slack**, U.S. Army Engineer Research and Development Center Waterways Experiment Station EE-A, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

**Christopher M. Taylor**, Department of Natural Resources Management, Texas Tech University, Box 42125, Lubbock, TX 79049

The physical template of the biologically diverse Upper Tombigbee River was altered in the late 1970's through its incorporation into the Tennessee-Tombigbee Waterway (TTW). Museum vouchers archived pre-TTW (1953-1983) provided a contrast for collections describing contemporary fish assemblages (2002-2010). We have documented differences in pre- and post-TTW assemblages. Fluvial specialists in the East Fork Tombigbee River declined while habitat generalists such as the western mosquitofish, *Gambusia affinis* became more prominent in the assemblage. Some fishes occurring throughout the system during both time periods exhibited dietary shifts. Most notable is that of the crystal darter, *Crystallaria asprella*. It fed primarily on macroinvertebrates pre-TTW and consumed more zooplankton post-TTW. Preliminary data suggest altered interactions between fishes and mussels. The percentage of longear sunfish, *Lepomis megalotis*, bearing a glochidial load has increased post-TTW. Future work will determine the taxonomic structure of glochidia infestations in these sunfish to provide insight into how mussel assemblages have changed. Also, stable isotopes may be used to characterize the history of trophic structure in the system.

## **EFFECTS OF HYDROLOGY ON FLATHEAD CATFISH GROWTH IN TWO IOWA RESERVOIRS**

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**Randall D. Schultz**, Iowa Department of Natural Resources, 24570 U.S. Highway 34, Chariton, Iowa 50049

We compared growth of flathead catfish *Pylodictis olivaris* from two flood control reservoirs in Iowa (Red Rock and Rathbun reservoirs). We also compared various hydrologic and morphologic variables such as average depth, reservoir surface area, pH, conductivity, secchi depths, relative water fluctuations, and the number of days above conservation pool. Flathead catfish were collected in 2003 and 2007 between the months of May and August using low-frequency pulsed DC electrofishing. Fish were measured for total length (TL; mm) and weighed (g). Pectoral spines were removed from all flathead catfish and sectioned through the basal recess using a low-speed saw. Annuli were measured from all samples and back-calculated lengths at age were estimated using the Dahl-Lea method. Data were analyzed for each reservoir to identify statistical correlations between hydrologic and morphologic characteristics and flathead catfish growth. Red Rock reservoir had a larger surface area, greater variation in water level ( $P < 0.02$ ), and significantly more days ( $P < 0.001$ ) above conservation pool than did Rathbun reservoir. Furthermore, Red Rock reservoir yielded faster growth rates ( $P < 0.001$ ) and also indicated greater longevity for flathead catfish than did Rathbun reservoir with maximum ages of 18 and 13 respectively. Our data suggests a strong correlation between flathead catfish growth and both hydrologic and morphologic variables. These variables need be taken into account when managing for flathead catfish in large reservoirs.

**Mississippi Chapter of the American Fisheries Society  
Treasury Report  
February 15, 2011**

Chapter Account Starting Balance (January 29, 2010): \$8,374.07 (\$1283.33 is USM Student Caucus)

Chapter Account Ending Balance (February 15, 2011): \$8,871.32

**Disbursements:**

\$ 100.00	Check # 1246	MS Wildlife Federation Meeting Registration	2/1/10
\$ 200.00	Check # 1247	John Francis Student Raffle Change	2/2/10
\$ 300.00	Check # 1248	Michael Lowe Student Award 1st	2/4/10
\$ 200.00	Check # 1249	Jonathan Fleming Student Award 2nd	2/4/10
\$ 100.00	Check # 1250	Larry Southern Student Award 3rd	2/4/10
\$ 470.00	Check # 1251	Kevin Hunt Programs	2/5/10
\$ 100.00	Check # 1252	Stephen Ross Travel	2/5/10
\$ 2905.00	Check # 1253	Tara Wildlife MS Meeting Location	2/5/10
\$ 300.00	Check # 1254	MSU Fisheries Club Raffle Reimbursement	2/5/10
\$ 8.48	Check # 1255	Mark Peterson Lunch for Stephen Ross Reimb.	2/9/10
\$ 0.00	Check # 1256	VOID	2/10/10
\$ 269.92	Check # 1257	Eric Hoffmayer CA Schultz Award Reimb.	2/19/10
\$ 500.00	Check # 1258	Southern Division AFS Rainy Day Fund	2/22/10
\$ 8.80	Check # 1259	US Postal Service book of stamps	2/23/10
\$ 57.00	Debit	Direct Checks new checks	3/5/10
\$ 0.00	Check # 1260	VOID	3/20/10
\$ 100.00	Check # 1261	American Fisheries Society 2010 Plaques	3/24/10
\$ 100.00	Check # 1262	American Fisheries Society 2009 Plaques	6/10/10
\$ 150.00	Check #1263	American Fisheries Society (Liability Ins.)	8/26/10
\$ 72.02	Check #1264	Michael Lowe (USM Student Meeting)	8/31/10
\$ 2239.31	Transfer	USM Student Subunit of AFS Reimburse	9/3/10
\$ 1000.00	Check #1265	Imperial Palace (2012 Meeting Deposit)	10/20/10
\$ 500.00	Check #1266	Florida Chapter of AFS (SD Donation)	11/1/10
\$ 200.00	Check #1267	City of Ocean Springs (SD deposit)	1/6/11
\$ 242.98	Check #1268	Eric Hoffmayer (CA Schultz Award Reimb)	1/11/11

