

**21st Annual Meeting  
February 16 – 18, 2004  
Gulf State Park Resort Hotel  
Gulf Shores, Alabama**

**Monday, February 16, 2004**

10:00 am – 1:00 pm Registration

1:00 Welcome and Opening Remarks by Randell Goodman, AFA President and Claude Reeves, Program Chair and President-Elect

**SESSION 1 – CONTRIBUTED PAPERS**  
**Moderator: Bernie Kuhajda, University of Alabama**

- 1:15 [Mussel monitoring in the headwaters of the Paint Rock River.](#) James C. Godwin, Alabama Natural Heritage Program, Huntingdon College
- 1:30 [Status of fish communities in a rapidly developing watershed: the Upper Cahaba River.](#) Robert Angus\*, Ken Marion, and Jaideep Honavar, Biology Department, University of Alabama at Birmingham
- 1:45 [Assessing persistence of a rare darter species, \*Etheostoma boschungii\*, using population viability analysis models.](#) Wendi W. Hartup\* and Carol E. Johnston, Auburn University, Department of Fisheries and Allied Aquacultures
- 2:00 [State Wildlife Grants and the Alabama Comprehensive Wildlife Conservation Plan: New funding for fish and wildlife conservation.](#) Jim McHugh, Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries
- 2:15 [Potential egg predation by crayfish \(\*Cambarus latimanus\*\) on pygmy sculpin \(\*Cottus paulus\*\) in Coldwater Spring, Alabama.](#) Amelia C. Knight and Carol E. Johnston, Department of Biological Sciences and Department of Fisheries, Auburn University
- 2:30 [Discovery of the blackmouth shiner, \*Notropis melanostomus\*, in Alabama.](#) James D. Williams, U.S. Geological Survey, and Bernard R. Kuhajda\*, Department of Biological Sciences, University of Alabama
- 2:45 Break

[Poster Presentation:](#)

Turkey Creek and the vermilion darter, *Etheostoma chermocki*

Daniel Drennen, U.S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Suite A, Jackson, MS 39213

SESSION 2 – AQUACULTURE  
Moderator: Bill Daniels, Auburn University

- 3:00 [Effects of Dietary Protein and Lipids on Growth and Body Composition of Juvenile Red Snapper \*Lutjanus campechanus\*](#). Christian L. Miller\*, D. Allen Davis, and R. P. Phelps, Department of Fisheries and Allied Aquacultures, Auburn University
- 3:15 [Culture of Protozoans and Dinoflagellates as Possible First Foods for Red Snapper Larvae](#). Daniel Rodriguez- Guerrero\*, Herbert Enrique Quintero Fonseca, and Ronald P. Phelps, Department of Fisheries and Allied Aquacultures, Auburn University
- 3:30 [The Effects of Injecting Free Amino Acids in Maternal Brood Stock Red Snapper, \*Lutjanus campechanus\*, as Measured in Fertilized Eggs and Yolk-sac Larvae](#). Ryan P. Hastey, Laban C. Lindley, Ronald P. Phelps, Department of Fisheries and Allied Aquacultures and Keith A. Cummins, Department of Animal Sciences, Auburn University
- 3:45 [Evaluation of Feed Management Strategies for \*Litopenaeus vannamei\* Under Pond Production Conditions](#). Oscar Zelaya \*, D. A. Davis, David B. Rouse, Department of Fisheries and Allied Aquacultures, Auburn University
- 4:00 [Enrichment of Copepod Nauplii with Free Amino Acids for First-feeding Larval Red Snapper, \*Lutjanus campechanus\*](#). Laban C. Lindley\*, Ryan P. Hastey, Ronald P. Phelps, Department of Fisheries and Allied Aquacultures, Auburn University, and Keith Cummins, Department of Animal Sciences, Auburn University
- 4:15 [An Overview of Red Snapper \(\*Lutjanus campechanus\*\) Reproduction at the Claude Peteet Mariculture Center](#). Amy Ferry\*, David Maus and Ronald P. Phelps, Department of Fisheries and Allied Aquacultures, Auburn University
- 6:00 AFA Social

**Tuesday, February 17, 2004**

SESSION 3 – RESERVOIRS  
Moderator: Doug Powell, Alabama Power Company

- 8:00 [Variations in Age and Growth of Freshwater Drum \(\*Aplodinotus grunniens\*\) in Alabama Rivers and Reservoirs](#). Andrew L. Rypel, Justin B. Mitchell and David R. Bayne, Department of Fisheries and Allied Aquacultures, Auburn University
- 8:15 [Factors Influencing the Bioaccumulation of Polychlorinated Biphenyls \(PCBs\) in Six Game Fish Species from Logan Martin Reservoir, Alabama](#). Justin B. Mitchell, Andrew L. Rypel, and David R. Bayne, Department of Fisheries and Allied Aquacultures, Auburn University
- 8:30 [BASS and the BASS Federation Role in Natural Resource Conservation](#). Chris Horton, BASS
- 8:45 [The Influence of River Connectivity on Backwater Fish Communities in Demopolis Reservoir, Alabama](#). Jeffrey W. Slipke and Michael J. Maceina, Department of Fisheries, Auburn University

- 9:00 [The Potential Impact of Water Reallocation on Retention and Chlorophyll a in Weiss Lake, Alabama.](#) Michael J. Maceina and David R. Bayne, Department of Fisheries, Auburn University

#### **SESSION 4 – FISH HEALTH**

**Moderator: Jeff Turhune, Auburn University**

- 9:15 [Influence of Angling and Fish Confinement on Prevalence of Largemouth Bass Virus.](#) Benjamin H. Beck, J.M. Grizzle, S.D. McClenahan, Department of Fisheries and Allied Aquacultures, Auburn University and Harold L. Schramm, Department of Wildlife and Fisheries, Mississippi State University
- 9:30 [Identification and Genetic Characterization of Flavobacterium columnare Isolates.](#) Cova Arias, Department of Fisheries and Allied Aquacultures, Auburn University and Craig Shoemaker, T. Welker, P. Klesius, Aquatic Animal Health Research Unit, ARS/USDA
- 9:45 [An Overview of Recent Advances in Vaccination of Cultured Fishes.](#) Kenneth E. Nusbaum and R.C. Bird, Department of Pathobiology, College of Veterinary Medicine, Auburn University, and Bruce F. Smith, Scott Ritchey Research Center, College of Veterinary Medicine, Auburn University
- 10:00 [Influence of Adrenaline and Fecal Coliforms on Brachydanio rerio Development.](#) DeLisa L. Gillon and Brian S. Burnes, Department of Biology, Judson College
- 10:15 Break

#### **SESSION 5 – AQUATIC EDUCATION**

**Moderator: Hugh Hammer, Gadsden State University**

- 10:30 [An Introduction to Best Practices in Fishing and Aquatic Resources Stewardship Education.](#) Doug Darr, Alabama Wildlife and Freshwater
- 10:45 [The Dauphin Island Sea Lab and the Natural Resources of Mobile Bay.](#) John Dindo, Dauphin Island Sea Lab
- 11:00 [High School Aquaculture Programs: A Success Story.](#) P.J. Waters, Auburn University Marine Extension and Research Center
- 11:15 [Design and Implementation of a Scaled Down Version of the University of the Virgin Islands Commercial Aquaponics System as an Aquascience High School Program.](#) Kristie Howell, Hale County Technology Center
- 11:30 [The Aquatic Biology and Aquaculture Technician Program at Gadsden State Community College.](#) Hugh S. Hammer, Gadsden State Community College
- 11:45 [Strengthening Aquatic Science Programs in Secondary Schools and Community Colleges.](#) Hugh S. Hammer, Gadsden State Community College
- 12:00-1:20 Lunch

## SESSION 6 – WATERSHED/RIVERINE TOPICS

Moderator: Stuart McGregor,  
Geological Survey of Alabama

- 1:25 [Community-based Conservation Programs in the Paint Rock River Watershed.](#)  
Doug Fears and Paul Freeman, The Nature Conservancy
- 1:45 [Measurement of Sedimentation Rates and Determination of Sediment Loading for Selected Streams in Alabama and Mississippi.](#) Marlon R. Cook, Geological Survey of Alabama
- 2:00 [Renew Our Rivers: A Major Waterways Cleanup.](#) Doug Powell, Alabama Power
- 2:15 [Biological monitoring in the Cahaba River revisited.....yet again.](#) Patrick E. O’Neil and Thomas E. Shepard, Geological Survey of Alabama
- 2:30 [Long-term Changes in a Fish Assemblage in the Conecuh River, Escambia County near Brewton, Alabama.](#) Karen J. Popp, Department of Fisheries and Allied Aquacultures, Auburn University
- 2:45 [Response of Fish Communities to Cropland Density and Natural Environmental Setting in the Eastern Highland Rim Ecoregion of the Lower Tennessee River Basin, Alabama and Tennessee,](#) 1999. Jeffry R. Powell, U.S. Fish and Wildlife Service
- 3:00 Break

## SESSION 7 – MARINE / COASTAL TOPICS

Moderator: P.J. Waters,  
Auburn University Marine Extension and Research Center

- 3:15 [Survival, Movement, and Residency of Hatchery-reared Red Snapper Lutjanus campechanus, on Artificial Reefs in the Northern Gulf of Mexico.](#) Hruskoci A. M., and S. T. Szedlmayer, Department of Fisheries and Allied Aquacultures, Auburn University
- 3:30 [Long-term residency and Diel Movements of Red Snapper Lutjanus campechanus, on Artificial Reefs in the Northern Gulf of Mexico.](#) Schroepfer R., and S. T. Szedlmayer, Department of Fisheries and Allied Aquacultures, Auburn University
- 3:45 [A Comparison of the Fish Communities Between Artificial Reefs With and Without Attached Food Resources.](#) Sutterer R. A., and S. T. Szedlmayer, Department of Fisheries and Allied Aquacultures, Auburn University
- 4:00 [Juvenile Red Snapper Essential Fish Habitat in the North Central Gulf of Mexico.](#) D.C. Newton and W.F. Patterson, III, Department of Marine Sciences, University of South Alabama, C.A. Wilson, J.H. Cowan, Jr., and S.J. Bentley, School of the Coast and Environment, Louisiana State University, and J. Jackson, Florida Marine Research Institute

