

# Fisheries in Recovery?



**26-29 January 2012**

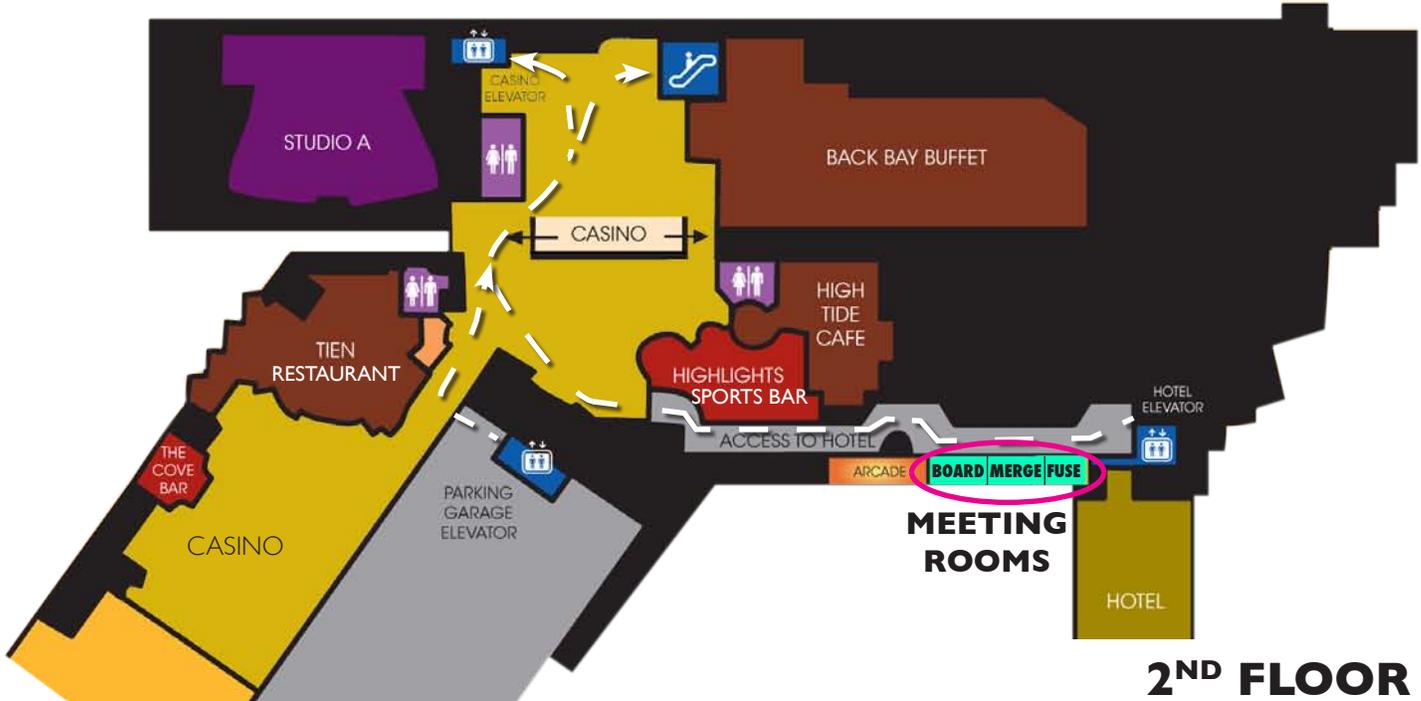
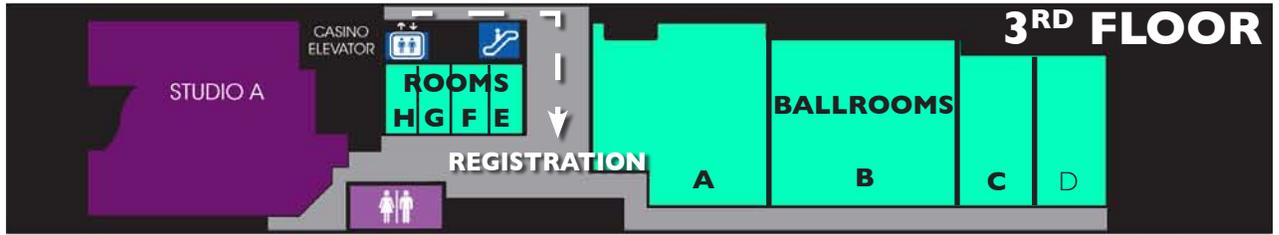
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*Hosted by the Mississippi Chapter of the American Fisheries Society*

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# IP RESORT AND CASINO FLOOR PLAN



**2012 Southern Division AFS Floor Plan of IP Resort and Casino**  
Merge and Fuse session rooms and Computer Central (Board room) can be found on the 2nd floor. Registration, session rooms H, G, F, E and Ballrooms A, B, C can be found on the 3rd floor. The 3rd floor can only be accessed by the Casino elevator or escalator. The 2nd floor meeting rooms can be accessed from the 1st floor Hotel elevator or Parking Garage elevator. The white lines on the 2nd floor show the paths by which you can reach the Casino elevator and escalator.



Thank you to all our meeting sponsors  
for their generous donations!