Total Disbursements from January 29, 2010 to February 15, 2011 = \$10,123.51

Total reimbursed to USM Student Subunit = \$2,311.33

**Income:**

\$1500.00	Jack Kilgore MS Meeting Donation	2/1/10
\$ 520.00	USM Registration for MS Meeting	2/1/10
\$ 500.00	State of MS DMR Meeting Donation	2/3/10
\$ 3103.00	MS Meeting Income (auction, raffle, dues, donations)	2/11/10
\$ 200.00	N. Kuntz, T. Slack, E. Hoffmayer Raffle	2/19/10
\$ 25.00	Jennifer McKinney Auction	2/23/10
\$ 80.00	D. Hardesty (raffle & dues) R. Jones (dues)	3/26/10
\$ 120.00	Glenn Parsons Raffle	4/8/10
\$ 190.00	AFS Parent Society Dues	4/13/10
\$ 2365.00	MS Meeting Registration Payment (MSU online)	6/15/10
\$ 152.76	AFS chapter dues rebate	7/22/10
\$ 220.00	AFS chapter dues rebate	12/21/10
\$ 500.00	DMR 2011 Meeting Donation	1/18/11
\$ 45.00	USM Subunit Reimbursement	1/21/11
\$ 500.00	CFRD 2011 Meeting Donation	2/1/11
\$ 600.00	CCA 2011 Meeting Donation	2/1/11

Total Income from January 29, 2010 to February 15, 2011 = \$ 10,620.76

**Southern Division has borrowed \$1,200.00 to make deposits for the 2012 meeting, to be reimbursed.**

**CA Schultz Award Fund Balance is \$145.10.**

**Current Balance as of February 15, 2011 is \$ 8,871.32**

**Mississippi Chapter of the American Fisheries Society  
Certificates of Deposit – January 5, 2010**

BancorpSouth (Account # 259203)

Issue/Renewal Date	Amount Invested (\$)	Interest Rate (%)	Earnings (\$)
3-4-99	1,000.00	4.30	21.68
9-4-99	1,021.68	4.70	23.94
3-4-00	1,045.62	4.70	24.77
9-4-00	1,070.39	5.18	27.50
3-4-01	1,097.89	4.69	25.96
9-4-01	1,123.85	3.52	19.62
3-4-02	1,143.47	1.89	10.89
9-4-02	1,154.36	1.59	9.10
3-4-03	1,163.46	1.25	7.33
9-4-03	1,170.79	1.00	5.84
3-4-04	1,176.63	1.00	5.93
9-4-04	1,182.56	1.25	7.33
3-4-05	1,189.89	1.74	10.44
9-4-05	1,200.33	2.53	15.06
3-4-06	1,215.39	3.22	19.73
9-4-06	1,235.12	3.72	22.78
3-4-07	1,257.90	3.96	25.11
9-4-07	1,283.01	3.72	23.80
3-4-08	1,306.81	2.44	15.99
9-4-08	1,322.80	1.84	12.15
3-4-09	1,334.95	1.25	8.36
9-4-09	1,343.31	1.25	-

BancorpSouth (Account # 259202)

Issue/Renewal Date	Amount Invested (\$)	Interest Rate (%)	Earnings (\$)
3-4-99	1,000.00	4.50	45.12
3-4-00	1,045.12	5.01	52.36
3-4-01	1,097.48	4.91	53.89
3-4-02	1,151.37	2.13	24.52
3-4-03	1,175.89	1.49	17.57
3-4-04	1,193.46	1.15	10.31
Account closed March 3, 2005; Check for \$1,203.77 sent to Megan Ellis, MSAFS Secretary/Treasurer			

BankPlus (Account # 1299101568)

Issue/Renewal Date	Amount Invested (\$)	Interest Rate (%)	Earnings (\$)
8-19-02	2,500.00	2.15	53.67
8-19-03	2,553.67	1.00	25.66
8-19-04	2,579.33	1.74	45.17
8-19-05	2,624.50	2.97	86.02
8-19-06	2,703.32	3.94	108.10
8-19-07	2,811.42	3.94	112.53
8-19-08	2,923.95	2.23	65.76
8-19-09	2,989.71	1.74	-

BankPlus (Account # 1299101586) **C. A. Shultz Conservation Award**

Issue/Renewal Date	Amount Invested (\$)	Interest Rate (%)	Earnings (\$)
8-19-02	2,000.00	2.13	42.95
8-19-03	2,042.95	1.00	20.52
8-19-04	2,063.47	1.74	36.14
8-19-05	2,099.61	2.97	68.82
8-19-06	2,162.67	3.94	86.48
8-19-07	2,249.15	3.94	90.04
8-19-08	2,339.19	2.23	52.60
8-19-09	2,391.79	1.74	-