

Abstracts

Wednesday, February 17, 2010

SESSION 1

COASTAL/MARINE

Moderator: Ben Ricks, Alabama Wildlife and Freshwater Fisheries

1:10 COASTAL ALABAMA SUBMERSED AQUATIC VEGETATION MAPPING PROGRAM

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The ADCNR-State Lands Division Coastal Section and the Alabama Coastal Area Management Program (ACAMP) has been active in habitat mapping and habitat restoration activities since 1999. Two of these programs, the Submerged Aquatic Vegetation (SAV) Mapping Program and the recent Emergency Disaster Relief Program (EDRP) Fish and Shellfish Restoration Project will be highlighted.

The ACAMP, the ADCNR Wildlife and Freshwater Fisheries Division, the Corps of Engineers and other partners, have been mapping SAVs in the coastal area since 1981. This included mapping events in 1981, 1987, 1994, 2001 and 2009. Based on the SAV coverage found during these mapping events, it appears that SAV coverage on the upper Mobile Bay and lower Mobile Tensaw River delta is precipitation and/or tropical storm event driven. The ACAMP intends to utilize meteorological data and statistical analysis to further explore these anecdotal observations. Additionally, the ACAMP and its partners intend to continue to map SAV on a 3-5 interval as funding allows.

Following Hurricane Katrina, the ADCNR-State Lands Division (SLD) was provided funds through the NOAA EDRP program to conduct finfish and shellfish nursery habitat restoration projects. The SLD currently has two projects underway. The first is a large scale, 32 acre salt marsh restoration project located just west of the mouth of Bayou la Batre. The second is a partnership with the Dauphin Island Sea Lab, which is conducting smaller scale wave attenuation and seagrass restoration projects in combination with an intensive 3 year research and monitoring program. The intent of this program is to develop data to show the efficacy of various restoration techniques. This project will be completed in the fall of 2011.

1:30 AGE DISTRIBUTION AND ABUNDANCE ESTIMATES OF ADULT RED DRUM *Sciaenops ocellatus* IN OFFSHORE WATERS OF THE NORTH CENTRAL GULF OF MEXICO

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The red drum (*Sciaenops ocellatus*) fishery in the North Central Gulf of Mexico has been defined as overfished for the latter part of the 20th century. However, due to aggressive management of the species for the past twenty years, the stock is showing signs of recovery (Figure 1). The status of the stock is now undefined due to the lack of quantitative



Figure 1. ROV snapshot of red drum school in the North Central Gulf of Mexico

information to describe the overall health of the fishery. This is the result of the cessation of the commercial fishery and the data the fishery provides. To overcome this limitation, the Fisheries

Ecology Lab at the University of South Alabama initiated a study to examine age distribution, abundance, and physical condition of *Sciaenops ocellatus*.

Fish are collected by the Fisheries Ecology Lab longline survey (100 hooks 1 nm), a monthly gillnetting survey, and by hook and line. Many red drum were also collected at the Alabama Deep Sea Fishing Rodeo an event that attracts fishermen to the Alabama Gulf Coast for a highly esteemed tournament that provides a valuable sampling opportunity to the scientific community.

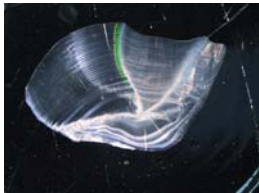


Figure 2. Red drum otolith image

Quantifying the age composition of red drum is essential to determine if the stock is currently overfished. Age distribution of red drum is being studied by the use of otolith processing. Otoliths are small calcium carbonate structures found in the heads of all bony fishes and used in sensory perception. They can be sectioned and analyzed to determine the age of a fish (Figure 2). In addition to using otoliths to obtain age, they can be used to analyze growth by measuring interannual distances between rings. These incremental measurements are used for back-calculation of length that can describe growth of the fish.

Morphometric measurements such as gonadosomal index and intraparetoneal fat index are used to determine the health of each fish. Gonads and intraparetoneal fat are removed and weighed and compared to total weight of each fish to calculate these indices.

This study will provide an overview of the age distribution, condition and estimated abundance of the North Central Gulf of Mexico *Sciaenops ocellatus* stock. These results will present managers the quantitative information needed to best describe the current status of the fishery and lead to a better understanding of the methodology that can be used in a stock assessment.

1:50 CROSS SHELF DISTRIBUTION OF COASTAL SHARKS IN THE NORTHERN GULF OF MEXICO

Andrea Kroetz*, J. Marcus Drymon, John Dindo & Sean Powers.

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Several studies have suggested that populations of large sharks are declining worldwide (Myers et al. 2007 and others). Most sharks are long-lived, slow growing fishes that reach sexual maturity at a late age and large size; these traits, coupled with long gestation periods and low fecundity make these species especially vulnerable to over-harvest.

It is important that adequate management for these fishes is implemented as declines in shark populations may be attributed to overharvesting, incidental bycatch and insufficient management. To that end, the National Marine Fisheries Service (NMFS) initiated an annual fisheries-independent bottom longline survey in 1995 to monitor the status of shark populations in the Gulf of Mexico. NMFS vessel limitations preclude sampling in shallow waters; therefore, in 2006 the Fisheries Ecology Laboratory at the Dauphin Island Sea Lab (DISL) initiated a fisheries-independent bottom longline monitoring program to evaluate fine scale patterns of shark abundance and distribution in the coastal waters of Alabama. In order to examine habitat utilization by sharks along the continental shelf (2-366m) data from the NMFS offshore survey were analyzed in combination with the nearshore data from the DISL survey (Figure 1). The combined data set (1995-2008) yielded 22 species of sharks with 12 species in the nearshore dataset (2006-2008) and 21 species in the offshore dataset (1995-2008). Multivariate analysis of the datasets revealed depth to be a determining factor in the community structure. Atlantic

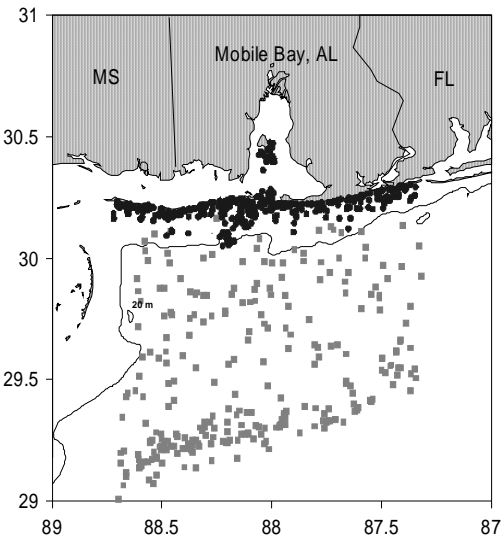


Figure 1: Map of survey area. Grey squares represent NMFS offshore stations and black squares represent DISL nearshore stations

sharpnose (*Rhizoprionodon terraenovae*), blacknose (*Carcharhinus acronotus*) and blacktip (*Carcharhinus limbatus*) sharks were the most abundant species causing these differences in community structure. Blacktip shark CPUE was higher in shallow water (<10 m), while blacknose sharks had higher CPUE at mid-depth (10-30 m). Atlantic sharpnose sharks were abundant in both shallow and mid-depth water. Analysis of sex ratio and length frequency data indicate that blacktip sharks use waters <10 m for parturition while blacknose and Atlantic sharpnose sharks likely use water greater than 30 m deep for parturition. These data comparisons illustrate the importance of sampling across the entirety of a species' depth utilization and surveys that fail to do this risk inaccurately reporting habitat use by these apex predators.

2:10 PREDATOR AVOIDANCE BY AGE-0 RED SNAPPER *LUTJANUS CAMPECHANUS*, ON ARTIFICIAL REEFS IN THE NORTHERN GULF OF MEXICO

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Small artificial reefs (0.3 x 1.0 x 1.2 m) were built in July 2008 (n = 20) and 2009 (n = 20), 28 km south of Dauphin Island, Alabama, in the northern Gulf of Mexico. Each reef consisted of a polyethylene double pallet, to which 10 concrete half-blocks (each 10 x 20 x 41 cm) and a plastic crate (65 x 35 x 28 cm) were attached with 175 lb cable ties. We also built 10 large artificial reefs in 2008 and 10 in 2009 (8 m³; steel cages 2.5 x 2.6 x 1.2 m). All reefs were secured to the substrate with a 1.5 m ground anchor. Each year 10 small reefs were placed 15 m away from the larger cage reefs and 10 were placed 500 m away from the larger cage reefs. Each set of reefs (2 small and 1 large) were placed 1 km apart. Reefs were surveyed in August 2008, and August and September 2009. During each survey, two SCUBA divers counted all fish present on the reef and estimated 25 mm length categories. In 2009 all small reefs were videotaped and photographed. In the lab, all fish in the photographs were identified to species and counted with Image-pro software. A similar procedure was used with a single frame of the video. There were significantly ($p < 0.05$) higher abundances of age-0 red snapper, *Lutjanus campechanus*, on the small reefs placed 500 m ($46.1/m^2 \pm 8.3$) from the larger reefs compared to small reefs placed 15 m away ($3.4/m^2 \pm 1.8$) on all three surveys. We suggest that the typically larger fish (> 300 mm TL) of several species (red snapper, gag grouper *Mycteroperca microlepis*, gray triggerfish *Balistes capriscus*, greater amberjack *Seriola dumerili*) that had colonized the larger reefs resulted in a predator avoidance response by the age-0 red snapper.