- 4:15 [Seasonal Comparison of Standardized Fish Samples from the Mobile Delta.](#) David Armstrong and Joe Zolczynski, Alabama Wildlife and Freshwater Fisheries
- 4:30 [Gulf Sturgeon Investigations in Alabama and Florida.](#) Frank M. Parauka, U.S. Fish and Wildlife Service
- 4:45 [Stock Discrimination Between Atlantic and Gulf of Mexico King Mackerel, \*Scomberomorus cavalla\*, With Otolith Shape Analysis.](#) T.R. Clardy, W.F. Patterson, III, Department of Marine Sciences, University of South Alabama, D.A. DeVries, and C. Palmer National Marine Fisheries Service, Southeast Fisheries Science Center
- 5:00 Largemouth Bass in the Mobile-Tensaw Delta: Population Characteristics Across a Salinity Gradient. Alicia J. Norris, Dennis R. DeVries, and Russell A. Wright, Department of Fisheries and Allied Aquacultures, Auburn University
- 6:00 Banquet

**Wednesday February 18, 2004**

**SESSION 8 – AQUATIC PLANTS**

Moderator: Joe Jernigan,  
Alabama Wildlife and Freshwater Fisheries

- 8:00 [Aquatic Adjuvants and Their Impact on Efficacy.](#) L. Marshall, Ph.D. and R. Lowe, Trans America Product Technology, Inc.
- 8:20 History of aquatic weed problems at Walter F. George Lake, Tom Morrison, Park Manager, Walter F. George Lake
- 8:40 [Population Characteristics of Largemouth Bass Associated with Changes in Abundance of Submersed Aquatic Vegetation in Lake Seminole, Georgia.](#) Steve M. Sammons and Michael J. Maceina, Department of Fisheries, Auburn University
- 9:00 [Hyperspectral Remote Sensing of Native and Invasive Wetland Plant Species in Northern Mobile Bay.](#) Tami M. Wells\*, Mark S. Peterson, The University of Southern Mississippi, Gulf Coast Research Laboratory, Gregory A. Carter, Gulf Coast Geospatial Center, and Joseph B. Jernigan, Alabama Wildlife and Freshwater Fisheries
- 9:30 Annual Business Meeting
- 10:30 Adjourn

## Session 1 - Contributed Papers

### Mussel monitoring in the headwaters of the Paint Rock River

James C. Godwin, Alabama Natural Heritage Program, Huntingdon College, 1500 E. Fairview Avenue, Montgomery, AL 36106

Abstract. The Paint Rock River, a tributary of the Tennessee River, has its headwaters on the Cumberland Plateau of Tennessee and Alabama. This watershed drains approximately 824 square kilometers (318 square miles), and for its size is one of the more diverse watersheds in the southeastern United States with approximately 100 species of freshwater fish and 45 extant species of mussels. Four of the mussels are federally listed as endangered, the shiny pigtoe (*Fusconaia cor*), fine-rayed pigtoe (*Fusconaia cuneolus*), Alabama lampmussel (*Lampsilis virescens*), and pale lilliput (*Toxolasma cylindrellus*). The Alabama lampmussel and pale lilliput have been extirpated throughout their range except within the headwaters of the Paint Rock River. Three additional species are considered globally imperiled based on the Natural Heritage ranking system developed by The Nature Conservancy. These are the Tennessee pigtoe (*Fusconaia barnesiana*), slabside pearlymussel (*Lexingtonia dolabelloides*), and the purple lilliput (*Toxolasma lividus*). Mark-recapture of mussels in Estill Fork, Hurricane Creek, Larkin Fork, and the uppermost stretch of the mainstem has been done in 2002-2003. Over 500 individuals of 23 species have been captured, measured and marked; results from this study are being presented in this paper. ([Back to Top](#))

## **Status of fish communities in a rapidly developing watershed: the upper Cahaba River**

Robert Angus\*, Ken Marion, and Jaideep Honavar

Biology Department, University of Alabama at Birmingham, Birmingham, AL 35294-1170

*Abstract.* The upper Cahaba River watershed in the vicinity of Birmingham, Alabama has experienced extensive urbanization in recent years. Effects of urban development on aquatic systems include increased input of silt and degradation of both water and habitat quality. We performed rapid bioassessments at sites chosen to provide a wide range in amount of siltation they had experienced. Our objective was to identify the fish species that are most sensitive to siltation and whose change in abundance can serve as an indicator of the impact of sediment stress in a stream system. We assessed the habitat quality and then investigated the degree to which sediment-indicative habitat quality variables at the study sites were correlated with ichthyofaunal assemblages at those same sites. An index of biotic integrity was also calculated and correlated to sediment-indicative habitat parameters. Multivariate ordination techniques were used to investigate overall changes in species composition at sites with different degrees of siltation. The index of biotic integrity did not correlate very strongly with sediment-indicative habitat quality variables. Other characteristics of the ichthyofaunal community, such as the percent relative abundance of crevice-spawning minnows, disturbance-sensitive darters, suckers, top carnivores and herbivores and omnivores did show associations with sediment-indicative variables. Multivariate ordination successfully separated silt-impacted from non-impacted sites.

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## **Assessing persistence of a rare darter species, *Etheostoma boschungii*, using population viability analysis models**

Wendi W. Hartup\* and Carol E. Johnston, Auburn University, Department of Fisheries and Allied Aquacultures, 203 Swingle Hall, Auburn University, AL 36849

*Abstract.* Information on life history and ecology is essential to the effective management of fish populations. *Etheostoma boschungii*, the slackwater darter, is a federally listed threatened species endemic to northwest Alabama and southwest Tennessee. Habitat loss due to agricultural practices and water use changes is the greatest threat to the continued existence of *E. boschungii* throughout its range. This study assesses population levels at historic sites, calculates survival rates for each life stage (larvae, juvenile, and adult), and uses the program, Poptools, to construct a stage-based Leslie matrix and run a Monte Carlo simulation. Analyses of the model will assess which life stages are most sensitive to environmental changes and which life stage has the greatest effect on population growth rate, predict average extinction time periods, and estimate minimum viable population size. Conclusions from this study will aid in the prioritization of populations of *E. boschungii* for management and may provide evidence for strengthened federal protection. ([Back to Top](#))

## **State Wildlife Grants and the Alabama Comprehensive Wildlife Conservation Plan: New funding for fish and wildlife conservation**

Jim McHugh, Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, 64 North Union Street, Montgomery, Alabama 36130

*Abstract.* State Wildlife Grants (SWG) are a new funding source from Congress to the Division of Wildlife & Freshwater Fisheries intended to identify and focus management on “species in greatest need of conservation.” SWG refers to wildlife in the broadest sense, to include fish and aquatic invertebrates, such as mussels and snails. As part of these appropriations, Congress has directed how SWG funds are to be spent. SWG funds may not be used to supplement existing programs. Congress intends that SWG funds be used to manage and conserve declining species and avoid their potential listing under the Endangered Species Act. A major requirement of SWG funding is that each State develop a Comprehensive Wildlife Conservation Plan (CWCP). This plan must be approved by the Fish and Wildlife Service, Division of Federal Aid prior to October 1, 2005. The CWCP must include information on the distribution and abundance of low and declining species of wildlife, descriptions of the locations and condition of key habitats and community types, descriptions of problems that might adversely affect these species or habitats, descriptions of conservation actions necessary to conserve these species and their habitats, and proposed monitoring plans. A contract has been awarded to compile the required data and write the Alabama CWCP. In conjunction with development of the CWCP the Division of Wildlife & Freshwater Fisheries can now begin to direct SWG funds to priority conservation actions. Completion of the CWCP and the implementation of conservation actions will require the Division to enter into many creative partnerships with other agencies and conservation organizations. The effort to pass SWG in Congress was led by the International Association of Fish and Wildlife Agencies. The Alabama appropriation is more than \$3 million for the Fiscal Years 2002-2004, combined. However, it is the hope of the International that funding will grow substantially as Congress comes to recognize the pressing needs of a broad array of fish and wildlife species. ([Back to Top](#))

## **Potential Egg Predation By Crayfish (*Cambarus latimanus*) On Pygmy Sculpin (*Cottus paulus*) In Coldwater Spring, Alabama**

Amelia C. Knight and Carol E. Johnston, Department of Biological Sciences and Department of Fisheries, Auburn University, Auburn, AL 36849

*Abstract.* The understanding of competitive interaction between crayfish (*Cambarus latimanus*) and pygmy sculpin (*Cottus paulus*) in Coldwater Spring, Alabama is vital to the development of an appropriate management plan for the protection of pygmy sculpin. This study focused on the predation of pygmy sculpin eggs by crayfish and male sculpin, who exhibit filial cannibalistic behavior. Nesting tiles (105mm x 105mm x 15mm high) were placed in Coldwater Spring run. The egg clutches produced on these tiles were then placed inside enclosures within the run. The enclosures (with egg clutches) were used in one of four treatments ranging from the control (a lone clutch of eggs) to a clutch of eggs, a male sculpin and a crayfish. The results of these treatments (n=5 each treatment; 20 total) were significantly different (Kruskal-Wallis,  $X^2= 14.5$ ,  $p=0.002$ ). The findings of this experimental study support the contention that both parental male sculpin and crayfish are predators in this system ([Back to Top](#))

## **Discovery of the blackmouth shiner, *Notropis melanostomus*, in Alabama**

James D. Williams, U.S. Geological Survey, 7920 NW 71st Street, Gainesville, FL 32653, and Bernard R. Kuhajda\*, Department of Biological Sciences, Box 870345, University of Alabama, Tuscaloosa, AL 35487-0345

*Abstract.* The blackmouth shiner, *Notropis melanostomus*, was originally discovered in Pond Creek, a tributary to the Blackwater River, in northwest Florida in 1939 and was not collected again until 1975. It was collected in Shoal River, a tributary to the Yellow River, in 1977. Once it was determined that the preferred habitat of the blackmouth shiner is quiet, open backwater areas adjacent to flowing water, hundreds of specimens were collected at and near the Pond Creek site, and the species was described in 1989. Since the description, this species has been discovered in a handful of sites in lower Black Creek, Chickasawhay, and Pascagoula River systems in southwest Mississippi. Although the blackmouth shiner is locally abundant at times, this species is often rare and is highly vulnerable given that it has a short life span of 1-2 years and occupies seasonally ephemeral habitats. Recent collections from the Shoal River site in the Yellow River system, Florida, have produced only a few specimens, and recent efforts at Doctor Lake, Pascagoula River system, Mississippi, have failed to yield any specimens. This species has not been found in Alabama until the senior author collected 14 specimens in Bay Minette Creek, Mobile Bay drainage, in April 2003. Several freshwater coastal fishes have one species of a species pair inhabiting the Mobile Basin and coastal drainages to the west, while the other species occurs in drainages east of Mobile Bay. Pigment variation in populations of blackmouth shiners follows this distributional pattern. ([Back to Top](#))