PLATINUM LEVEL



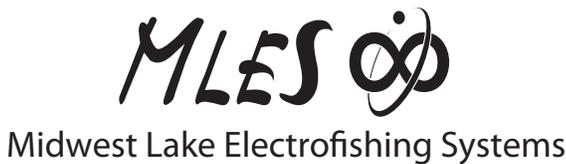
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GOLD LEVEL



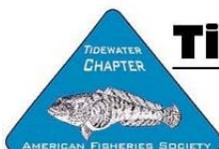
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# ACKNOWLEDGMENTS

No meeting of this scale is accomplished without a lot of cooperation and teamwork. The Organizing Committee would like to thank everyone who provided energy to that end. In particular, the support of our Sponsors allowed us to develop a great meeting for all attendees and we thank them first and foremost.

We would also like to thank Marty Wilson, a local artist who designs amazing, original artwork, and who donated the logo for this meeting (as can be found on the program, bags, and t-shirts). We truly appreciate the time, effort, and talent he extended on our behalf.

The materials and printing of this program were generously provided by the Mississippi Department of Wildlife, Fisheries and Parks and the MDWFP Fisheries Bureau. The excellent product is a major contribution to this meeting.

We are indebted to Fred Janssen and Jerry Finke for maintaining the Southern Division meeting website, Karen Brasher, Dave Ammon, and Chase Shaw in the Forest and Wildlife Research Center at Mississippi State University for providing their web expertise with on-line registration, and Chinna Nalla of the Human Dimensions & Conservation Law Enforcement Laboratory at Mississippi State University for his web expertise associated with the abstract submission process. We would also like to thank Annice Hill and Diane Weeks of the Department of Wildlife, Fisheries, and Aquaculture at Mississippi State University for processing credit card transactions and providing accounting services.

We extend thanks to the members of the Mississippi State University and University of Southern Mississippi AFS Sub-units for their help with putting together registration packets and volunteering for additional duties at the meeting.

Finally, we would like to acknowledge The University of Southern Mississippi's Gulf Coast Research Laboratory, which provided logistical support and facility use during the development and organization of this prestigious event.

Thank you all!!! We could not have had such a successful meeting without you.

## ORGANIZING COMMITTEE

<b>GENERAL MEETING CHAIR</b>	<b>MARK S. PETERSON</b>
FUND RAISING/SPONSORSHIPS	JIM FRANKS/DENNIS RIECKE/MEGAN SEWALL
FINANCES	JILL HENDON
SDAFS WEB PAGE COORDINATION	JERRY FINKE/FRED JANSSEN
PUBLICITY/ADVERTISING	MARK S. PETERSON
<b>PROGRAM CHAIR</b>	<b>KEVIN M. HUNT</b>
POSTERS	READ HENDON/BUCK BUCHANAN
LOCAL REGISTRATION	ERIC HOFFMAYER
MODERATORS	PAUL MICKLE
SYMPOSIA	MATT ROBERTS
STUDENT AFFAIRS	JOHN JACKSON
<b>LOCAL ARRANGEMENTS CHAIR</b>	<b>NANCY J. BROWN-PETERSON</b>
LOCAL ACTIVITIES	HARRIET PERRY
SIGNAGE	JEANNE-MARIE HAVRYLKOFF/PAUL GRAMMER
AUDIO/VISUAL	PETER ALLEN
WORKSHOPS	TOM HOLMAN
TECHNICAL COMMITTEES	TOM HOLMAN/LARRY PUGH
HOSPITALITY COORDINATOR	STEPHEN BROWN

## SDAFS & MSAFS OFFICERS

SDAFS	OFFICER	MSAFS
STEVE LOCHMANN	PRESIDENT	JASON OLIVE
BRIAN R. MURPHY	PRESIDENT-ELECT	NANCY BROWN-PETERSON
MICHAEL S. ALLEN	VICE-PRESIDENT	
ELIZABETH OSIER MOATS ( <i>OUTGOING</i> ) CRAIG BONDS ( <i>INCOMING</i> )	SECRETARY/TREASURER	JILL HENDON
FRED JANSSEN	PAST-PRESIDENT	TOM HOLMAN

# TECHNICAL COMMITTEE MEETINGS

THURSDAY, JANUARY 26

TIME	COMMITTEE	ROOM
8AM - NOON	CATFISH	ROOM E
8AM - NOON	STRIPED BASS	ROOM F
8AM - 5PM	WARMWATER STREAMS	ROOM G
8AM - 5PM	ALLIGATOR GAR	ROOM H
8AM - 5PM	RESERVOIR	BALLROOM C
1-5PM	AQUACULTURE	MERGE
1-5PM	SMALL IMPOUNDMENTS	ROOM F
5:30 - 7:30PM	SDAFS EXCOM	ROOM E

# WORKSHOPS

## CATFISH SAMPLING WORKSHOP

**Instructors:** Various members of the SDAFS Catfish Management Technical Committee and the NCDAFS Ictalurid Technical Committee

**Cost:** \$40 for Professionals/ \$15 for Students

**Date/Time:** Friday, January 27, 8 am-5 pm

**Room:** Fuse

**Max number of participants:** 35

**Description:** Workshop participants will learn about current sampling methods for blue, channel, and flathead catfish in various habitats (e.g. small impoundment, reservoir, inland and tidal rivers). For each sampling gear, we will cover equipment setup, field methods, site selection, and sample size. Also included will be sections on current tagging and telemetry techniques. A wrap-up session will discuss gear bias and research needs relative to improving catfish sampling methodology. The workshop will include a field trip to a local tidal river to set and run gear as well as lunch off-site.