2:30 CONTROL OF INVASIVE APPLE SNAILS IN THE THREEMILE CREEK DRAINAGE

Ben Ricks* and Andy Ford. ADCNR-Division of Wildlife and Freshwater Fisheries, District V Fisheries Biologist, , 30571 Five Rivers Blvd, Spanish Fort, AL 36527 Ben.Ricks@dcnr.alabama.gov

The island apple snail is native to South America where it lives in a variety of aquatic habitats. It has been introduced around the world, where it often causes severe damage to native wildlife habitats and agricultural crops. Since its invasion into Florida in the 1970's, it has spread rapidly along the Gulf Coast and East Coast from Texas to South Carolina.

The Alabama Department of Conservation and Natural Resources (ADCNR) Wildlife and Freshwater Fisheries Division (AWFF), in cooperation with the U.S. Fish and Wildlife Service (USFWS) Alabama Ecological Services Field Office and several other partners (including many volunteers from the public), began efforts in Fall 2009 to control the population of exotic island apple snails that have become established in the lakes at Langan Municipal Park (LMP) and Threemile Creek (TMC) in Mobile, AL.

The island apple snail was first observed in the Threemile Creek watershed in 2004. It wasn't until 2008 that the densities noticeably escalated. We believe the population of apple snails at these locations originated from aquarium pet releases. An initial copper sulfate treatment to eradicate adult and juvenile snails was conducted on the LMP lakes October 6, 2009, and on TMC on October 7 and 9, 2009; a second application was made within the LMP lakes on October 15 and 16, 2009. Control measures also include trapping apple snails and the manual removal and destruction of apple snail eggs from these locations. An effort to remove eggs and adult snails was initiated October 3, 2009, at Langan Park involving 40-50 volunteers. Another volunteer effort on October 10, 2009, involved 30-40 volunteers. A trapping effort to monitor the apple snail population post-chemical treatment began October 20, 2009, with the deployment of 20 traps within the lakes at LMP, and has continued to present.

A long-term monitoring and control program will be needed to keep this species from expanding its range in Alabama and threatening other aquatic habitats. The primary goal of this plan is to greatly diminish the population of apple snails in the TMC drainage and restrict further expansion of their range in Alabama.

SESSION 2
SPECIAL SESSION: TENNESSEE RIVER BASIN
Moderator: Brook Fluker, University of Alabama

3:10 DID THE TENNESSEE RIVER ONCE FLOW DIRECTLY INTO THE GULF OF MEXICO?
INSIGHTS FROM THE SPECKLED DARTER *Etheostoma stigmaeum*

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Molecular phylogenies can provide valuable information when making management decisions. On a broad scale, phylogenies can infer underlying patterns that provide insight into the history of drainage basins. These inferred patterns can then be used to recognize areas of endemism, determine the feasibility of translocation of species, choose brood stocks for restocking or reintroduction efforts, and choose surrogates for conservation studies involving endangered species. Although a number of phylogenies for various fishes are available, there are drainage histories that remain obscured. The history of the Tennessee River exemplifies this problem.

Geological evidence exists which suggests that the ancestral Tennessee River flowed directly to the Gulf of Mexico via a path across Mississippi with branches that flowed across Alabama. To examine this hypothesis from a biogeographical standpoint, analysis of the widely used mitochondrial cytochrome *b* and nuclear *S7* genes was used to infer a molecular phylogeny of the speckled darter *Etheostoma stigmaeum*. With its low vagility and widespread distribution across Tennessee, Alabama, and Mississippi, *Etheostoma stigmaeum* is an ideal choice to test this hypothesis.

Results of the phylogenetic analysis revealed four major clades – an upland basin clade that contains endemics to the Duck and Cumberland River drainages, a Mississippi River clade containing the Yazoo, Big Black, and Bayou Pierre drainages of Mississippi, a Gulf Coastal Plain clade inclusive of the Cahaba, Alabama, Pascagoula, Pearl, and Amite drainages, and a Tennessee-Tombigbee clade inclusive of Bear Creek in the lower Tennessee drainage, and the Buttahatchee, Luxapalila, Noxubee, Sucarnoochee, and Black Warrior systems of the Tombigbee. Intraclade relationships are well supported, but interclade relationships remain unresolved.

Did the Tennessee River once flow directly into the Gulf of Mexico? Results of this analysis are inconclusive and may stem from a variety of reasons including lack of sufficient variability among the cytochrome *b* and *S7* sequences to resolve interclade relationships or insufficient time for divergence among fishes in the drainages of the coastal plain to occur. These results highlight how little is actually known of the phylogenetic relationships of the lower Tennessee basin to those of both the Mobile basin and the drainages of Mississippi, and how little is known of the genetic diversity among fishes of the Gulf Coastal Plain. More research using alternate genes and alternate aquatic species is necessary to resolve these relationships, thus providing information that may be used to inform management decisions for conservation of both species and habitats.

3:30 SURVEY OF THE BEAR CREEK SYSTEM FOR FISH SPECIES OF MODERATE TO HIGHEST CONSERVATION CONCERN, 2007-09

Tom Shepard*, Pat O'Neil, Stuart McGregor, Brett Smith, and Cal Johnson. Geological Survey of Alabama, P.O. Box 869999, Tuscaloosa, AL 35486-6999. tshepard@gsa.state.al.us

In 2007-09, 81 fish samples were collected at 58 stations in the Bear Creek system to determine the present distribution and relative abundance of ten fish species of moderate to highest conservation concern historically known from the system. One hundred and one species were collected including seven of the ten target species. The species of conservation concern encountered were the slenderhead darter (*Percina phoxocephala*), the brindled madtom (*Noturus miurus*), the bandfin darter (*Etheostoma zonistium*), the blueface darter (*E. sp. cf. zonistium*), the gilt darter (*Percina evides*), the American brook lamprey (*Lampetra appendix*), and the highland shiner (*Notropis micropteryx*). A single specimen of the slenderhead darter was collected in lower Bear Creek, and the species appears to be significantly reduced in abundance in the system based on recent collections. The suckermouth minnow (*Phenacobius mirabilis*) was not collected in this survey or other recent collections in the system and may now either be extremely uncommon or extirpated. Two nonnative species, which have probably invaded the Tennessee River Basin from the Tombigbee River system via the Tennessee-Tombigbee Waterway, were also found in the system. These were the weed shiner (*Notropis texanus*) and the blacktail shiner (*Cyprinella venusta*). The weed shiner was found at 21 stations in Bear Creek and its tributaries. The blacktail shiner was found at a single locality in lower Bear Creek.

3:50 SURVEY OF KEY CAVE AND THE STATUS OF THE ENDANGERED ALABAMA CAVEFISH *Speoplatyrhinus poulsoni*

Bernard R. Kuhajda* (bkuhajda@bama.ua.edu) and Brook L. Fluker. Department of Biological Sciences, University of Alabama, Box 870345, Tuscaloosa, AL 35487-0345 bkuhajda@bama.ua.edu

The federally endangered Alabama Cavefish *Speoplatyrhinus poulsoni* is restricted to Key Cave within the Tennessee River drainage in northwestern Alabama, with a total population of perhaps less than 100 individuals. This species is highly vulnerable to extinction due to its extremely small range and subterranean specialization. Although the Key Cave National Wildlife Refuge has been established in the high recharge area of Key Cave, its aquifer is still threatened by urban and industrial growth and agricultural practices. The last survey of Key was conducted in 1997. Six surveys were conducted between October 2008 and April 2009. The number of Alabama Cavefish observed per trip ranged from none to six, with low counts associated with high or turbid water. Multiple size classes were present, indicating recruitment is ongoing. Although numbers were lower than in previous surveys, it appears that the population of Alabama Cavefish in Key Cave is stable and reproducing. Southern Cavefish *Typhlichthys subterraneus* were also observed in low numbers, with one to three individuals observed per visit. Two species of cave crayfish, the Alabama Cave Crayfish *Cambarus jonesi* and the Phantom Cave Crayfish *Procambarus pecki*, were present on all visits. One specimen of cave shrimp representing an undescribed species was discovered in March 2009, with two more specimens collected in April 2009. The cavefishes, crayfishes, and cave shrimp of Key Cave should continue to be monitored, and surveys should continue to search for additional undiscovered aquatic taxa.

4:10 SYSTEMATICS OF THE TENNESSEE RIVER ENDEMIC, BLENNY DARTER *Etheostoma blennioides*

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The blenny darter (*Etheostoma blennioides*) is a non-game riverine species distributed in tributaries to the Tennessee River in Tennessee and Alabama. Morphological analyses have identified two subspecies, a widespread nominal form and *E. b. sequatchiense*, from the Sequatchie River, with intergrade populations from the Elk River system and Second Creek. In addition, detailed molecular studies on the greenside darter (*E. blennioides*) indicated a close relationship with the blenny darter, likely due to hybridization and introgression. To examine the systematics of the blenny darter and further understand its relationship to greenside darters, a dataset was generated for mitochondrial and nuclear markers with samples of both subspecies, hypothesized intergrades and greenside darters. Phylogenetic analyses provide insight into the systematics and taxonomy of the blenny darter and reveals additional details on the introgression of greenside darter haplotypes into blenny darter populations. A thorough reexamination of morphological characters in light of these findings should be conducted to update the taxonomic status of this species.

4:30 **Special Guest Speaker**

SMALLMOUTH BASS FISHING ON PICKWICK AND WILSON RESERVOIRS

Steve Hacker

Bass Fishing Guide (since 1989 on Pickwick and Wilson; supplier of brood fish for State smallmouth bass hatchery program in Carbon Hill).