## Poster Presentations

### **Snap shots of land use changes in the Turkey Creek watershed; implications on three imperiled darters**

Daniel Drennen, U.S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Suite A, Jackson, MS 39213

*Abstract.* Land use changes in the Turkey Creek watershed in Jefferson County, Alabama, have been dramatic over the last 40 years. Urbanization of the area includes an increase in structure, road and drainage construction. Impacts on the watershed are highlighted in three areas: the Tapawingo Springs drainage, the Narrows, and the unnamed spring drainage along Alabama Highway 79. Implications of urbanization as possibly the major threat on three species of imperiled darters (vermillion, rush, and watercress darters) are considered. ([Back to Top](#))

**SESSION 2 – AQUACULTURE**  
**Moderator: Bill Daniels, Auburn University**

**EFFECTS OF DIETARY PROTEIN AND LIPIDS ON GROWTH AND BODY COMPOSITION OF JUVENILE RED SNAPPER *Lutjanus campechanus***

Christian L. Miller\*, D. Allen Davis, and R. P. Phelps

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The red snapper, *Lutjanus campechanus*, is one of the most important species, with respect to commercial and recreational fisheries in the northern Gulf of Mexico. Their wide acceptance as an excellent food fish and high market value has led to over harvesting of wild stock in many areas. An increased awareness of the red snapper fishery has led to an interest in the development of culture methods for commercial production and stock enhancement. Little information exists on nutritional requirements for juvenile red snapper. Gaining an understanding of the nutritional requirements for juvenile red snapper, and the development of a practical diet for this species is an area which must be addressed. The research presented was designed to evaluate the response of juvenile red snapper to graded levels of dietary protein and lipid.

Two studies were designed and conducted to evaluate the influence of dietary protein and lipid levels on growth and body composition of juvenile red snapper. To evaluate the response to dietary protein, four diets were formulated to contain 44, 40, 36, and 32% protein with practical energy:protein (E:P) ratios. Diets were fed to juvenile red snapper (mean initial weight 5.9 g) based on a percentage of body weight, to quadruplicate rectangular tanks containing 190 l of seawater at 32g/l,  $27.0 \pm 0.76^{\circ}\text{C}$  for 8 weeks. No significant differences ( $p < 0.05$ ) were found in final weights, feed conversion efficiency, survival, whole body lipid, or hepatosomatic index, however, there was a significant difference in protein conversion efficiency. Fish fed a diet containing 32-36% protein retained dietary protein at much more efficient rate. To evaluate the response to dietary lipid levels, four isonitrogenous diets (44% protein) were formulated to contain 14, 12, 10, and 8% lipid. Diets were fed to juvenile red snapper (mean initial weight 8.6 g) based on a percentage of body weight, to triplicate circular tanks containing 1000 l of seawater at 33g/l,  $26.3 \pm 1.02^{\circ}\text{C}$  for 10 weeks. No significant differences ( $p < 0.05$ ) were found in final weights, feed conversion efficiency, survival, whole body lipid, or hepatosomatic index, however there was a significant difference in the intraperitoneal fat ratio and % whole body protein. Fish fed a diet containing 14% lipid had a significantly greater amount of fat deposition in the body cavity, while those fed a diet

containing 10% lipid had a significantly higher percentage of protein based on a whole body composition.

These results indicate that dietary protein requirements for juvenile red snapper may be as low as 32%. Data also suggests that dietary lipid should not exceed 10% in order to limit the amount of body fat deposition in juvenile red snapper, and possibly allowing the sparing of dietary protein for growth. ([Back to Top](#))

## **CULTURE OF PROTOZOANS AND DINOFLAGELLATES AS POSSIBLE FIRST FOODS FOR RED SNAPPER LARVAE**

Daniel Rodriguez- Guerrero\*, Herbert Enrique Quintero Fonseca, and Ronald P. Phelps

Department of Fisheries and Allied Aquacultures  
Auburn University, AL 36849

Larvae of many marine fish include protozoans as a first food. However, the use of protozoans as a first food in a marine fish hatchery is not common due to the difficulty in producing adequate quantities. Because of its size (100X150 um) and its high reproductive rate the euryhaline ciliate Fabrea salina has been identified as a possible food organism for hatchery produced red snapper larvae. The dinoflagellate Gymnodinium sanguineum, which is smaller in size (38X44 mm) than Fabrea salina, has been used successfully in the culture of several marine fish and is a potential first food for red snapper larvae. Techniques are being developed at the Claude Peteet Mariculture Center, Gulf Shores Al for the mass production of Fabrea and Gymnodinium.

Gymnodinium can be produced as an autotroph using F1 media and a 12 hr light 12 hr dark photoperiod. Densities in 2 L flasks of 4,000/ml can be obtained in 9 days from an initial density of 1,500 /ml. When produced in larger 200 L containers, average maximum densities are approximately 1000/ml and are obtained after 9 days from an initial stocking of 180/ml. Total ammonia concentrations of 0.1 mg/L impact Gymnodinium sanguineum growth.

Fabrea salina is a filter feeding ciliated protozoan, which can be produced in the laboratory using single cell algae (Rhodomonas lens) as a food. Densities of >400 /ml can be obtained in 9 days in 4 L flasks and 100/L in 40 L plastic bags using a 3 hr light 21 hr dark photoperiod. Production of Fabrea is affected by algae abundance. Under these conditions high densities (>120,000/ml) reduce growth. Algal densities of 100,000 □ Fabrea support good growth but daily additions of algae may be required. Fabrea production is impacted by >1.0 mg/L of ammonia.

With further refinement in production techniques, both Fabrea and Gymnodinium may be an important first food organisms for the hatchery production of hard to culture marine fish larvae such as red snapper

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## THE EFFECTS OF INJECTING FREE AMINO ACIDS IN MATERNAL BROOD STOCK RED SNAPPER (*Lutjanus campechanus*) AS MEASURED IN FERTILIZED EGGS AND YOLK-SAC LARVAE

Ryan P. Hasterp<sup>1\*</sup>, Laban C. Lindley<sup>1</sup>, Ronald P. Phelps<sup>1</sup>, and Keith A. Cummins<sup>2</sup>

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Free amino acids (FAA) are an important energy substrate for pelagic marine fish eggs and post-hatch larvae before exogenous feeding begins. The majority of the FAA pool is depleted either by hatch or by first feeding. The dominant essential FAA in ovulated eggs are valine (val), isoleucine (ile), leucine (leu), and lysine (lys). It has been postulated that providing a surplus amount of FAA initially to the eggs may enhance survival of the eggs and/or larvae until mouthparts can fully form to begin exogenous feeding.

Adult female red snapper were captured by hook and line and were injected with human chorionic gonadotropin hormone at 1100 IU/kg to induce spawning. Half of the fish were also immediately injected intramuscularly with a FAA cocktail buffered in saline containing 250 mM val, lys, leu, and ile respectively at a rate of 20mg FAA/kg of fish body weight, while the other half were administered a sham-saline injection. Fertilized eggs and larvae from the spawns of the FAA-injected or sham-injected fish were analyzed by maternal origin over two days post-fertilization for morphological and FAA profile changes. Eggs and hatched larvae were maintained at 26.5 °C in seawater (30.9 ‰). A second set of red snapper maternal brood stock were treated identically to the conditions mentioned above. Plasma samples were taken at various time points to compare the FAA profiles of the control fish and the FAA-injected fish.

Newly spawned fertilized eggs from control females had a mean total FAA content of 22.1 nmoles/egg, while fertilized eggs from FAA-injected females had a mean total FAA content of 28.3 nmoles/egg, representing a 28.1% increase in FAA content. The increase was not statistically significant. For the control and the FAA-injected fish, the val, lys, leu, and ile FAA content in eggs increased by 27.0%, 28.7%, 28.3%, and 28.7% respectively with only ile being statistically significant. At 24 hrs post-hatch the mean total FAA content of the larvae had decreased by 79.6% and 84.8% since fertilization for the control and FAA-injected fish. No significant differences between treatments were found for % fertilization, % hatch, or for % survival of larvae right before first feeding. Plasma samples showed a significant increase of lys from the FAA-injected snapper compared to the controls at 30 hrs post-injection. A larger decline of lys from the FAA-injected snappers compared to the controls at 36 hrs was also found.

These findings demonstrate that at the quantities of certain FAA supplied, via intramuscular injection, the oocytes were able to absorb some of the extra amino acids. However, the amounts of amino acids

absorbed had no evident effect on egg or larval survival to the point of mouthparts formation. ([Back to Top](#))

## **EVALUATION OF FEED MANAGEMENT STRATEGIES FOR *Litopenaeus vannamei* UNDER POND PRODUCTION CONDITIONS**

Oscar Zelaya \*, D. A. Davis, David B. Rouse

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Feeding is one of the most important activities when considering pond dynamics, management and production economics. Despite the importance of feed management there are few studies that have evaluated feeding strategies. A variety of factors should be considered when determining feeding, including estimates of survival, desired feed conversion ratios, water and pond bottom quality.

This study was designed to investigate two feeding strategies. It was conducted at the Claude Peteet Mariculture Center near Gulf Shores, Alabama. Three treatments were evaluated: 1) an early aggressive feeding schedule, 2) a late aggressive feeding schedule and 3) a control. All treatments were conducted in 0.1 ha ponds, each with four replicate ponds. The first feeding strategy incorporated a high feed input early in the cycle to maximize early growth of the shrimp with feeding rates reduced during the second half of the cycle when water quality might be more unstable. The second treatment minimized early feed inputs when natural productivity is high and maximizes feed inputs late in the cycle when natural productivity might be more likely to be limiting. The third treatment or control utilized a more typical feeding strategy between the first two treatments. The study was designed so that the total quantity of feed input was similar by the end of the production cycle. All treatments were fed equally through the first six weeks of culture. Starting the seventh week, feed inputs were increased based on a theoretical FCR of 2.6 for the early aggressive treatment (trt 1) and an FCR of 1.3 for the late aggressive feeding (trt 2). Halfway through the culture period, feed inputs were switched for treatments 1 and 2, so that the feed inputs were based on an FCR of 1.3 (early aggressive), 2.6 (late aggressive).