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Pickwick/Wilson are known nationwide as two of the best trophy smallmouth bass fisheries in the world. Discussion of present state of fishery, how conditions/fishing have changed in the last 20 years, tactics and tackle, contribution to Carbon Hill hatchery program. No PowerPoint or any electronic media during this presentation, but do plan to bring tackle and photo albums for interested parties in the audience.

POSTER SESSION

Moderator: Andrew Rypel, University of Mississippi

Microsatellite DNA markers for population-genetic studies of *Micropterus punctulatus* and *Micropterus cataractae* as well as species identification of two suspected hybrid micropterids in Halawakee Creek and Osanippa Creek, Alabama

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Microsatellite DNA loci analyses can be used to assess aspects of population demographics such as allele frequencies of populations and reveal if species are hybridizing. Hybridization within micropterids has been reported between micropterid species (e.g. *Micropterus punctulatus* x *M. dolomieu*, *M. dolomieu* x *M. treculi*) and is suspected to be occurring between *M. cataractae* (the shoal bass) and *M. punctulatus* (spotted bass). Currently, many habitats previously inhabited by *M. cataractae* are now dominated by *M. punctulatus*, and there is concern that hybridization between the shoal and spotted bass may result in a negative impact to the integrity of the natural gene pools of the shoal bass. The objectives of this study were to examine if microsatellite DNA loci primers developed for other micropterids would amplify homologous microsatellite loci in *M. punctulatus* and *M. cataractae*, to quantify the levels of genetic variation of *M. punctulatus* and *M. cataractae* population around Lake Warding Alabama, and to determine if two unknown micropterids collected in Halawakee Creek and Osanippa Creek are hybrids of *M. punctulatus* and *M. cataractae*. 12 microsatellite DNA loci were amplified for *M. punctulatus* individuals sampled from four sites and *M. cataractae* individuals sampled from one site and two suspected hybrids. Information concerning allele frequencies, how genetic variation was partitioned within individuals and among individuals, and the number of *K* genetically differentiated population clusters were obtained using standard software and methods for the analysis of microsatellite DNA loci. Our results show four genetically distinct populations according to this microsatellite data set. Furthermore, based upon observed allele frequencies and population cluster information it was determined that the two suspected hybrids are in fact *M. punctulatus* and not hybrids. These results suggest that in the areas sampled for this study hybridization is not occurring between *M. punctulatus* and *M. cataractae*.

A limnological survey of Alabama's water for cyanobacterial toxins

RajReni Kaul, Michael Chislock, Kristin Adamson, Gina LoGiudice, and Alan Wilson. Department of Fisheries and Allied Aquacultures, Auburn University

Cyanobacteria (blue-green algae) can form unsightly scums and poison aquatic systems, when abundant. However, little is known about the occurrence of cyanobacteria or cyanotoxins throughout freshwater systems in Alabama. To better understand the threat that cyanobacteria pose to the State's stakeholders, we surveyed over 100 waterbodies across a large productivity gradient throughout the summers of 2008 and 2009. The water usage at each site varied widely including domestic, aquaculture and recreational purposes. In addition to standard limnological sampling at each site, we also measured the concentration of a hepatotoxic cyanotoxin (microcystin) in the seston using two techniques, an expensive commercial enzyme-linked immunosorbent assay (ELISA) kit and a newly developed, relatively inexpensive protein phosphatase inhibition assay (PPIA). Both approaches provide information about microcystin concentrations in the water column, while PPIA also provides evidence regarding the toxicity (i.e., protein inhibition) of the bloom. Microcystin concentrations across sites measured via PPIA and ELISA were highly correlated, suggesting that the less expensive and more descriptive technique, PPIA, is a suitable alternative for similar samples in the future. Moreover, microcystin concentrations ranged from below detection limits (<0.0001 ug/L) to >35 ug/L. The latter concentration is well above the threshold set by the World Health Organization for microcystin in processed drinking water of 1 ug/L. As expected, the highly-eutrophic aquaculture ponds had a significantly higher concentration of microcystin than other, less productive sites.

Comparison of standard metabolic rates in the Tennessee cave salamander *Gyrinophilus palleucus* and the spring salamander *Gyrinophilus porphyriticus*

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Adaptations such as endurance to starvation, adoption of K-selected life histories (e.g. lower growth rates, increased lifespan, and postponed reproduction), loss of circadian rhythms and lowered metabolic rates are characteristics common to most obligate cave species. Absence of sunlight and energy limitation are suggested to be the evolutionary pressures driving these adaptations in cave species. Here we present preliminary results of a study that estimated standard metabolic rates of both the Tennessee cave salamander *Gyrinophilus palleucus* and its surface dwelling sister species, the spring salamander *Gyrinophilus porphyriticus*. Standard metabolic rates were estimated using a closed-system respirometer design. Additionally, circadian rhythms were examined for three individuals of each species by taking standard respiration measurements every four hours over a 24 hour period. Analysis of variance followed by a Bonferroni post hoc analysis suggested that neither *G. palleucus* nor *G. porphyriticus* exhibit a circadian rhythm (ANOVA: $p > 0.05$). Average standard metabolic rates were $155.74 (\pm 28.50)$ and $297.09 (\pm 43.64)$ $\mu\text{g O}_2 \text{ g}^{-1} \text{ hr}^{-1}$ for *G. palleucus* and *G. porphyriticus*, respectively, and were significantly different (t-test: $p < 0.01$). The lack of a circadian rhythm and reduced standard metabolic rate suggests that *G. palleucus* has derived some physiological adaptations common to most cave organisms. This study also demonstrates a mechanism by which *G. palleucus* copes with the energy-limited cave environment and provides a better understanding of this top predator's role in the energy flow of cave systems.

The first record of the exotic oriental weatherfish *Misgurnus anguillicaudatus* in Alabama

Brook L. Fluker*, View-Hune Teoh, and Bernard R. Kuhajda. The University of Alabama, Department of Biological Sciences, Tuscaloosa, AL 35487-0345, blfluker@crimson.ua.edu

The globally invasive oriental weatherfish (*Misgurnus anguillicaudatus*) was discovered in Poorhouse Branch, a direct tributary to the Coosa River (Logan Martin Reservoir), in September 2009. Subsequent collections revealed that the species occurs throughout the entire reach of Poorhouse Branch including lentic areas at the confluence with Logan Martin Reservoir, but has not been located in adjacent tributaries. *Misgurnus anguillicaudatus* occurred in moderated abundances where collected, ranging from 30-90 mm standard length, suggesting ongoing reproduction in Poorhouse Branch. Although the origin of this introduction is currently unknown, mitochondrial DNA sequence data suggests the stock originated from China. This species has been shown to have a moderate impact on streams where introduced and may pose a threat to several of Alabama's threatened and endangered stream fishes. Thus, we recommend further sampling to determine the effects of *Misgurnus anguillicaudatus* on the state listed coldwater darter (*Etheostoma ditrema*) in Poorhouse Branch. Additional sampling should be continued to determine the distribution of *Misgurnus anguillicaudatus* in adjacent tributaries, especially nearby Choccolocco Creek which is home to two federally threatened (*Cyprinella caerulea* and *Cottus paulus*) and one state listed (*Etheostoma brevirostrum*) species.

Life history of the obligate cave crayfish *Orconectes australis*

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Crayfish are often a dominant element in cave ecosystems, but little is known about their basic life history characteristics. In general, obligate cave species often exhibit slower growth rates and longer life spans than their surface relatives. An extreme example of this relationship can be seen in the cave crayfish *Orconectes australis australis*, which has a reported life span and time-to-maturity ranging from 37 to 176 and 16 to 105 years, respectively. If true, such estimates could have significant implications regarding cave ecosystem processes and conservation. Here, we present preliminary results from an ongoing mark/recapture study on *O. a. australis* in northeastern Alabama caves. To date, ~1600 individuals have been marked among 3 cave systems. Using measurements of individuals recaptured more than one year after initial marking, a linear growth model estimating annual growth increment was developed. The model predicts that males and females reach sexual maturity after 2 and 8 years, respectively. We are currently unable to provide an accurate estimate of life span, however, preliminary figures suggest that life span may be significantly lower than previous reports. Our results provide a more realistic picture of *O. a. australis*'s life history and role in cave ecosystem processes.

Aquatic species conservation in the Mobile River Basin – the North River strategic habitat unit

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In 2004 the U.S. Fish and Wildlife Service designated 26 stream segments in the Mobile River Basin as critical habitats for 11 listed mussel species. Strategic Habitat Units (SHUs) were established for each critical habitat unit, encompassing the entire watershed of each. The North River SHU, located in the Black Warrior River system of west Alabama, is home to 5 federally listed species: *Hamiota perovalis*, *Medionidus acutissimus*, *Pleurobema furvum*, *Pleurobema perovatum*, and *Ptychobranthus greenii*. Mussel surveys performed by the Geological Survey of Alabama (GSA) and others in 1991 and 2008 documented a decline in species richness and abundance in the North River SHU. *Hamiota perovalis* and *P. furvum* were the only listed species encountered in either survey and significant declines in distribution and abundance were documented for each. Causes of these declines (likely changes in water and habitat quality) are under investigation by GSA. Stream habitat evaluation revealed sediment bedload to be a significant nonpoint source pollutant, particularly in the Clear Creek watershed, and analysis of land cover changes from 1974-2007 documented a 32 % increase in impermeable surface areas, such as cultivated fields, urban development, and mining. Recent water quality investigations revealed high levels of *E. coli* and Specific Conductance values in the watershed. Nutrients flush through the watershed, eventually reaching Lake Tuscaloosa, once considered an oligotrophic lake, but now becoming eutrophic. Recovery of imperiled aquatic species and removal of North River from the 303(d) list will require cooperation among landowners and government and non-government agencies.

Age and growth of North America's freshwater mussel fauna: conservation and management implications

Andrew L. Rypel^{1,2} and Wendell R. Haag².

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Freshwater mussels are frequently viewed as being long-lived and slow-growing. However, this perspective is based on few taxa (e.g., *Margaritifera margaritifera*) and is not applicable to the Order Unionoida as a whole. We investigated age, growth, size and longevity patterns in 57 freshwater mussel species and 146 populations using original data and literature sources. Longevity spanned nearly two orders of magnitude (4–190 y), and the Von Bertalanffy growth constant, K , spanned a similar range (0.02–1.01). Longevity, K , and size also varied dramatically among populations of the same species; in some cases, longevity and K differed between populations by a factor of 2 or more. Growth differed between sexes in 11 of 16 species and males typically reached larger sizes than females. A population of *Quadrula asperata* in the Sipsey River, AL exhibited two distinctly different growth trajectories. Most individuals in this population had a low-moderate value of K (0.15) and intermediate longevity (27 years) but other individuals showed extremely slow growth ($K=0.05$) and reached advanced ages (72 years). Across all mussel species, longevity was related negatively to the growth rate (K) and K explained a high percentage of variation in longevity. Age and growth is highly variable in freshwater mussels and this finding has essential management implications. Growth characteristics cannot be generalized across species or even across populations of the same species. In fisheries management, failure to consider age and growth can result in unintended or even harmful outcomes. We contend that age and growth data should become a pre-requisite for management of freshwater mussel populations as it is for management of fish populations.

Coastal movement of Gulf sturgeon throughout northwest Florida

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Two hundred and three Gulf Sturgeon, *Acipenser oxyrinchus desotoi*, were tagged with ultrasonic transmitters between 2003 and 2008 in the Florida portions of Escambia (n=43), Blackwater (n=12), Yellow (n=34), Choctawhatchee (n=42), Apalachicola (n=11), Brothers (n=35), and Ochlockonee Rivers (n=26). Gulf sturgeon marine migration was monitored in the Gulf of Mexico (GOM) between the entrances of Mobile Bay, Alabama (AL) and Ochlockonee Bay, Florida (FL) with roving telemetry on a biweekly basis from December through April 2003–2008. The GOM supported sturgeon in two distinct areas, Mexico Beach, FL and Gulf Shores, AL. The seasonal presence of Gulf sturgeon in these particular nearshore marine habitats was correlated with sediment studies that characterized and quantified prey items during the winter foraging months. Trawling activity conducted to re-nourish beaches also helped confirm foraging locations for 16 sturgeon, 13 untagged and 3 tagged, near Panama City Beach, FL (n=8), Perdido, FL (n=5), Destin, FL (n=1), and Mobile, AL (n=2).

ADEM Field Operations Display

State of Alabama Water Quality Monitoring Strategy; summary: Brief overview of ADEM monitoring strategy goals and water quality monitoring programs.

Water Quality Monitoring Stations; summary: Brief overview of State regulations for water quality and ADEM water quality monitoring that is under development.

Ambient Air Quality Monitoring in Alabama

Ambient air quality is monitored by ADEM and other agencies in Alabama. This banner display summarizes the network of monitors through out the state. It gives references for the annual monitoring plan and online access to the data

Bonnie Hamiter and Ranse Williams

Field Operations Division-Montgomery; Alabama Department of Environmental, 1350 Coliseum Blvd, Montgomery, AL 36110

Thursday, February 18, 2010

SESSION 3 RESERVOIR

Moderator: Joey Slaughter, GA Power

8:00 REVIEW OF THE LARGEMOUTH BASS POPULATION IN WILSON RESERVOIR BEFORE, DURING AND FOLLOWING IMPLEMENTATION OF A 15-INCH MINIMUM SIZE LIMIT.

Phil Ekema, Alabama Division of Wildlife and Freshwater Fisheries, 21453 Harris Station Road, Tanner, AL 35671. phil.ekema@dcnr.alabama.gov.

Wilson Reservoir is a 15,500-acre Tennessee River impoundment in north Alabama. World renowned for its smallmouth bass fishery, it also provides excellent angling for largemouth bass. From 1992 through 2009, the largemouth bass population was sampled 10 times, twice prior to the October 1993 implementation of a 15 inch minimum size limit, 7 times during the size limit, and once following the February 2005 removal of the 15 inch minimum size limit. Electrofishing data, angler creel data, and BAIT data will be presented in this review of the 15 inch minimum size limit.

8:20 HISTORY OF BLACK BASS MANAGEMENT AT HARRIS RESERVOIR

Michael P. Holley, Alabama Division of Wildlife and Freshwater Fisheries, P.O. Box 158, Eastaboga, AL 36260. Mike.Holley@dcnr.alabama.gov

Constructed in 1983, Harris Reservoir is the newest of Alabama Powers 14 hydropower reservoirs in the state of Alabama. Initial stocking of Florida strain bass led to good growth during the “new reservoir boom”, and anglers flocked to catch “clean” bass for the table. By the early 90’s, large spotted bass and largemouth bass began to decline. In 1993 a slot limit was implemented on spotted bass and largemouth with the intention to provide larger bass for anglers. The slot limit remained in effect until 2006 and at that time it was removed on spotted bass due to lack of harvest of fish below the slot, which resulted in stockpiling of small spotted bass. Harris reservoir provides a good framework for monitoring fishing mortality, and adjusting harvest restrictions to maintain preferable black bass population metrics.

8:40 15 WITH 14; THE LARGEMOUTH BASS FISHERY AT DEMOPOLIS RESERVOIR AFTER 15 YEARS WITH A 14-INCH MINIMUM LENGTH LIMIT

Jay B. Haffner, Alabama Division of Wildlife and Freshwater Fisheries, Northport, AL
Jay.Haffner@dcnr.alabama.gov

Electrofishing surveys performed at Demopolis Reservoir from 1987 to 1993 revealed a decline in the abundance of largemouth bass *Micropterus salmoides* ≥ 300 mm. Creel survey data indicated anglers harvested bass from Demopolis at about twice the rate they did at other west-Alabama reservoirs and 74.0% of the bass they harvested were less than 356 mm. On October 1, 1995, the Alabama Division of Wildlife and Freshwater Fisheries implemented a 14-inch minimum length limit on all black bass *Micropterus spp.* at Demopolis Reservoir. To determine if the management goals for the regulation were met, we compared the relative abundance, population structure, growth, and creel statistics before and after the regulation was implemented.

Spring electrofishing surveys have been performed at Demopolis every year since 1998. Since 2000, bass ≥ 300 mm have been 55.3% more abundant in our collections compared to the 4 pre-length limit collections, and from 2006-09, CPH of bass ≥ 300 mm has increased 56.1%. The CPH of largemouth bass ≥ 356 mm in 2009 reached an all-time high of 26.8. Since 2006, the average CPH of largemouth bass ≥ 356 mm is 45.5% greater than pre-length limit collections. However, electrofishing catch rates of largemouth bass ≥ 380 mm have been highly variable since the implementation of the 14-inch minimum length limit. The average CPH of largemouth bass ≥ 380 mm post-length limit is 19.4% greater than 4 pre-length limit collections. Since 2006, the average CPH of largemouth bass ≥ 380 mm is 25.7% greater than the pre-length limit average. Recruitment, as measured by the CPH of age-1 fish has remained moderate stable since 2000.

In recent collections, length-at-capture of age-1 to age-3 largemouth bass is at or above the average of pre-length limit collections. However, growth has slowed substantially for older fish. In the 2006 and 2007 collections it took 4.77 years for largemouth bass to reach 15 inches, compared to 4.1 years in 1993 and 1995. Total annual survival of largemouth bass ≥ 356 mm was 50%; in 2 pre-length limit collections, total annual survival was estimated to be 57%. Increased production of legal-size fish appears to be limited by slow growth. Bass “stockpiling” below the 14-inch minimum-length limit continue to frustrate tournament anglers.

From the late 1990’s to 2001, data collected from bass tournaments suggested a decline in the quality of the adult bass population. The numbers and pounds of bass weighed-in/angler-day fell to their lowest levels while the fishing effort required to catch a 5-pound bass increased nearly 10-fold. Circumstantial evidence suggested Largemouth Bass Virus was to blame. Since that period, the numbers and pounds of bass weighed-in and the fishing effort needed to catch a 5-pound bass have generally improved. Since 2006, 11.5% fewer bass have been weighed-in compared to those years prior to the implementation of the length limit. However, the pounds of bass weighed-in/angler-day has risen an average of 19.2% and the fishing effort needed to catch a 5-pound bass has declined 6.3%.

Demopolis Reservoir anglers have been creeled 3 times since the implementation of the 14-inch minimum length limit. Catch rates of bass, by bass anglers, were identical (0.72 fish/hour) in 2 of 3 creel surveys. Harvest rates of black bass by bass anglers have steadily declined to 0.01 fish/hour in 2007. CPH of bass ≥ 356 mm by bass anglers reached a high of 0.29 in 2001 and fell in 2007 to a low of 0.20. Bass anglers released 98.2% of all the bass they caught. In 2007, 68.4% of bass anglers said they approved of the 14-inch minimum-length limit. A similar response (67.1%) was noted in the 2001 creel. In 1998, the minimum length limit had a much greater appeal among bass anglers when 90.5% responded that they were in favor of it.

Using the Fishery Analyses and Simulation Tools software, changes in the fishery will be examined under various modifications to the current regulation.