No significant differences were found among treatments for survival, final weight or total yield. Survivals averaged 77% and yields averaged 4,370 kg/ha. The observed mean survival and size distribution (CV) were higher in the early aggressive feeding strategy, suggesting the sustenance of less competitive individuals in the initial critical culture period. FCR's ranged from 1.5 to 2.1. Late aggressive feeding resulted in the highest observed FCR's. These results include a 15% reduction in feed used when compare to previous studies using typical feed tables. ([Back to Top](#))

## **ENRICHMENT OF COPEPOD NAUPLII WITH FREE AMINO ACIDS FOR FIRST-FEEDING LARVAL RED SNAPPER *Lutjanus campechanus***

Laban C. Lindley\*, Ryan P. Hastey, Ronald P. Phelps and Keith Cummins

Department of Fisheries and Allied Aquacultures  
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The potential of the red snapper *Lutjanus campechanus* for culture has been well recognized, and as for many marine fishes, the amount of scientifically sound culture production techniques is limited. Notably, the proper nutrition of first feeding larvae is lacking, resulting in poor culture success. Marine pelagic fish eggs can contain up to 50% of the total amino acid pool as FAA (free amino acids), and nearing the time of first feeding most of this FAA pool has been lost during yolk resorption. Typical live foods of modern marine teleost larvae such as zooplankton contain a significant pool of FAA. Marine zooplankters are osmotic to sea water and adjust their osmolyte concentration in response to changing water salinity through the regulation of the organic osmolytes, mostly FAA. In hyposmotic environments, FAA are either catabolized or excreted. Many culture operations that currently use copepod nauplii as live feed often obtain them from brackish water. The challenge is to increase the reduced levels of the FAA pool in the copepod nauplii to levels that can be beneficial to first-feeding larvae in a culture setting. Current data of the enrichment of other live foods such as *Artemia* suggests that this may be possible through direct enrichment techniques using FAA. Studies of similar marine teleost species suggest that four essential FAA (lysine, leucine, isoleucine and valine) may play the greatest role in developing fish larvae in terms of content and decline over time.

This research addressed the enrichment of copepod nauplii with FAA and was aimed at increasing the levels of FAA in the nauplii. Copepod nauplii were trapped from several brackish water ponds (1-5 ppt) and acclimated to full strength sea water over the 3 h experimental period. Several different enrichment protocol treatments were completed using a combination of the four FAA mentioned above at various concentrations. Fatty acid (FA) enrichment (Super Selco) was also added to two treatments in addition to FAA to measure the effect of FA on the absorption of FAA. Nauplii from each treatment were analyzed to determine the amount of FAA after the acclimation/enrichment period.

In general, acclimated and enriched nauplii increased their level of FAA over the experimental period above that of the control. Nauplii sampled immediately after trapping from the ponds (control) contained 28.25 pmol of total FAA/individual. This level declined by 11% over the 3 h experimental period. Nauplii transferred directly to full strength sea water showed a 36% decrease in the level of total FAA/individual. The acclimation/enrichment of nauplii with FAA/FA at the highest concentration provided 40.41 pmol total FAA/individual, a 43% increase. The acclimation/enrichment with FAA at the lowest concentration and without any

FA enrichment showed an 84% increase in total FAA. The methods and significant effects of each acclimation/enrichment protocol on the level of FAA in the nauplii are discussed.

Treatment	Survival	Mean weight	Mean Yields	FCR	Size distribution
	g	g/ha			CV
<b>Early</b> <sup>1</sup>	<b>5.18<sup>a</sup></b>	<b>,328<sup>a</sup></b>			<b>66.0<sup>a</sup></b>
<b>Late</b> <sup>1</sup>	<b>6.03<sup>a</sup></b>	<b>,384<sup>a</sup></b>			<b>63.7<sup>a</sup></b>
<b>Control</b> <sup>1</sup>	<b>6.24<sup>a</sup></b>	<b>,398<sup>a</sup></b>			<b>62.0<sup>a</sup></b>
<b>P value</b> <sup>19</sup>	<b>.388</b>	<b>.859</b>			<b>0.398</b>

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## **ENRICHMENT OF COPEPOD NAUPLII WITH FREE AMINO ACIDS FOR FIRST-FEEDING LARVAL RED SNAPPER *Lutjanus campechanus***

Laban C. Lindley\*, Ryan P. Hastey, Ronald P. Phelps and Keith Cummins

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## **AN OVERVIEW OF RED SNAPPER *LUTJANUS CAMPECHNAUS* REPRODUCTION AT THE CLAUDE PETEET MARICULTURE CENTER**

Amy Ferry\*, David Maus and Ronald P. Phelps

Department of Fisheries and Allied Aquacultures  
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Red snapper, *Lutjanus campechanus*, is important in the recreational and in commercial fisheries in the Gulf of Mexico. The controlled reproduction of this species is of considerable interest in aquaculture and fisheries management, but has offered a number of challenges.

Wild gravid fish can be caught by hook and line in the Gulf of Mexico during May and June, and induced to spawn with HCG. Females ovulate at approximately 30 hr post-injection but with a high degree of variability among females. Eggs and sperm are stripped manually into seawater, and viable eggs float to the surface. Relative fecundity of viable eggs averaged 118,000/kg. Eggs develop rapidly and hatch around 24 h post-fertilization at 28 C. Hatching rate is variable, ranging from 10% to > 93%. Larval survival from hatch to 36 hr post-hatch is generally less than 50% for larvae.

Wild-caught brooders can be held under artificial conditions simulating the natural temperature and photoperiod cycle and stimulated to spawn. Spawning has been inconsistent across six temperature/photoperiod tanks. Some tanks have given > 50 spawns while others have not spawned. Fertilization of natural spawns is an issue with approximately half of the egg releases not being fertilized. For the spawns that were fertilized, the mean fertilization rate, the hatch rate, and the survival at 36-40 hour post-hatch, averaged 90.5%, 83% and 49% respectively.

Red snapper larvae develop rapidly, mouthparts are formed by 50-60 hrs post hatch. Larvae are approximately 2.6-2.7 mm at this time with no yolk reserve left and <5% of the initial oil globule remaining. Temperature affects the development time, oil globule reserves, larval size and survival.

Larval survival is a major bottleneck in the culture of red snapper. Copepod nauplii have proven to be an acceptable first food for red snapper larvae; however, production of copepod nauplii in adequate quantities is an issue. Trapping techniques have been developed to collect >50 million nauplii/d from outdoor ponds. Even using copepod nauplii, snapper larval survival is variable, averaging <5.0 % after a 30-day nursery.

Once red snapper have successfully completed metamorphosis they can be trained to formulated feeds and moderate growth rates can be obtained. Juvenile snapper (15-25 g) given a formulated feed will grow approximately 0.5 g/d. Sub-adult growth rates (200-300 g fish) have averaged 1.25 g/d. Other issues in the culture of red snapper include temperature tolerances, aggression, and body conformation and coloration associated with the use of formulated feeds.

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### **SESSION 3 – RESERVOIRS**

Moderator: Doug Powell, Alabama Power Company

#### **Variations in Age and Growth of Freshwater Drum (*Aplodinotus grunniens*) in Alabama Rivers and Reservoirs**

Andrew L. Rypel, Justin B. Mitchell and David R. Bayne  
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**Abstract:** We examined the age and growth of freshwater drum (*Aplodinotus grunniens*) in Alabama rivers and reservoirs. The freshwater drum has received little attention by fishery scientists because of its undesirable nature as a sport fish. Nonetheless, holistic approaches to ecology in recent years have caused scientists to re-evaluate the importance of non-game fishes. The literature suggests that there may be a growth stunting effect occurring on certain fishes due to the impoundment of rivers. To test this hypothesis on freshwater drum, we collected 20-40 fish from five rivers and four reservoirs throughout the state that encompassed a variety of aquatic habitats. Otoliths were used to age each individual fish. Using covariate regression analyses, we found significant ( $p < 0.10$ ) differences in age and growth among sites. The slopes of the total length at age relationships at riverine sites revealed higher grow rates at these sites compared to reservoirs. Additionally, freshwater drum caught from lotic sites were in better condition than drum caught from lentic sites on the same river system.

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## **Factors Influencing the Bioaccumulation of Polychlorinated Biphenyls (PCBs) in Six Gamefish Species from Logan Martin Reservoir, Alabama**

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**Abstract:** Polychlorinated biphenyls (PCB) concentrations in fishes increased in Choccolocco Creek (a tributary to Logan Martin Reservoir) and Logan Martin Reservoir (Coosa River) after dredging operations in upstream reaches of Choccolocco Creek exposed PCBs that were previously buried by sediment. We measured individual PCB concentrations and lipids in skinless fillets from largemouth bass (*Micropterus salmoides*) (n=254), spotted bass (*Micropterus punctulatus*) (n=252), striped bass (*Morone saxatilis*) (n=112), black crappie (*Pomoxis nigromaculatus*) (n=155), channel catfish (*Ictalurus punctatus*) (n=320), and freshwater drum (*Aplodinotus grunniens*) (n=176). Fish were collected in the fall months of 1996, 2001, and 2002. Trend data revealed declining PCB concentrations across years in all species except freshwater drum. We examined the influence of six factors (age, gender, total length, percent fillet lipid content, relative condition, and distance from the sampling station closest to the point source) on rates of bioaccumulation of PCBs in these fish. Percent fillet lipid was the strongest predictor of PCB residues in largemouth bass, spotted bass, channel catfish, and freshwater drum. Lipid was the second strongest predictor for black crappie and striped bass. However, various other factors including total length, distance from the closest station to the point source, age and gender played an important role in the bioaccumulation of PCBs in some fishes. Knowledge of the influence of these factors could be used to design more effective and efficient monitoring programs for PCBs in the future. ([Back to Top](#))

## **BASS and the BASS Federation Role in Natural Resource Conservation**

Chris Horton, Conservation Manager BASS

BASS represents the largest group of anglers in the world. Since 1968, the exposure to bass angling, generated through the tournament and media assets of BASS, provided the catalyst necessary to propel the sport of bass fishing into a multi-billion dollar industry. As the sportfishing industry continues to grow, there comes an increasing need for responsible stewardship of the resource. Since the Company's beginning, BASS has been committed to the conservation of our nations bass fisheries, and that commitment has never been stronger. State BASS Federations and their volunteer advocates, are the heart of BASS. Through the BASS Federations and the BASS staff, bass anglers have a voice and an opportunity to make positive changes at the local, state, regional and national level. In many states BASS is the only organized voice for anglers.