9:00 DESCRIPTION OF THE BLACK BASS AND CRAPPIE FISHERIES ON BOB WOODRUFF (JONES BLUFF) RESERVOIR

R. Graves Lovell, Alabama Division of Wildlife and Freshwater Fisheries, 1820 Glynwood Dr, Suite C, Prattville, AL 36066. graves.lovell@dcnr.alabama.gov.

Bob Woodruff (a.k.a. Jones Bluff) Reservoir is a 12,510-acre impoundment situated on the Alabama River above Millers Fairy and near Montgomery, AL. Jones Bluff is a run-of-the-river impoundment that fluctuates very little and has a short retention time. The impoundment is located in a relatively fertile watershed used largely for agriculture. These characteristics typically promote stable recruitment and above average growth of sport fish. Crappie are sought after by many anglers as the population is typically abundant with many quality size individuals. Both largemouth and spotted bass populations are abundant and often targeted by anglers. Distinct segregation in preferred habitat between largemouth and spotted bass is evident on Jones Bluff. Stratifying sampling sites in the recent past has provided a better description of black bass populations.

9:20 REVIEW OF TRENDS IN THE LARGEMOUTH BASS AND CRAPPIE FISHERY ON WILLIAM DANNELLY (MILLERS FERRY) RESERVOIR

David Armstrong, Alabama Division of Wildlife and Freshwater Fisheries, 30571 Five Rivers Blvd., Spanish Fort, AL 36527. david.armstrong@dcnr.alabama.gov.

William Dannelly (a.k.a. Millers Ferry) Reservoir area is a 17,200-acre impoundment that falls primarily within Wilcox and Dallas counties. Annual average reservoir fluctuation is generally less than 1-foot. A fertile watershed comprises 20,637 square miles across soils within the Coastal Plain Province. These attributes combine to create a stable and productive reservoir. From 1985 through 2007, over 30 samples were collected for largemouth bass and crappie. Sportfish populations in this reservoir provide an above-average fishery for both largemouth bass and crappie. Standardized sampling and angler catch data will be expanded upon during this presentation.

9:40 SECRETS OF THE CONECUH: GANTT AND POINT A RESERVOIRS

Ken Weathers, Alabama Division of Wildlife and Freshwater Fisheries, 3520 Plaza Drive, Enterprise, Alabama 36360. Ken.Weathers@dcnr.alabama.gov

Gantt Reservoir (approximately 2,700 acres) and Point A Reservoir (approximately 700 acres) are adjacent impoundments in south-central Alabama located along the Conecuh River. These dams were constructed in the early 1920's by the River Falls Power Company for hydroelectric production, and are currently owned and operated by Power South Electric Cooperative. Point A dam is located just downstream of the confluence of the Conecuh River and Patsaliga Creek and has a watershed of approximately 1300 acres, while Gantt Dam is directly upstream and drains approximately 650 acres. The watershed lies in the East Gulf Coastal Plain, and results in relatively infertile reservoirs which typically stay a dark brown color due to tannic acid. Spring electrofishing typically indicates largemouth bass populations mostly comprised of small, slow growing fish with few above RSD-preferred size classes. Bluegill populations were generally better quality, with many fish in the RSD quality and preferred size ranges. Both of these lakes are known locally for quality redear sunfish angling, especially from mid-April through May. This is mainly due to an abundance of shallow water, aquatic vegetation, mussels, and snails. Some of the lesser known attributes of these reservoirs such as large flathead catfish, quality bowfin and chain pickerel, and quality crappie fishing will also be discussed. Problems associated with this area such as drastic reservoir draw downs for periodic dam maintenance, siltation in the upper end of Gantt, and bank excavation by fossil hunters will also be addressed. Secret sites to launch canoes for quality float trips on the Patsaliga may be mentioned, but several members known to frequent quiet, lonely streams may be asked to leave the room.

SESSION 4
CONTRIBUTING PAPERS

Moderator: Tonya Mayberry, Alabama Department of Environmental Management

10:20 CYANOBACTERIA BLOOMS AND ASSESSMENT IN GPC RESERVOIRS

Tom Broadwell, Georgia Power Company, 5131 Maner Road, Smyrna, GA 30080.

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Recent events during the summers of 2008 and 2009 have generated recognizable growths (blooms) of Cyanobacteria in several Georgia Power Company (GPC) reservoirs. After some historical searching, these blooms were found to not be new occurrences. However, new simple field methods for evaluating the blooms could show if they are producing toxins harmful to humans. There are levels of toxins produced that can be harmful for contact recreation, but also levels that make drinking water unsafe without additional treatment. This presentation will discuss our historical review and development of our response to assessing the extent and severity of Cyanobacteria blooms in GPC reservoirs.

10:40 POTENTIAL FOR TROPHIC COMPETITION BETWEEN INTRODUCED SPOTTED BASS AND NATIVE SHOAL BASS AND LARGEMOUTH BASS IN THE FLINT RIVER, GEORGIA

S.M. Sammons*, Department of Fisheries and Allied Aquacultures, Auburn University, sammosm@auburn.edu

Black bass were collected for diet analysis in September-October 2007, December 2007, March-April 2008, and July 2008. A total of 316 largemouth bass, 341 shoal bass, and 321 spotted bass were processed for diet analysis. Diets of all three species was very broad; 10 categories of invertebrates and 15 species of fish were identified from diets. Since few large spotted bass were collected, all comparisons among species were conducted only for juvenile fish (< 200 mm) and subadult fish (200-300 mm). Juvenile largemouth bass diets were dominated by fish in all seasons, mainly sunfish. Juvenile largemouth bass rarely ate insects except in spring, when all three species consumed large numbers of insects. In contrast, juvenile shoal bass diets were dominated by insects in all seasons but winter. Juvenile spotted bass diets were more varied- highly piscivorous in the fall and winter and highly insectivorous in spring and summer. Diets of subadult largemouth bass were similar to that of juvenile fish, and heavily dominated by fish, particularly sunfish. Similar to juveniles, diets of subadult shoal bass were much less piscivorous than largemouth bass. Crayfish were important components of subadult shoal bass diets in all seasons but summer. Insects were important components of shoal bass diets in fall and summer. Diets of subadult spotted bass were generally more piscivorous than shoal bass, but less than largemouth bass. As fish size increased, largemouth bass diets shifted from fish to crayfish, until crayfish became the dominant item in diets of fish > 400 mm. In contrast, although the chance of crayfish dominating the diets of shoal bass and spotted bass also increased with fish size, the chance of fish being in their diets increased with fish size as well. Thus while largemouth bass shifted their diets from fish to crayfish as they grew, fish were readily eaten by shoal bass and spotted bass along with crayfish. Diets of introduced spotted bass appeared to occupy an intermediate position between the two native black bass species, but was generally more similar to shoal bass. Despite the high diversity observed in diets of shoal bass and spotted bass, significant diet overlap was common between these species, occurring in 50% of the samples. In contrast, diet overlap was only observed in 30% of the samples between spotted bass and largemouth bass, and only 20% of the time between the two native bass species. Thus, concerns about the trophic effects of spotted bass on shoal bass appear to be well-founded, and could be a potential issue whenever food is limiting.

11:00 HATCH DATES AND GROWTH RATES OF THREE SPECIES OF AGE-0 BLACK BASS IN THE FLINT RIVER, GEORGIA.

Matthew R. Goclowski* and Steven M. Sammons. Department of Fisheries, 203 Swingle Hall, Auburn University, AL 36849 mrg0005@auburn.edu

Age-0 largemouth bass *Micropterus salmoides*, shoal bass *M. cataractae*, and spotted bass *M. punctulatus* were collected from two regions of the upper Flint River, Georgia, in 2008 and 2009 to investigate the potential for competition among the three species at early life stages. Age-0 black bass were collected during early summer of both years; all fish were measured (TL, mm), weighed (g), and had sagittal otoliths removed for age determination. Hatch dates and growth rates were estimated for each aged fish. Hatching occurred from April to June each year; hatch durations varied from 21-61 d for largemouth bass, 21-56 d for shoal bass, and 23-38 d for spotted bass. Mean hatch dates varied among species and region, but there were no consistent trends in the relative timing of mean hatch. Mean hatch dates were later in 2009, when the Flint River experienced high discharge levels due to flood events. Mean growth rates varied from 0.82-0.95 mm/d for largemouth bass, 0.89-1.1 mm/d for shoal bass, and 0.94-1.0 mm/d for spotted bass among regions and years. Mean growth rates varied among species and regions but differences were not consistent across sample periods. Growth rate increased with hatch date for all species, indicating that early spawning did not provide any growth advantages. Our data suggest that hatching periodicity does not promote any competitive advantages among species of black bass in the Flint River.

11:20 THE EFFECTIVENESS OF ADVANCED OXIDATION TECHNIQUES COUPLED WITH SONICATION IN DEGRADING ENVIRONMENTAL ESTROGENS IN WASTEWATER

Bryan S. Arwood. Department of Biology, University of Alabama at Birmingham. arwood@uab.edu

Recently there has been growing concern about environmental estrogens and their effects on the health of humans and wildlife. Many compounds of human origin have been shown to act as estrogens with the potential to disrupt the endocrine systems of wildlife and humans, and thus have been classified as endocrine disrupting compounds (EDCs). EDCs have been shown to occur worldwide in various aquatic habitats. Of the EDC's, one of the most potent is 17- α -ethinyl-estradiol (EE2), a synthetic estrogen found in birth control pills. These are excreted by females in the urine and end up in the wastewater. While waste-water treatment plants (WWTPs) are successful at removing many organic compounds, they frequently fail to remove steroidal compounds efficiently. Thus, there is a need to improve the effectiveness of treatment methods at removing these ubiquitous endocrine-disrupting substances from wastewater. I intend to study the effectiveness of various advanced oxidative treatments (AOTs) at breaking down EE2 in water. The objective is not necessarily to completely destroy these substances, but to break open the steroid rings so that microbes can degrade them more effectively. AOT methods to be tested include UV photolysis, ozonolysis, and sonication. Samples of DI water spiked with EE2 (1mM) will be treated for various lengths of time and then analyzed using reverse phase high pressure liquid chromatography (HPLC) to compare the amount of remaining EE2 with that in the original water sample. In addition, the treated samples will then be tested for residual estrogen activity using the yeast estrogen screening assay (YES assay).

11:40 ADEM WATER QUALITY MONITORING: CURRENT STATUS AND FUTURE ACTIVITIES

Fred Leslie. Alabama Department of Environmental Management fal@adem.state.al.us

During 2010, the water quality monitoring strategy for the state of Alabama will be revised and updated according to EPA program specifications. As in 2005, EPA program specifications will include:

- EPA's *Elements of a State Water Monitoring and Assessment Program* that provided a basic framework that states were required to use to monitor and assess their aquatic resources. The elements include the development of a strategy that outlined quality assurance plans, data management, data analysis, reporting, program review, and overall resource needs.
- EPA's linkage of Clean Water Act (CWA) §319 nonpoint source funding to the CWA §303(d)/TMDL process. Combining these programs was needed to begin implementing nonpoint source control activities more effectively.
- EPA's *Integrated Water Quality Monitoring and Assessment Report Guidance* that required placement of all state waters into one of five categories that describe the extent to which state water quality criteria/designated uses are met.

Changes in ADEM water quality monitoring programs that will be included in the Strategy are as follows:

- Revision of the state of Alabama Water Quality Monitoring Strategy to document current water quality data needs and develop methods to meet these needs. In the 2005 Strategy, implementation of the Rivers and Streams Monitoring Program (RSMP) and the Rivers and Reservoirs Monitoring Program (RRMP) was initiated to coordinate monitoring efforts and ensure consistency within wadeable and nonwadeable waterbodies. In 2010, the Strategy will initiate the Coastal Monitoring Program and the Wetlands Monitoring Program that are scheduled to be implemented in 2011.

The presentation to be given during the AFA meeting will describe the Monitoring Strategy as well as the structure and function of the water quality monitoring programs described in the strategy.

SESSION 5
AQUATIC BIODIVERSITY

Moderator: Andrew Henderson, Alabama Wildlife and Freshwater Fisheries

1:40 STATUS OF NONINDIGENOUS RED SHINER (*Cyprinella lutrensis*) IN ALABAMA

Heath Haley* Carol Johnston and Emily Hartfield. Fish Biodiversity Lab, Department of Fisheries, and Allied Aquaculture, Auburn University haleyth@auburn.edu

Red Shiner, (*Cyprinella lutrensis*) is a highly aggressive species that has been repeatedly introduced outside of its native range via baitbucket and aquarium release, and other mechanisms. This species now dominates degraded streams in the Chattahoochee River drainage near Atlanta, Georgia where it was introduced, in some areas comprising over 90% of species present. Hybrids/introgressed individuals between red shiner and congeners have been reported, all from areas where red shiners have made secondary contact or have been introduced into areas with native species (i.e., *Cyprinella venusta*, *Cyprinella camura*, *Cyprinella spiloptera*, *Cyprinella callitaenia*) and it is probable that red shiners will hybridize with additional species of *Cyprinella* if contact is made. In Alabama, the nonindigenous red shiner has been reported from sites in the Tombigbee, Chattahoochee and Coosa river drainages. In the Coosa River drainage, red shiner threaten the federally listed threatened blue shiner (*Cyprinella caerulea*) (high conservation concern, P2 in Alabama). Red shiner was reported in low numbers at sites in the Coosa River drainage, but recent data are lacking. This area is especially important to monitor due to the proximity to the smallest and possibly most endangered population of blue shiner in Alabama, in Spring Creek, Cherokee County. Our objective was to determine the current distribution and abundance of red shiner in selected sites in the Coosa River, Alabama. We found red shiner/introgressed individuals at 13 of 54 sites surveyed. These individuals were often extremely abundant, and were distributed from the Georgia state line in Weiss reservoir to the mouth of Choccolocco Creek.

2:00 HEARING AND THE EFFECT OF NOISE ON ALABAMA FISHES

Daniel E. Holt* and Dr. Carol E. Johnston. Department of Fisheries and Allied Aquaculture, Auburn University holtdan@auburn.edu

Noise pollution is a serious problem that has increased dramatically with recent human development. Despite their seemingly quiet underwater habitat, freshwater fishes are not sheltered from elevated noise levels. Bridge and boat traffic, along with natural noise sources including other organisms, waterfalls, rainfall, and water turbulence all contribute to a noisy aquatic environment. Higher noise levels can result in elevated hearing thresholds, and decrease the signal-to-noise ratio of acoustic signals. Because many fishes use acoustic signals during critical life history stages (such as reproduction and territory defense), it is important to determine whether elevated noise levels affect behavior during these stages.

An understanding of the ambient noise alone is not enough to make predictions about how a particular species will be affected by elevated noise. This is due to the fact that different fish have different hearing capabilities, and are affected differently by noise. Fish such as minnows and catfish have specialized organs that amplify sounds, giving them more sensitive hearing. These fishes are known as hearing specialists. Fishes without these specializations, such as bass and darters, have less sensitive hearing and are known as hearing generalists.

Both hearing generalists and specialists may take several actions in order to compensate for elevated noise levels. First, individuals may increase the amplitude of their acoustic signals to enhance their audibility. This is known as the Lombard effect. Second, individuals may change some temporal component of their signals for greater redundancy over time. If physiologically possible, individuals may also change spectral components of their calls in an attempt to enhance audibility. Decreasing the distance between sender and receiver is another way individuals may enhance their audibility.

We attempted to determine the effect of elevated noise levels on nest choice, acoustic communication, and reproductive and aggressive behaviors in the black tail shiner (*Cyprinella venusta*). To determine how noise affected nest choice, two underwater speakers were suspended over artificial crevice nests on opposite sides of a 1022 l tank. Band limited white noise was played from one speaker, while the other speaker remained silent. The amount of time spent, and number of aggressive and reproductive behaviors performed by males at the quiet nest was then compared to the noisy nest.

To determine how elevated noise affected acoustic communication, trials during which the sounds and associated behaviors of *C. venusta* were recorded were performed in two tanks: one with elevated noise, and one with silence. Temporal and spectral acoustical parameters and behaviors were compared between the two conditions to determine the effect of noise on the sounds and behaviors.

2:20 PHYLOGEOGRAPHY OF THE ROCK DARTER SPECIES COMPLEX IN THE MOBILE BASIN, *Etheostoma Rupestre* (TELEOSTOMI: PERCIDAE)

Alexis M. Janosik* and C.E. Johnston. Department of Biological Sciences, Auburn University. Department of Biological Sciences, Auburn University, 101 Rouse Life Sciences Building, Auburn, AL 36849 amjanosik@gmail.com

The Rock Darter, *Etheostoma rupestre*, is one of many fish species endemic to the Mobile Basin. Within this distribution, the species has a disjunct distribution, with populations in the upper Coosa drainage, Hatchet Creek, Tallapoosa River below the Fall Line, Tombigbee, Warrior and Alabama rivers. In his analysis of morphological variation within the species, Tsai recognized two clearly defined races: one in the Tombigbee-Warrior, and one found in the rest of the species range. Using the mitochondrial cytochrome b and nuclear intron S7 loci, we examined the distinctiveness of these races from specimens of *E. rupestre* across the known distribution. Genetic variation is distributed in a pattern across the distribution that correlates with biogeographic history. Tombigbee River populations are distinct from others and have most likely recently re-invaded this system from upland regions. Variation is present throughout the remaining range of the species, indicating some degree of isolation between these populations.

2:40 SOUND PRODUCTION AND REPRODUCTIVE BEHAVIOR IN THE *Catonotus* DARTERS OF NORTHERN ALABAMA

Patty Speares* and Carol Johnston. Fish Biodiversity Lab, Department of Fisheries, Auburn University, Auburn Alabama 36849 pas0004@auburn.edu

Darters of the genus *Etheostoma* are an extremely diverse group of over 150 species, most of which are endemic to the Southeastern United States. Species within this genus have a wide variety of reproductive behaviors, including nest guarding, the use of pheromones, egg mimics and sound production. To date the only subgenus that has been found to produce vocalizations is the subgenus *Catonotus*. Sound production is prevalent throughout this subgenus. Typically males of these species will occupy a nest and attract multiple females to their nest using courtship behaviors and acoustic signals. Sound production is present in the majority of the *Catonotus* darters and appears to be essential to the reproductive success of these species. All darter vocalizations have multiple components including knocks, purrs, and drums. These components however, vary in duration and frequency between species and therefore may be used for reproductive isolation.

There are multiple species of *Catonotus* darters present in Northern Alabama, including the lollypop darter (*Etheostoma neopterum*), the crown darter (*Etheostoma corona*), the blackfin darter (*Etheostoma nigripinne*), the fringe darter (*Etheostoma crossopterum*) and the fantail darter (*Etheostoma flabellare*). All of these darters have been documented in the lab to produce sounds during courtship, spawning and aggression. Although sometimes found sympatric with other darters, each of these species have specific habitat preferences. This talk will discuss the reproductive behavior of these darters including their species specific vocalizations, and the importance of these vocalizations in concert with other behaviors to reproductive success. How the environment affects these behaviors and the need for habitat conservation will also be discussed.