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## **The Influence of River Connectivity on Backwater Fish Communities in Demopolis Reservoir, Alabama**

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We initiated a study on Demopolis Reservoir to assess the importance of backwater areas to the sport fishery and fish community. Sample sites were chosen to represent riverine habitat, backwater areas with open-access to the river, and backwater areas closed-off or nearly closed-off due to sedimentation. A total of 49 species were collected. Spearman rank correlations indicated that the fish communities in the riverine areas and the closed-off areas were the least similar among all comparisons. Also, the areas closed-off from the river were represented by fewer species than the other habitat types. Based on electrofishing catch rates, largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* spp.), and shad (*Dorosoma* spp.) were more abundant in the sites open to the river than in the closed-off sites or riverine sites, whereas bluegill (*Lepomis macrochirus*) and redear sunfish (*Lepomis microlophus*) were more abundant in the closed-off sites. Bluegill grew faster in the closed-off sites, crappie grew faster in the open-access sites, and largemouth bass growth was similar between open and closed sites. Mean relative weights for these three species were higher in the closed-off sites than the other habitat types. Based on radio-telemetered fish, largemouth bass and white crappie were less likely to move from a deeper backwater area that remained connected to the river compared to a shallower backwater area that became disconnected from the river at low water levels. ([Back to Top](#))

## **The Potential Impact of Water Reallocation on Retention and Chlorophyll *a* in Weiss Lake, Alabama**

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Abstract: Water supply demand has increased in North Georgia and prompted government officials to propose a water reallocation plan that would permit two reservoirs upstream from Weiss Lake, Alabama to increase water withdrawals nearly three fold. Hydrologic modeling predicted lower flows in the Coosa River, the primary tributary of Weiss Lake, during average to below average flows (exceedences from 50 to 90%). Consequently, we predicted retention (reservoir volume/discharge) would increase in Weiss Lake under reallocation and using data from 1989 to 2000 as a baseline, we estimated the effect of longer retention on chlorophyll *a* concentrations (CHLA) and water clarity. CHLA measured during the growing season (April to October) was positively correlated ( $P < 0.01$ ) to retention in both upstream and downstream reservoir regions and retention accounted for 24 to 28% of the variation in CHLA in linear and non-linear regression models. Under the reallocation scheme, increased retention (as predicted by HEC-5) could potentially cause an increase in CHLA of 8 to 15% compared to historic conditions if CHLA increased linearly with retention. If retention should increase 10 days with water reallocation, we estimated CHLA could increase about 20 to 30% under a “worst-case scenario”. Water reallocation would have little or no impact on water clarity as Secchi transparency did not increase with lower CHLA concentrations. If longer retention does occur in Weiss Lake with water reallocation, a greater frequency of hypereutrophic conditions is expected. ([Back to Top](#))

**SESSION 4 – FISH HEALTH**  
**Moderator: Jeff Turhune, Auburn University**

**Influence of angling and fish confinement on prevalence of largemouth bass virus**

Benjamin H. Beck<sup>1</sup>, John M. Grizzle<sup>1</sup>, Shasta D. McClenahan<sup>1</sup>, and Harold L. Schramm<sup>2</sup>

1. Department of Fisheries and Allied Aquacultures, Auburn University, Auburn, AL

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Largemouth bass virus (LMBV) has been found in many populations of largemouth bass *Micropterus salmoides* in the southeastern United States, but the effect of this virus on angling success and the effect of catch-and-release angling on LMBV infections are unknown.

Largemouth bass were captured from three Alabama reservoirs by electrofishing and angling and then divided into two groups. One group was euthanized after capture and assayed for LMBV, and the remaining fish were transported to a fish hatchery in Tupelo, Mississippi, where they were held in raceways for up to 6 days. During this period, fish were collected periodically for LMBV testing and also all fish surviving the holding period were tested. The probability that a fish was infected with LMBV was not related to the method of capture.

However, of the 170 fish tested after being held in the hatchery, 80.6% were LMBV positive, which is significantly greater ( $P < 0.05$ ) than the 12.5% that were positive ( $N=208$ ) on the day of capture. The increased prevalence of LMBV infection could result from the virus spreading between fish during confinement or from the virus increasing from an undetectable to detectable level because of the high temperature and crowding during captivity. Further studies are needed to examine the transmission of this virus, and the effects of confinement and handling and their role in initiating an LMBV epizootic. ([Back to Top](#))

## Identification and genetic characterization of *Flavobacterium columnare* isolates

Cova Arias<sup>1</sup>, Craig Shoemaker<sup>2</sup>, Thomas Welker<sup>2</sup>, Phillip Klesius<sup>2</sup>

1, Department of Fisheries and Allied Aquacultures, Auburn University, Auburn, AL

2, Aquatic Animal Health Research Unit. ARS/USDA. Auburn, AL

*Flavobacterium columnare* is the causal agent of columnaris disease, probably the most important bacterial disease of freshwater fish species. This bacterium is ubiquitous in fresh water environments around the world, affecting both wild and cultured fish. Columnaris disease is especially important in the Southeastern U.S., where negatively impacts the catfish industry. Currently, *F. columnare* is considered the most important bacterial pathogen in commercial culture of channel catfish. However, little is known about the ecology and epidemiology of *F. columnare* in catfish aquaculture.

In this study we have applied different techniques for identification of *F. columnare* isolates at different taxonomic levels. Analysis of the fatty acid methyl ester (FAME) composition of bacteria is an excellent tool for *F. columnare* identification to the species level. We have analyzed FAME profiles of more than 40 *F. columnare* isolates, together with isolates from other related *Flavobacterium* species. *F. columnare* isolates, regardless of host fish species and geographic origin, formed a discrete cluster apart from other *Flavobacterium* species.

Genetic variability among *F. columnare* isolates was characterized using restriction fragment length polymorphism (RFLP) analysis of the 16S rDNA gene, intergenic spacer region (ISR) sequencing, and amplified fragment length polymorphism (AFLP) fingerprinting. Thirty *F. columnare* cultures isolated from different fish species and geographic origins as well as reference strains were included in the study. Fifteen isolates belonged to genomovar I while eleven were ascribed to genomovar II. Analysis of the ISR sequence confirmed the genetic differences between both genomovars but revealed a higher diversity among genomovar I isolates. The maximum resolution was provided by AFLP fingerprinting, since up to 22 AFLP profiles could be defined within the species. ([Back to Top](#))

## **An overview of recent advances in vaccination of cultured fishes**

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Vaccination in all terrestrial domestic species has been crucial for the economic success of all food species. The challenge of vaccination of aquatic species is confounded by an understanding of mechanism of pathogenesis, fish size and individual value, and target infectious agent. Thus while it is economical to vaccinate individual large carps in India against *Aeromonas hydrophila*, there is no hope of doing the same for catfish fry. We used channel catfish virus as a model to develop a DNA vaccine for channel catfish. Ten viral genes or open reading frames (ORF) were cloned based on size and presumed viral product, and the gene clones were introduced into an expression vector. Those catfish injected with CCV ORF 59 or ORFs 59 and 6 were resistant to challenge with virulent CCV.

The problem then became introduction of the vaccine into greater numbers of smaller fish. Other investigators have developed cloned viral vaccines from viral hemorrhagic septicemia and introduced them into trout by ultrasonic bath. These fish were protected from challenge with virulent virus. In order to explore mass vaccination of channel catfish, we are attempting to use a pulsed electrical field, electroporation, to introduce DNA vaccines into catfish fry and baby guppies less than 8 mm in length. Fish were subject to voltages of up 250 V across a 4 mm gap. All fish subject to 200 V or less survived the procedure. Vaccine concentrations of 6 to 24  $\mu$ g of DNA per 600  $\mu$ l of distilled water were tested. Earliest results indicate that DNA vaccine constructs at any concentration can easily be detected in electroporated guppies and catfish. Expression of the vaccine construct has been less frequently detected. No challenge of vaccinated fish has been done, nor has protection been demonstrated. Development of this technology will open the way to vaccination of all small fishes to a wide variety of infectious agents between hatching and release into grow out ponds. Mass vaccination must be in place in order to combat emerging Nodavirus infections, and to prepare for emergence of agents currently unrecognized that invariably accompany intense cultivation of food animals. ([Back to Top](#))

## **Influence of Adrenaline and Fecal Coliforms on *Brachydanio rerio* Development**

DeLisa L. Gillon and Brian S. Burnes  
Department of Biology, Judson College, Marion, AL

Danio (*Brachydanio rerio*) embryos were exposed to various concentrations of adrenaline or fecal coliforms and observed for a seventy-two hour period. Adrenaline affected development at  $2.3 \times 10^{-4}$  concentration and caused death at all higher concentrations. Danio rerio showed no signs of adverse effects to fecal coliforms at concentrations up to  $2 \times 10^6$ /mL, but died upon higher levels of exposure. ([Back to Top](#))

**SESSION 5 – AQUATIC EDUCATION**  
**Moderator: Hugh Hammer, Gadsden State Community College**

**An Introduction to Best Practices in Fishing and Aquatic Resources Stewardship Education**

Doug Darr, 334-242-3884  
Fisheries Section, 64 North Union Street, Montgomery, AL 36130

Fisheries biologists have long prided themselves in trying to use the best science to manage aquatic resources. Why not use the best science and proven techniques in our education efforts? The Recreational Boating and Fishing Foundation has put together a number of best practices that will help any program with planning, training, delivering, and evaluating their educational efforts. Information will help you with your educational program and may peak your interest in attending a workshop on the subject. ([Back to top](#))

## **The Dauphin Island Sea Lab and the Natural Resources of Mobile Bay.**

John Dindo, 251-861-7558

Dauphin Island Sea Lab, 101 Bienville Blvd, Dauphin Island, AL 36528

Mobile Bay is the 4<sup>th</sup> largest drainage basin by volume in North America. Each day 43 billion gallons of fresh water meet the incoming tides of the Gulf of Mexico to create a rich and diverse assemblage of flora and fauna. For the past thirty years the Dauphin Island Sea Lab has been conducting marine research and education in the bay and Gulf of Mexico. The presentation will include examples of coastal plants and animals, the current research being conducted at the sea lab and educational opportunities in marine science for all grade levels.

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## **High School Aquaculture Programs: A Success Story**

PJ Waters, (251) 438-5690  
Auburn University Marine Extension and Research Center  
4170 Commanders Dr, Mobile, AL 36615

Across Mobile and Baldwin counties, there are six (6) high schools and middle schools with aquaculture programs. These programs are unique to one another in student body demographics, species raised, and system sophistication. The commonality among these programs and others across the country is the use of hands on applications to teach the subjects of biology, chemistry, physics, math, statistics, water quality, and physiology. These students demonstrate an improved ability to retain and apply the subject matter they are exposed to through improved test scores and tours lead by students through their facilities. Outside of the scholastic education, the students learn responsibility, teamwork, and self-confidence. These programs are built and maintained by the students for the students.

Most schools begin raising tilapia (*O. niloticus*) in small recirculating systems. This animal's resistance to poor water quality, and general hardiness makes them ideal for new programs. As students and teachers become comfortable with the tilapia, additional systems and species can be added. Systems are designed to allow for easy expansion. Species that have been grown in Mobile and Baldwin county programs include, tilapia, gambusia, cobia, red snapper, rainbow trout, Australian red claw, pacific white shrimp, and oysters. Aquaponics have been incorporated in two of the programs. Culture units in the two counties include outdoor and indoor ponds, and recirculating systems of various volumes. Funding for these programs comes from grants and donations.

As the individual programs come online and become established, cross program interaction is becoming commonplace. This increases the individual student's exposure to different species, and culture techniques. The future of high school aquaculture in Alabama will include teacher access to information from other programs to share with their students, as well as a central location for teachers to derive ideas, and learn from one another. ([Back to top](#))

## **Design and Implementation of a Scaled Down Version of the University of the Virgin Islands Commercial Aquaponics System as an Aquascience High School Program**

Kristie Howell, 334-624-3691

Hale County Technology Center, PO Box 517, Greensboro, AL 36744

Aquaponics is the combination of aquaculture and hydroponics. Aquaponics is an ideal means of teaching students nutrient recycling, biology, fish anatomy and nutrition in addition to plant science and pH relationships. Practical applications of physics, chemistry, economics, engineering and mathematics are implemented through the teaching of aquaponics. Students develop and use problem solving, observation, measuring, testing, experimenting, recording data and critical thinking skills on a daily basis. Because the students monitor and care for the aquaponic system they feel a sense of responsibility and are motivated to apply themselves in class. This motivation inspires creativity and creates a productive learning environment. A scaled down version of the University of the Virgin Islands commercial-sized recirculation aquaponics system was designed, built and implemented for use in a new aquascience high school program in Hale County, Alabama.

The development, implementation and impacts of an aquaponics and aquascience curriculum will also be discussed. ([Back to top](#))

## **The Aquatic Biology and Aquaculture Technician Program at Gadsden State Community College.**

Hugh S. Hammer, 256-549-8345,  
Aquaculture Education and Development Center, Gadsden State Community College, 1000  
George Wallace Drive, Gadsden, AL 25902-0227

The Aquaculture Education and Development Center at Gadsden State Community College is a 40 acre facility with 13 bodies of water, 1,700 sq ft of indoor hatchery space, a modern classroom and wet/dry laboratory space. The program offers an Aquaculture Technician Certificate, Associate of Science Degree in Aquatic Biology and the opportunity to participate in a large number of unique internships with public aquariums, aquaculture farms, and research institutes all over the nation. Students graduating from the program pursue careers with public aquariums, aquaculture farms, pet stores, state fisheries units or transfer into 4-yr institutions such as USA, Auburn, UAB or JSU. Over 1,000 people from Gadsden and the surrounding areas come to the AEDC for children's fishing events, educational activities/labs, or tours of the facility each year. The AEDC is active in supporting Alabama's researchers and farmers by providing catfish, FW Shrimp, koi, and tilapia. The AEDC is supported by an appropriation from the Alabama legislature, GSCC and through grants from NSF, AACC, and ARC. ([Back to top](#))

## **Strengthening Aquatic Science Programs in Secondary Schools and Community Colleges**

Hugh S. Hammer, 256-549-8345

Aquaculture Education and Development Center, Gadsden State Community College, 1000 George Wallace Drive, Gadsden, AL 25902-0227

Five years ago the GSCC Aquaculture Education and Development Center along with partners from The Alabama Cooperative Extension System, The Auburn University Department of Fisheries and Allied Aquacultures and The University of Alabama at Birmingham Department of Biology were funded by the National Science Foundation to bring aquaculture and aquatic science education into K12 schools throughout Alabama. To date this program has provided 28 turn key aquaculture systems to K12 schools (at an estimated value of over 98K), trained over 90 teachers across the state in basic aquaculture through 5-day workshops, delivered free fish to schools across the state, provided curriculum materials and presentations to all the program's teachers and provided technical assistance to all the teachers that have needed help. This grant project has been tremendously successful and a grant renewal/expansion is in the process of being written and submitted. ([Back to top](#))

**SESSION 6 – WATERSHED/RIVERINE TOPICS**  
**Moderator: Stuart McGregor, Geological Survey of Alabama**

**Community-based Conservation Programs in the Paint Rock River Watershed.**

Fears, Doug.<sup>1</sup> and Paul Freeman<sup>2</sup>

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The scenic Paint Rock River watershed drains approximately 317 square miles of Northeast Alabama and Southeast Tennessee and is home to dozens of rare plant and animal species. The Paint Rock River and its tributaries flow across karst, Ridge and Valley limestone hills and eventually join Wheeler Reservoir of the Tennessee River. The watershed's land use is mostly forested (86%), with significant portions in agriculture (12%) and less than 0.5 % urban. The Paint Rock River has a historic assemblage of approximately 100 fish and 45 mussel species including over a dozen rare and imperiled species. Populations of the following fish and mussels protected under the federal Endangered Species Act have recently been observed in the watershed: Palezone Shiner, *Notropis albizonatus*, Snail Darter, *Percina tanasi*, Shiny Pigtoe, *Fusconaia cor*, Alabama Lampmussel, *Lampsilis virescens* and Pale Liliput, *Toxolasma cylindrellus*.

In an effort to conserve and preserve the unique ecological settings these species and others need to survive, The Nature Conservancy (TNC) initiated a community-based conservation program in 2001. Since opening an office in Gurley, AL, TNC has worked to build partnerships and trust with landowners, foresters and farmers. TNC has established two nature preserves and initiated 13 stream restoration projects to protect crucial habitat and water quality. To date, TNC and partners have placed over 21,000 acres into permanent protection. TNC, Natural Heritage staff and numerous partners have continued biological monitoring to determine the status and viability of imperiled species and the overall ecological health of the streams. Continued efforts by private, State and Federal agencies, as well support from the local residents will hopefully lead to further protection and restoration of the globally significant Paint Rock River watershed for generations to come. ([Back to top](#))

## **Measurement Of Sedimentation Rates and Determination of Sediment Loading For Selected Streams In Alabama and Mississippi**

Marlon R. Cook, Geological Survey of Alabama, Hydrogeology Division, P. O. Box 869999, Tuscaloosa, Alabama 35486-6999, mcook@gsa.state.al.us

*Abstract.* Sedimentation of streams and impoundments has long been a subject of concern for anyone involved with development or protection of watersheds in Alabama. Deforestation for land development during the twentieth century has resulted in increased runoff, erosion of soils, and sedimentation of streambeds and impoundments. Excessive sedimentation causes impaired water quality, increased flooding, and damage to structures such as roadways and bridges.

Sedimentation data are essential for comprehensive watershed management. These data may be utilized for water quality protection, land and water resource development, land treatment planning and design, and land use technique assessment.

This paper summarizes data collected from 17 watersheds that drain portions of 10 counties in southeast, northeast, and northwest Alabama and northeast Mississippi. The southeast Alabama area is underlain by geologic units of Tertiary age and is characterized by highly erodable soils. The Northeast Alabama area is underlain by Valley and Ridge sediments, primarily limestone and sandstone. The Northwest Alabama-Northeast Mississippi Area is underlain by limestone and sandstone of the Cumberland Plateau and Highland Rim and unconsolidated coastal plain sediments of the Tuscaloosa Group. The watersheds include urban, forest, and agricultural runoff.

Stream sediment loads are defined for these projects as the volume and mass of material greater in size than 0.45 microns. Material that is suspended in the water column, called suspended solids, was directly measured by gravimetric analysis of water samples. Material that rolls or saltates along the streambed, called bedload sediment, was measured directly by collection of material moving along the streambed. The bedload material was collected in two types of devices that are modifications of the Birbeck Pit Sediment Sampler.

Sediment loads for each watershed were calculated using discharge data collected at the time of sample collection. Sedimentation rates, total sediment loads, and normalized sedimentation loads were calculated for each watershed. An Excel adaptation of the USGS seven-parameter regression model for load estimation was used to calculate suspended sediment loads.

Sedimentation rates and loads were used to determine the source and magnitude of water-quality impairment and the effectiveness of best management practices implemented in eight of the watersheds. ([Back to top](#))

## **RENEW OUR RIVERS - A Major Waterways Cleanup**

Doug Powell -Alabama Power

In July 1999, Alabama Power employees picked up trash along a stretch of the Coosa River near Gadsden Steam Plant. This clean stretch of river made a problem more evident- the rest of the Coosa system was laden with tons of trash and debris. Alabama Power employee Gene Phifer envisioned a cleanup that would involve communities throughout the Coosa system. As a result a major cleanup effort was initiated in 2000 throughout the Coosa system called "Renew the Coosa". A total of over 245 tons were removed from the Coosa system over the next three years. A name change was initiated in 2003 to "Renew Our Rivers" to include the Black Warrior and Tallapoosa River systems. A total of over 1.7 million pounds have been removed from the three river systems since 2000. This effort is one of the largest waterways cleanups in the Southeast. ([Back to top](#))

## **Biological monitoring in the Cahaba River revisited.....yet again**

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*Abstract.* The Cahaba River in central Alabama has remained the focus of biological monitoring studies over many years for two predominant reasons. First, the Cahaba system supports one of the most biologically diverse fish faunas in the United States. Second, the headwaters and several main tributaries are experiencing one of the fastest population growth rates in the state. These two facts will continue to be focal points for the debate over wastewater disposal, water-quality management, and resource conservation in this region. In 2002 the Geological Survey of Alabama (GSA) in conjunction with the Environmental Protection Agency (EPA) undertook a study to examine the biological condition of the Cahaba River main channel from Centreville upstream to Trussville in support of efforts to determine target limits for nutrients in the Cahaba River system. Methods used to examine the effects of river degradation on fish communities in the Cahaba River have varied from simple species counts and comparisons of historical and recent data to calculations of species diversity and indices of biotic integrity. Although species lists are a direct measure of biodiversity and one of the least complicated measures to determine, their interpretation relative to whether streams and rivers are degraded can be difficult. One significant reason for this difficulty is that membership on a species list is determined in large part by the type of sampling gear, sampling strategy, and expertise of the sampling crew. Data collected during this investigation were used to define a method for using both historical and recent sampling data to interpret biodiversity patterns in a watershed. Additionally, calculations of biological condition using the Index of Biotic Integrity (IBI) were compared to IBI results from earlier GSA studies and the longitudinal patterns were found to be similar over the intervening nine year period