3:20 SYSTEMATICS OF THE COOSA BASS COMPLEX IN ALABAMA

Carol Johnston*, Winston Baker, and Rebecca Johansen. Fish Biodiversity Lab, Department of Fisheries and Allied Aquacultures, Auburn University Johnsc5@auburn.edu

Coosa Bass are a small-bodied species of bass restricted to upland portions of the Alabama, Chattahoochee, Altamaha and Savannah river drainages. Because the species does not cross the Fall Line, it is assumed that little gene flow among drainages exists. This restriction may have isolated populations, setting the stage for speciation over geologic time. Using standard morphological techniques and analysis of markers in the nuclear genome, we examined variation among population of Coosa Bass. We recognize three new species, (Black Warrior, Tallapoosa and Chattahoochee forms) and discuss variation in additional populations. Due to range restriction and habitat degradation, at least one species in the complex, the Black Warrior population, is in need of conservation. Recognition of new species in the Black Warrior and Tallapoosa rivers is consistent with high endemism in those river systems.

3:40 THE LAST STAND OF THE ALABAMA SHOAL BASS: CONSERVATION STATUS OF SHOAL BASS IN ALABAMA TRIBUTARY STREAMS OF THE CHATTAHOOCHEE RIVER

Steven M. Sammons*, Department of Fisheries and Allied Aquacultures, Auburn University sammosm@auburn.edu

Shoal bass *Micropterus cataractae* have been virtually eliminated in the mainstem channel of the Chattahoochee River along the Georgia-Alabama state line, due to numerous impoundments that have flooded shoal habitat necessary to the survival of this species. Since the 1950s, most of the remaining shoal bass populations in this area were restricted to shoal habitat areas in major tributaries to the Chattahoochee River. However, recent surveys of the Alabama tributary streams have revealed that shoal bass have been virtually eliminated from these areas over the last 30 years. Currently, one shoal bass population exists in Alabama, persisting in an isolated 600-m stretch of shoals and consisting of approximately 75-100 adults. Reasons for the decline of this fish are unknown, but likely causes include changed land-use, increased human population in the watersheds of these streams, and possible competitive interactions with non-native spotted bass *M. punctulatus*. Approximately 300 6-10" shoal bass were stocked into three of these streams in an attempt to bolster these waning populations. Relatively few fish were recaptured during surveys in 2008 and 2009; only 21 of the 314 stocked fish were ever recaptured, and recovery rates ranged between 4-8 percent among the stream reaches. Stocking failed to appreciably change the species composition of the black bass community by the end of the project in all stream reaches but one, where the proportion of shoal bass increased nearly 10-fold over pre-stocking conditions. However, few black bass of any species were collected in this stream during these surveys, and only one stocked fish was collected in the last sample. Shoal bass and spotted bass were found to use shoal habitat more than other types of habitat available in these streams. Furthermore, a tank experiment revealed some indications that spotted bass can have negative competitive interactions with shoal bass. Alabama populations of shoal bass remain in great danger of extinction. These populations can likely only be recovered with rapid and decisive management actions. If drastic actions are not taken rapidly, it is only a matter of time before wild shoal bass are gone from Alabama's waterways.

4:00 CONSEQUENCES OF LOW-HEAD DAMS TO CRAYFISH ASSEMBLAGES AND GENE FLOW IN ALABAMA STREAMS

Emily E. Hartfield*, Michael M. Gangloff, Scott R. Santos, and Jack W. Feminella. Department of Biological Sciences, Auburn University, Auburn, AL hartfee@auburn.edu

Dams are numerous in many southeastern U.S. streams, with >10,000 in Alabama alone. Instream physicochemical and biotic impacts of dams can be dramatic, including altering flow and sediment regimes and channel geomorphology as well as reducing longitudinal movement by fishes and other mobile organisms. Additionally, such barriers can fragment populations, thus decreasing genetic diversity while increasing extinction vulnerability. In 2006–2007, we quantified crayfishes and their habitats at reaches upstream, immediately downstream (mill sites), and $\geq 500\text{m}$ downstream of 22 low-head milldams within 9 Alabama drainages. Ten dams were intact, 7 were partially breached, and 6 were relict with more natural flow regimes. Crayfish populations were quantified using a combination of traps, kick seining, and electro-fishing. Fish communities were also quantified to test the prediction that aggregations of predatory fishes at dam sites may alter crayfish abundance. Additionally, tissue from crayfish specimens from two focal, intact dam sites were used to amplify and sequence a fragment of the mitochondrial cytochrome oxidase I (COI) gene, with individuals analyzed from each of the upstream, mill, and downstream reaches in order to quantify population connectivity.

4:20 DISPERSAL ABILITY AND GENETIC VARIABILITY IN TWO CLOSELY RELATED SPRING-DEPENDENT DARTERS, *Etheostoma boschungii* AND *E. tuscumbia*

Brook L. Fluker*, Bernard R. Kuhajda, and Phillip M. Harris. Department of Biological Sciences, University of Alabama., Tuscaloosa, AL 35487-0345 blfluker@crimson.ua.edu

Spring dependent species often, but not always, exhibit low levels of dispersal, resulting in reduced gene flow and high levels of population structure. We previously used nuclear and mitochondrial DNA to compare phylogeographical patterns in two spring dependent species, *Etheostoma boschungii* and *E. tuscumbia*, with nearly sympatric distributions in the lower bend of the Tennessee River. Despite their shared spring dependence and close phylogenetic relationship, the two species differed substantially in phylogeographic patterns. *Etheostoma boschungii* was highly genetically structured, with reciprocally monophyletic groupings among major creek basins, while *E. tuscumbia* was mostly panmictic over the same area with evidence for recent, local genetic structure. The shallower phylogeographic structure within *E. tuscumbia* suggests higher dispersal ability compared to *E. boschungii*, an unexpected result given the putatively greater spring dependence of *E. tuscumbia*. We suggest that differences in dispersal ability are tied to life history differences between the species. Here, we use microsatellite DNA data to determine the causes and consequences of levels of genetic variability within each species. Conclusions from this study will provide valuable information to guide conservation and captive propagation planning.

4:40 FINDINGS FROM 22 YEARS OF FISH COMMUNITY MONITORING IN TENNESSEE VALLEY STREAMS OF ALABAMA

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Since 1987, TVA has used the Index of Biotic Integrity (IBI), a stream fish community index, to monitor ecological conditions of Tennessee Valley streams. Monitoring supports three TVA programs including Reservoir Vital Signs (18 fixed stations monitoring potential influence of tributary rivers on reservoirs), Reservoir Releases Improvement (37 tailwaters stations monitoring the success of TVA reservoir releases improvements) and approximately 500 streams stations measuring watershed condition for clean water initiatives. To date, a total of 415 samples have been taken at 171 stream stations located in the Alabama portion of the Tennessee Valley.

The accuracy of IBI is dependent on obtaining a representative sample of the stream fish community for analysis. To accommodate this requirement, TVA developed standard fish sampling procedures that focus on several ecological aspects for the fish community, especially species diversity. This qualitative feature of IBI sampling and the large scope of TVA's IBI monitoring program make this sampling data a valuable source of information on fish species diversity. Topics discussed include distribution and status of protected species, fish biodiversity "hot spots" and expansion of invasive species.

Friday, February 19, 2010

SESSION 6

AQUACULTURE

Moderator: Greg Whitis, Alabama Cooperative Extension System

8:20 PARTITIONED AQUACULTURE SYSTEMS: FIRST YEAR RESULTS OF A COMMERCIAL SPLIT POND IN WEST ALABAMA

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A 4.00 hectare earthen pond consisting of a .80 hectare cell and a 3.2 hectare cell with a center levee and a concrete raceway at each end of the levee was constructed in the summer of 2008. A 3.72 kw paddlewheel aerator turning at approx. 30 rpm is circulating water at 56 cubic meters per minute through the raceways. The .80 hectare cell is receiving a complete water exchange from the larger cell every four hours. The smaller cell was stocked with 101,260 hybrid catfish *Ictalurus punctatus x I. furcatus* fingerlings. Harvest of these catfish is scheduled for the winter of 2009.

The other larger cell was stocked with red swamp crawfish *Procambarus clarkii*, threadfin shad *Dorosoma petenense*, grass carp *Ctenopharyngodon idella*, fathead minnow *Pimephales promelas*, paddlefish *Polyodon spathula* and wild green sunfish *Lepomis cyanellus*. 100 blue tilapia *Oreochromis aureus* were stocked in one of the concrete raceways.

Water quality parameters including total alkalinity, total hardness, total ammonia nitrogen, nitrite-nitrogen, nitrate-nitrogen, chloride and pH were monitored weekly.

The PAS is aerated with five 7.44 kw paddlewheel aerators and each cell is equipped with an automatic monitoring device.