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## **Long-term Changes in a Fish Assemblage in the Conecuh River, Escambia County near Brewton, Alabama**

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*Abstract.* In aquatic systems, long-term studies are critical to effectively address the differences between natural and anthropogenic changes in water quality. Long-term studies give better estimates of community variability and decrease the chance that unusual environmental conditions will result in misleading conclusions. We examined long-term trends in water quality and fish assemblages in the Conecuh-Escambia River near Brewton, Alabama. Our objective was to determine if point source pollution influenced fish community structure downstream from an urban area. Water quality and fishes were sampled at stations above and below the outfall annually over 22 years during low-flow periods in late summer and early fall. We found significant differences in water quality variables between sites. The downstream site (below the city of Brewton) had higher biochemical oxygen demand (5-day), lower dissolved oxygen, higher soluble reactive phosphorus, higher nitrite-nitrogen, and higher total alkalinity (repeated measures ANOVA). Significant differences were also found in the fish assemblages between sites. The affected site had higher total biomass of fishes along with higher abundance of lepisosteids and greater biomass of lepisosteids and centrarchids. By trophic composition, the affected site had significantly higher insectivore biomass followed by greater predator abundance and biomass (repeated measures ANOVA). Alterations in fish community structure were attributed to nutrient enrichment resulting from point source pollution. ([Back to top](#))

## **Response of Fish Communities to Cropland Density and Natural Environmental Setting in the Eastern Highland Rim Ecoregion of the Lower Tennessee River Basin, Alabama and Tennessee, 1999**

Jeffrey R. Powell, U.S. Fish and Wildlife Service, P.O. Drawer 1190, 1208-B Main Street, Daphne, AL 36526. email: jeff\_powell@fws.gov

*Abstract.* Responses of fish communities to cropland density and natural environmental setting were evaluated at 20 streams in the Eastern Highland Rim Ecoregion of the lower Tennessee River Basin during the spring of 1999. Sites were selected to represent a gradient of cropland densities in basins draining about 30 to 100 square miles. Fish communities were sampled by using a combination of seining and electrofishing techniques. A total of 10,550 individual fish, representing 63 species and 15 families, were collected during the study and included the families Cyprinidae (minnows), 18 species; Percidae (perch and darters), 12 species; and Centrarchidae (sunfish), 12 species. Assessments of environmental characteristics, including instream and terrestrial data and land-cover data, were conducted for each site. Instream measurements, such as depth, velocity, substrate type, and embeddedness, were recorded at 3 points across 11 equidistant transects at each site. Terrestrial measurements, such as bank angle, canopy angle, and canopy closure percentage, were made along the stream bank and midchannel areas. Water-quality data collected included pH, dissolved oxygen, specific conductivity, water temperature, nutrients, and fecal-indicator bacteria.

Substrate embeddedness was the only variable correlated with both cropland density and fish communities (as characterized by ordination scores and several community level metrics). Multivariate and nonparametric correlation techniques were used to evaluate fish-community responses to physical and chemical factors associated with a cropland-density gradient, where the gradient was defined as the percentage of the basin in row crops. Principal component analysis and correspondence analysis suggest that the Eastern Highland Rim Ecoregion is composed of three subgroups of sites based on inherent physical and biological differences. Data for the subgroup containing the largest number of sites were then re-analyzed, revealing that several environmental variables, such as nutrient concentrations, stream gradient, bankfull width, and substrate embeddedness, were related to cropland density; however, only a subset of those variables (substrate embeddedness, elevation, and streamflow) were related to fish communities. Results from this analysis suggest that although many water-quality and habitat variables are covariant with cropland density, most of the variables do not significantly affect fish-community composition; instead, fish communities primarily respond to the cumulative effects of sedimentation([Back to top](#))

## SESSION 7 – MARINE / COASTAL TOPICS

Moderator: P.J. Waters,

Auburn University Marine Extension and Research Center

**Title: Survival, movement, and residency of hatchery-reared red snapper *Lutjanus campechanus*, on artificial reefs in the northern Gulf of Mexico.**

Name: Hruskoci A. M., and S. T. Szedlmayer Phone: 251-990-4858

Address: Marine Fish Laboratory, Department of Fisheries and Allied Aquacultures, Auburn University, 8300 State Highway 104  
Fairhope, AL 36532

We examined movement and survival of age-0 red snapper, *Lutjanus campechanus* (n=1500) on 32 artificial reefs in the northern Gulf of Mexico. Red snapper were reared at the Claude Peete Mariculture Research Center, Gulf Shores, Alabama. All fish were tagged with a visible implant fluorescent elastomer (VIE) tag under the external edge of the eye membrane. There were four groups of fish each marked with a single color of red, orange, green, or yellow. All of the fish were also marked with either Alizarin red S or Oxytetracycline dehydrate (OTC) dye. We built two arrays of artificial reefs. Each array had two center reefs surrounded by six reefs each 20 m apart. Each of the center reefs were stocked in September with tagged fish of the same color tag (n=100) that differed among reefs. The reefs also alternated between OTC and Alizarin treatments. One week after stocking, survival was 27% for green fish, 47% for yellow, 57% for red, and 100% for orange. On the second survey a month later, survival was 17% for green, 18% for yellow, 30% for red, and 32% for orange tagged fish. The experiment was replicated with larger reefs and increased numbers of marked fish. Survival one month after stocking on the larger reefs was 10% for green, 12% for yellow, 10% for red, and 15% for orange. Marked fish were present on 91% of all 32 experimental reefs. A subsample (n=20) of each color tag, with treatments of either alizarin or OTC, and a control group with just a VIE tag were held in a closed seawater system to compare mortality rates, VIE tag and fluorescent mark retention. Tag retention 48 days after tagging was 85% for orange fish, 91% for yellow, 67% for green, 82% for red, and 67% for control fish. This study suggests age-0 fish move and evenly distribute themselves among reefs based on available habitat. ([Back to top](#))

**Long-term residency and diel movements of red snapper *Lutjanus campechanus*, on artificial reefs in the northern Gulf of Mexico.**

Name: Schroepfer R. and S. T. Szedlmayer Phone: 251-990-4858

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We tagged and tracked red snapper ( $n = 54$ ) on 12 artificial reefs in the northern Gulf of Mexico. Fish were surgically implanted with ultrasonic transmitters (1-4 year battery life, 65-90 x 16 mm and 67 x 18 mm) and monitored with Vemco remote underwater receivers and Sonotronics surface receivers from August 2000 to February 2004. Four fish were manually tracked from the surface overnight with positions recorded every hour for 16 h. Mean  $\pm$  SE total length of fish tagged was 591  $\pm$  15 mm. Mean  $\pm$  SE detections by the underwater receivers was 226,799  $\pm$  37,039. Red snapper were resident (within 800 m) on artificial reefs for a mean  $\pm$  SE of 224  $\pm$  30 days, with a range of 23-595 days. Fish were resident on the same site for three to six seasons. Red snapper showed changes in proximity to reefs with season, being significantly closer to the reef from August to December. Red snapper left the receiver range for certain periods of time, e.g. fish 25 left the reef 285 times for 1-4 h. However, all fish spent most time near the reef (mean = 98  $\pm$  1 % of their total time within the receiver range). No relation was detected between fish size and length of residency, but the number of times outside the receiver range was positively related to size and residency. There was a significant site effect, e.g. fish on site 8 showed a greater number of movements outside the receiver range, and fish on site 1 showed longer residency. Four fish showed diel patterns in proximity to the reef. Two fish were further from the reef during the afternoon hours and two fish were further from the reef at night. We detected no diel movements outside the receiver range. Fish manually tracked for 16 h showed diel movements. Fish used a larger area at dusk and were closer to the reef at dawn. Mean  $\pm$  SE area covered was 2,314.26  $\pm$  563.21 m<sup>2</sup> and mean  $\pm$  SE distance from the reef was 28.58  $\pm$  1.85 m.

In this study red snapper showed high site fidelity on artificial reefs. The underwater receivers showed continuous residency on artificial reefs for greater than one year. Also, tagged fish were larger, continuously monitored for several seasons, and detected more times compared to all previous red snapper tagging studies. ([Back to top](#))

**Title: A comparison of the fish communities between artificial reefs with and without attached food resources.**

Name: Sutterer R. A., and S. T. Szedlmayer Phone: 251-990-4858

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Fairhope, AL 36532

Abstract: We examined the effects of benthic communities on the recruitment of fishes to artificial habitats. Fish communities were compared between experimental habitats without benthic communities (n = 20) as they were painted with copper based paint to untreated habitats (n = 20). All reefs were 2x2 m, 3 mm mesh PVC mat with 10 concrete blocks, and built on 16-24 June 2003, 23 km south of Dauphin Island, AL, in the northeast Gulf of Mexico. We surveyed all reefs on 4-5 October 2003. Painted habitats showed 25 species and 1269 individuals, while untreated habitats showed 26 species and 1623 individuals. Dominant species were similar between habitats, with red snapper *Lutjanus campechanus*, long spine porgy *Stenotomus caprinus*, gray triggerfish *Balistes capriscus*, pygmy filefish *Monacanthus setifer*, and rock sea bass *Centropristis philadelphica*, making up 80 % of all individuals on untreated habitats, and 77 % of the individuals on the painted habitats. There were clear differences in benthic communities between habitats, with painted habitats showing no epi-faunal development. We detected significantly more *Lutjanus campechanus* (p = 0.05) and *Batistes capriscus* (p = 0.08) on untreated reefs compared to painted reefs, which suggested that fish may be responding to increased food resources on untreated reefs. ([Back to top](#))

**Title: Juvenile Red Snapper Essential Fish Habitat in the North Central Gulf of Mexico.**

Name: D.C. Newton<sup>1</sup>, W.F. Patterson, III<sup>1</sup>, C.A. Wilson<sup>2</sup>, J.H. Cowan, Jr.<sup>2</sup>, S.J. Bentley<sup>2</sup>, and J. Jackson<sup>3</sup>

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Address: <sup>1</sup>Department of Marine Sciences, University of South Alabama, LSCB 25, Mobile, AL 36688; <sup>2</sup>School of the Coast and Environment, Louisiana State University, Baton Rouge, LA 70803; <sup>3</sup>Florida Marine Research Institute, Cedar Key, FL

Abstract:

One of the most pressing issues facing federal fishery managers in the Gulf of Mexico (Gulf) is the overfished status of red snapper. Rebuilding the Gulf red snapper stock will require greatly minimizing shrimp trawl bycatch of juvenile red snapper; however, recent studies indicate currently approved bycatch reduction devices (BRD) do not reduce juvenile red snapper bycatch to needed levels. Therefore, other management tools such as time/area closures to shrimp trawls may be necessary to reduce juvenile bycatch. A greater understanding of juvenile red snapper habitat requirements is needed, however, before area closures can be considered a viable option. Toward this end, we have begun a research program to fill gaps in our understanding of red snapper life history and essential habitat requirements. Our program consists of mapping geotechnical properties of the seabed with digital side scan sonar in areas that historically produced high, median, and low juvenile red snapper catch rates in resource trawl surveys, and then examining contemporary differences in juvenile red snapper density among habitats with trawl sampling. Additionally, we are examining habitat-specific differences in juvenile red snapper diet and age and growth with analysis of stomach contents and otolith microstructure, respectively. Results indicate our mapping approach is effective for delineating juvenile red snapper habitat and that juvenile red snapper density is correlated with habitat type. Results of two years of trawl sampling will be presented, as well as preliminary analyses of diet and age and growth. Study results will be discussed in the context of juvenile red snapper essential fish habitat, as well as the problem of minimizing juvenile red snapper bycatch in shrimp trawls. ([Back to top](#))

## **Seasonal Comparison of Standardized Fish Samples from the Mobile Delta**

David Armstrong and Joe Zolczynski, Alabama Division of Wildlife and Freshwater Fisheries, District 5, P. O. Box 247, Daphne, AL 36526. 251-626-5153.

**Abstract:** The Alabama Division of Wildlife and Freshwater Fisheries is responsible for standardized fish population sampling within the Mobile Delta. Unique seasonal sampling problems occur in the Mobile Delta where high spring flows negatively affect sampling activities in upper delta areas. High salinities affect sampling within the tidally influenced lower delta. Historically, fish sampling activities have taken place during October to avoid high spring flows. During 2001-2003, standardized samples (N=77) of fish were collected during both spring and fall months to examine seasonal (between areas) and area (within years) differences in largemouth bass population indices. Samples were taken from upper (i.e., above Interstate 65) and lower (i.e., between Interstates 65 and 10) delta areas because each is comprised of distinctive habitats, different abiotic conditions (e.g., flow, tide, salinity), and unique fish population dynamics. In general, spring samples of largemouth bass exhibited higher total catch-per-effort rates and condition indices than fall samples. Compared to upper delta bass, lower delta bass samples always exhibited higher abundance and composition of young-of-year and age 1 fish, as well as higher growth to age 3 or older. Upper delta bass generally attain larger maximum lengths and weights, and higher percentages of older age classes. ([Back to top](#))

## **Gulf Sturgeon Investigations in Alabama and Florida.**

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The Panama City Field Office, U.S. Fish & Wildlife Service, conducted a survey to determine the availability of Gulf sturgeon spawning habitat in Northwest Florida and Southeast Alabama river systems. We located 152 sites totaling 93 km in the Escambia/Conecuh, Yellow, Choctawhatchee, Pea, Apalachicola and Ochlockonee rivers. Ninety percent of the potential Gulf sturgeon spawning sites were located in Alabama river systems.

Gulf sturgeon were collected in the Escambia /Conecuh River near Brewton, Alabama and Pensacola, Florida in June and July 2002. All fish were weighed, measured and tagged. The project is part of an effort to determine the Gulf sturgeon population in the Escambia/Conecuh river system

Archival pop-off tags and sonic tags were attached to Gulf sturgeon collected during their fall migration from the freshwater river systems (Yellow, Choctawhatchee and Apalachicola Rivers- 2002, Ochlockonee and Escambia/Conecuh Rivers 2003) to the marine waters in an effort to determine marine movement and habitat use. Gulf sturgeon were located in the Gulf of Mexico between Panama City and Mexico Beach, Florida. The fish were found over sandy substrate, 1-2 km from shore and in depths ranging from 2.5-6.0([Back to top](#))

**Title: Stock Discrimination Between Atlantic and Gulf of Mexico King Mackerel, *Scomberomorus cavalla*, With Otolith Shape Analysis**

Name: T.R. Clardy<sup>1</sup>, W.F. Patterson, III<sup>1</sup>, D.A. DeVries<sup>2</sup>, and C. Palmer<sup>2</sup>

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**Abstract:**

Natural stock-specific tags were developed from otolith shape analysis to discriminate U.S. Gulf of Mexico and Atlantic stocks of king mackerel. Fish were sampled from May through September in 2001 and 2002 when stocks were separate and sagittal otolith shape parameters were estimated with Fourier analysis. Discriminant function analyses were computed with shape data and jackknifed classification accuracies ranged from 65% to 81%. A maximum likelihood stock mixing model then was parameterized with stock-specific otolith shape data and applied to samples from winter mixed stock landings taken off south Florida, USA. In 2001, mixing estimates indicated a gradient of distribution in both females and males from 80% to 90% Atlantic stock in SE Florida to approximately 60% Atlantic stock in SW Florida. In 2002, winter mixing estimates were not consistent between sexes. Males followed a distribution gradient from 80% Atlantic stock off SE Florida to 50% Atlantic stock off SW Florida, while females were estimated to be 60% Gulf stock off SE Florida to nearly 100% Gulf stock off SW Florida. These results indicate the current management practice of assigning all south Florida winter landings to the Gulf stock greatly overestimates the contribution of the Gulf stock to winter landings. ([Back to top](#))

**SESSION 8 – AQUATIC PLANTS**  
**Moderator: Joe Jernigan,**  
**Alabama Wildlife and Freshwater Fisheries**

**Aquatic Adjuvants and Their Impact on Efficacy**

L. Marshall, Ph.D. and R. Lowe

Trans America Product Technology, Inc., 5988 Mid Rivers Mall Drive, Suite 124, St. Charles,  
MO 63304

Adjuvants can improve the performance of aquatic herbicidal applications by various modes of action. Traditional adjuvants have been designed for herbicidal use as surfactants, crop oil concentrates, and spreader/stickers for wetting, spreading, cuticle penetration, polymerization, defoaming, drift control and compatibility. Unfortunately, some of these adjuvants have properties that can obstruct the transport of the herbicide to its target. New patented microsp sponge technology, called Biocar®, derived from grain by-products, is currently being used in adjuvants for absorption of herbicide and adherence of treatments preventing wash-off due to rain and irrigation. The Biocar® microsp sponge system in TopFilm™ adjuvant attaches the herbicide to the foliage and protects treatments from being further washed away from water drifts from airboat turn-around procedures (as well as from rains). Data with the new adjuvant is showing maximized performance of aquatic herbicide through rainfastness. More information: [www.top-film.com](http://www.top-film.com)

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## **Population Characteristics of Largemouth Bass Associated with Changes in Abundance of Submersed Aquatic Vegetation in Lake Seminole, Georgia.**

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Population characteristics of largemouth bass *Micropterus salmoides* including growth, body condition (relative weight), size structure, and survival were examined in relation to abundance of submersed aquatic vegetation (SAV) coverage (primarily hydrilla *Hydrilla verticillata*) in three embayments of Lake Seminole, Georgia and compared to a previous study. Plant coverage changed little in the Chattahoochee River arm and slightly increased in the Flint River arm from 1998 to 2002. Hydrilla was reduced in Spring Creek beginning in 2000 by a drip-delivery fluridone system; SAV coverage declined from 72% in 2000 to 22% in 2001. Growth of age 1-3 of largemouth bass was higher in Spring Creek than in the other embayments and overall growth rates up to age 10 predicted from von Bertalanffy models were higher in the Spring Creek and Chattahoochee River embayments than in the Flint River embayment. Relative weights of largemouth bass were highest or ranked highest in Spring Creek for all but the largest size group. Quarterly samples beginning in August 2000 indicated that relative weight of largemouth bass was similar between the Chattahoochee River arm and the Spring Creek arm until August 2001, when relative weight of largemouth bass up to 500 mm became greater in Spring Creek. Annual survival of fish ranked highest in Spring Creek and lowest in the Chattahoochee River arm. Relative weights were inversely related to changes in SAV and were similar between 1998 and 2003 in the Chattahoochee River arm, and lower in 2003 in the Flint River for smaller fish. Relative weights of all sizes of largemouth bass in Spring Creek were higher in 2003 than in 1998 after SAV were reduced. Growth was similar between years in the Flint and Chattahoochee River arms, but growth increased significantly in 2003 for all ages of fish in Spring Creek after SAV declined. Mean annual survival in all reservoir arms decreased from 78% in 1998 to 55% in 2003. Abundance of SAV continues to be a strong structuring factor determining largemouth bass population characteristics in Lake Seminole. Our study demonstrates that large benefits in growth and condition of largemouth bass can result from large-scale treatment of SAV in heavily vegetated reservoir systems. ([Back to top](#))

## **HYPERSPECTRAL REMOTE SENSING OF NATIVE AND INVASIVE WETLAND PLANT SPECIES IN NORTHERN MOBILE BAY**

Wells, Tami M.\*<sup>1</sup>, Carter, Gregory A.<sup>2</sup>, Peterson, Mark S.<sup>1</sup>, Jernigan, Joseph B.<sup>3</sup>

<sup>1</sup> The University of Southern Mississippi, Gulf Coast Research Laboratory (GCRL), Ocean Springs, Mississippi 39566, <sup>2</sup> Gulf Coast Geospatial Center, GCRL, Ocean Springs, Mississippi 39566, <sup>3</sup> State of Alabama, Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Daphne, Alabama 36526.

### Abstract:

Hyperspectral image data were used as a baseline for mapping wetland plant species with emphasis on the detection of invasive plants in northern Mobile Bay. Reflectances of wetland plant species were acquired from imagery collected by the airborne ITD VNIR 10E Hyperspectral Sensor developed by Institute of Technology and Development at Stennis Space Center. Visible to near infrared wavelengths (350 – 1050 nanometers) were calibrated and regressed to determine the optimum spectral signatures of indigenous and non-indigenous plant species important to the structure and dynamics of the estuary. Spectral signatures acquired from the imagery were significant in delineating the diversity among native wetland plants and the detection of invasive plant species. Results from this research prove that hyperspectral imagery is extremely accurate and efficient in monitoring potential impacts of invasive plant species and preventing destabilization of critical coastal ecosystems due to low plant biodiversity.

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