8:40 CURRENT NUTRITION RESEARCH WITH FLORIDA POMPANO (*Trachinotus carolinus*)

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Current research on Florida pompano (*Trachinotus carolinus*) is intended to assist the development of sustainable U.S. aquaculture through the development of cost-effective diets for intensive production. Quite often marine fish feeds are based on the use of fish meal (FM) as the primary protein source, but FM supply is limited and may not match future demand. Albeit FM is an excellent ingredient, it is expensive and when used at high levels it represents a considerable portion of the feed costs. Replacing or reducing the FM in diet formulations with less expensive protein such as soybean meal, meat and bone meal, and poultry meal, singularly or in combination, could produce a less costly feed. Towards this goal, a series of nutrition studies are being conducted. The first, two 10-weeks growth trials have been conducted in a semi-closed recirculating system at the Claude Peteet Mariculture Center, Gulf Shores, Alabama. Juvenile Florida Pompano (3.48g mean initial weight) were used to evaluate replacement of FM by poultry by-product meal (PBM, Trial 1) and meat and bone meal (MBM, Trial 2). Practical diets were formulated to have similar proximate analysis with 40% protein and 8% lipid. Both trials evaluated the systematic substitution of FM (15, 10, 5, and 0%) with PBM or MBM (~ 0, 5, 10, and 15%) on an equal protein basis. In Trial 1, no significant differences ($P>0.05$) were found for final weight and survival among treatments, but fish fed the diet without FM had lower weight gain and the highest feed conversion ratio (FCR) (Table 1). In Trial 2, no statistically significant differences ($P>0.05$) were found among diets for FCR, but fish fed the diet without FM had a significantly lower final weight and weight gain (Table 1). These studies indicated that both, PBM and MBM, may be used as partial FM substitutes in practical diets for Florida pompano. A subsequent experiment is being carried out to evaluate possible limitations of lysine, methionine and taurine in diets without FM. To further optimize practical diets, in vivo digestibility of various carbohydrate sources is also being investigated.

Table 1. Response of Florida pompano (Final weight, Weight gain, FCR and Survival) to diets containing different FM:PBM and FM:MBM ratios in trial 1 and 2, respectively.

Diets in Trial 1	1	2	3	4
FM:PBM*	15:00	10:05	05:10	00:15
Final weight (g)	15.40a	14.78a	13.98a	12.54a
Weight gain (%)	338.09a	331.54ab	297.85ab	260.43b
FCR	2.03a	2.06a	2.21ab	2.42b
Survival (%)	97.3a	97.3a	94.7a	92.0a
Diets in Trial 2	1	2	3	4
FM:MBM*	15:00	10:05	05:10	00:15
Final weight (g)	10.79ab	12.33a	12.60a	9.53b
Weight gain (%)	293.60a	300.22a	298.55a	220.08b
FCR	2.32a	2.30a	2.25a	2.69a
Survival (%)	97.8a	91.1ab	97.8a	84.4b

*On a protein basis.

Mean values across a row with different letters differ significantly ($P>0.05$).

9:00 A REVIEW OF REMEDIATION TECHNIQUES TO IMPROVE PRODUCTION OF THE PACIFIC WHITE SHRIMP (*Litopenaeus vannamei*) IN INLAND SALINE WATERS OF WEST ALABAMA

Luke A. Roy*, D. Allen Davis, I. Patrick Saoud, Claude E. Boyd, Harvey J. Pine, Chris A. Boyd, David B. Rouse, Martin Perez-Velazquez. Department of Fisheries and Allied Aquacultures, Auburn University, Auburn, AL. 36489 royluke@auburn.edu

The culture of the Pacific white shrimp, *Litopenaeus vannamei*, in low salinity waters has been established in several regions worldwide, including west Alabama. Due to the uniqueness of each rearing environment (water source, salinity, ion profile, climate, etc), farmers must tailor production strategies to their specific farm and situation. Despite these differences, certain remediation strategies have proven effective at increasing survival, growth, and production of *L. vannamei* in low salinity environments. A small number of farmers in west Alabama have been successfully culturing *L. vannamei* in inland saline ponds using low salinity artesian groundwater. These farms are located more than 150 miles inland from the Gulf of Mexico. Since 1999, Auburn University has been conducting growth trials with post-larval, juvenile, and adult *L. vannamei* reared in low salinity waters of Alabama. These trials have addressed a number of key issues and concerns related to the culture of *L. vannamei* in low salinity water. Acclimation bioassays evaluated the effect of PL age, acclimation duration, acclimation temperature, salinity, and ion profile (Na:K and other ratios). A number of proposed hypotheses were tested regarding potential remediation techniques to improve growth and survival of *L. vannamei* in low salinity waters. Growth trials with juvenile and adult shrimp evaluated the effect of varying levels of aqueous potassium and magnesium on growth, survival, and respiration. In addition, a series of growth trials were designed to evaluate the effect of supplementing various dietary ingredients (potassium, magnesium, sodium chloride, cholesterol, lecithin, and select amino acids) to improve osmoregulatory capacity of shrimp. Potassium and magnesium budgets were determined for inland saline waters. For farmers having less than ideal low salinity water (ionic ratios markedly different from full strength seawater), the majority of the data point toward the correction of the rearing medium with required ions (for us potassium and magnesium fertilizers) as the most effective approach to increasing shrimp growth and survival, as opposed to the dietary supplementation of various nutrients minerals that have been proposed by a number of researchers. The major findings and results from the last decade of research on *L. vannamei* reared in low salinity waters of west Alabama will be discussed and summarized.

9:20 AQUACULTURE AS A TOOL TO TEACH MATH & SCIENCE TO K-12 STUDENTS:
BARRIERS AND OPPORTUNITIES

David J. Cline. Extension Aquaculturist, Alabama Cooperative Extension System Extension, 203 Swingle Hall, Auburn University, AL, 36849 clinedj@auburn.edu

Alabama High Schools have been adding aquatic science programs to the classroom for a number of years. These aquatic programs are varied and range from small aquaria to elaborate recirculating aquaculture systems (RAS) and even outdoor ponds. A wide variety of species are cultured including catfish, tilapia, koi, goldfish, redclaw crawfish, rainbow trout, red snapper, red drum and cobia. Recently, some of the schools have added aquaponics, and are determining which plants can flourish in the systems. Teachers frequently relate that the students are so engrossed in working with the systems they forget that they are studying science and math. The students take a great deal of pride and ownership in raising the fish and learn responsibility by working with live animals.

Aquaculture principles can be related to every discipline taught in the schools. The instructors utilizing aquaculture in the classroom find it highly effective in translating academic principles so the students can see their real-world application. However, increased infusion of aquaculture into the classroom has been stymied by a variety of barriers both real and perceived. One of the major barriers to infusion is the teachers' lack of preparation time and aquaculture knowledge. They are overwhelmed trying to prepare students for standardized testing and have little time to develop or adapt new materials. Teachers lack the specialized training to see how aquaculture concepts relate to their required teaching content standards.

Auburn University and the Alabama Cooperative Extension System (ACES), in close cooperation with the Aquaculture Education and Development Center at Gadsden State Community College (GSCC) have been helping teachers understand aquaculture and relate it to relevant content standards for more than 10 years. Grant funding obtained from various sources and the technical expertise of Alabama Aquaculture professionals have been utilized to provide training for over 200 teachers. ACES and GSCC are preparing to reach out to teachers across the country and internationally through the development of online aquaculture education modules that will help teachers infuse aquaculture concepts into the classroom.

10:00 THE IMPACT OF THE DOUBLE CRESTED CORMORANT (*Phalacrocorax auritus*) ON AQUACULTURE AND NATURAL FISHERIES: AN ALABAMA PERSPECTIVE

Jerry J. Feist. USDA- Wildlife Services USDA- Wildlife Services, Alabama Fish Farming Center, Greensboro, Alabama 36744 Jerry.J.Feist@aphis.usda.gov

Since the ban of DDT in the United States (1972), and the general decrease in environmental contamination, in concert with development of the catfish industry in the mid-1970's, the double-crested cormorant (*Phalacrocorax auritus*) [DCCO] population has grown dramatically. This has caused severe economic hardships for the commercial aquaculture industry – primarily channel catfish (*Ictalurus punctatus*) producers in the southeast U.S. where many DCCO winter. Alabama is the second largest producer of commercially grown catfish with ~ 250 operations utilizing ~ 22,100 water surface acres (MS is the largest). Initially DCCO predation on aquaculture stocks in the southeast was the focus of USDA Wildlife Services and the Department of the Interior's Fish & Wildlife Service's efforts to help producers manage losses to DCCO. This has now grown to also include sportfish ponds, hatcheries, and natural lakes and reservoirs across the central and eastern U.S.

Various regulations are in place to help manage predation on commercial aquaculture facilities as well as natural resource damage (e.g., trees/islands). Permits are now available for private sportfish pond owners who are experiencing predation from DCCO. It is not likely the population levels of DCCO will drop dramatically any time soon, so commercial and sportfish managers need to know what tools are available to help manage predation from DCCO.

Several northern states are now actively controlling DCCO up on their nesting grounds, with positive results locally. However, regionally the large population continues to have dramatic impacts on the commercial aquaculture facilities here in the southeast U.S. where large numbers of DCCO congregate to winter.

10:20 *Aeromonas hydrophila*, AN EMERGING THREAT TO THE US FARM RAISED CATFISH INDUSTRY

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Bacterial agents have always been a major cause of disease problems and subsequently losses in the farm raised catfish industry. Historically the Edwardsiella and Flexibacter groups have caused the most problems with the Aeromonad group being of a minor and usually secondary nature. However, starting in the spring of 2009 and continuing throughout the summer and early fall, a series of major fish kills occurred in the west Alabama catfish industry. The primary and only etiological agent at this time appears to be an Asian strain of *Aeromonas hydrophila* that has never been genetically documented in the catfish industry prior to this. The scope of its spread and severity of the losses catapults this strain of *Aeromonas hydrophila* into a major emerging threat to the catfish industry. The chronology of events leading up to this situation will be presented along with industry and research efforts to deal with the problem.