**Target Audience:** State and federal Fisheries Biologists, Fisheries Researchers, and students who plan to sample catfishes or are interested in a career with a state or federal agency.

**Background required:** None

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## COVER LETTERS AND RESUMES: HOW TO PUT YOUR BEST FOOT FORWARD IN THE JOB SEARCH (student interest)

**Instructor:** Dr. Ed McGinley, West Virginia University

**Cost:** Free to registered participants.

**Date/Time:** Friday, January 27, 1:30-5pm

**Room:** Merge

**Max number of participants:** 45

**Description:** Cover letters and resumes are important in any job search. This workshop will cover how to construct an effective cover letter and resume and include tips on the job search and interviewing from 1:30-3:00 pm and a Q&A session with professionals from 3:30-5 pm.

**Target Audience:** This workshop is aimed at students and anyone involved in the job hunt.

**Background required:** None, but feel free to bring a copy of your cover letter or resume to be critiqued.

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## **TELEMETRY/TAGGING TECHNIQUES AND SONAR SENSING/HABITAT ASSESSMENT TECHNOLOGIES**

**Facilitators:** Allyse Ferrara/Lee Holt/Lindsey Lewis.

**Cost:** \$30 for professionals / \$15 for students

**Date/Time:** Friday, January 27, 8am-3:15pm

**Room:** Room E

**Max number of participants:** 55

**Description:** The goal of this workshop is to provide a convenient and less distracted environment for researchers to be introduced to, and become familiar with, advancements of multiple telemetry/tagging gear types and sonar sensing and habitat assessment technologies. Vendors from various companies will be in attendance to present information and discuss their products. This workshop will provide an excellent opportunity for fisheries professionals to interact with vendors and to discuss specific research needs by utilizing the most recent technological advancements in fisheries monitoring.

**Target Audience:** This workshop is aimed at students and professionals interested in general tagging approaches and is coordinated by the Alligator Gar Technical Committee.

**Background required:** None

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## **MAPPING AQUATIC HABITAT USING LOW-COST SIDE SCAN SONAR AND GIS**

**Instructors:** Adam J. Kaeser, 850-769-0552 ext. 244, adam\_kaeser@fws.gov and Thomas L. Litts, 770-761-3014, thom.litts@dnr.state.ga.us. U.S. Fish and Wildlife Service & Georgia Department of Natural Resources.

**Cost:** Student \$75; Member \$100; Non-member \$150.

**Date/Time:** Friday, January 27, 8am-5pm

**Room:** Room G

**Max number of participants:** 55

### **Description:**

Session I: Introduction to side scan sonar and image interpretation.

Session II: Mission planning & execution (capturing and working with sonar data).

Session III: Image processing in ArcGIS (practical demonstration).

Session IV: Habitat map development & applications.

A need exists within the natural resource community for an inexpensive and rapid technique to map and quantify aquatic habitat features in navigable waterways. The Humminbird® Side Imaging system allows

users to quickly capture high-resolution, geo-spatially referenced images of underwater habitat. Unlike more expensive side scan systems, the Humminbird® system employs a boat mounted transducer that allows for the survey of shallow, rocky environments. We have developed a technique utilizing ArcGIS 9.x and 10 to transform Humminbird® images into georeferenced sonar image maps (SIMS). These maps show underwater habitat in a spatial context and can be used within a GIS to map, measure and quantify features such as rocky areas, large woody debris and areas of fine sediment (sand/mud). The potential fisheries applications for such detailed habitat maps are numerous and widespread, and the tools and techniques to develop such maps are just now within reach natural resource professionals and their agencies/ institutions.

\*Workbook provided. PowerPoint presentations, demonstration datasets and processing tools will be made available to all participants.

**Target Audience:** Natural resource professionals interested in aquatic habitat.

**Background required:** Basic understanding of GIS is helpful, but not required.

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## VEMCO UNDERWATER ACOUSTIC TELEMETRY WORKSHOP

**Instructor:** Dr. Richard Vallee, VP Sales, VEMCO, Richard.vallee@vemco.com

**Cost:** Free to registered participants

**Date/Time:** Friday, January 27, 8:00 am-5 pm

**Room:** Room F

**Max number of participants:** 55

**Description:** VEMCO staff will discuss several detailed technical issues related to passive and active acoustic technology and will provide the user with the necessary tools to effectively use the equipment. Potential topics include: understanding single frequency telemetry, equipment overview and representative deployments, detection performance and range limits, Vemco User Environment (VUE) software, analyzing and removing false detections, VR2W Positioning System (VPS), and future product directions. Participants are encouraged to help us explore problems regarding deployment methods, experimental design, identification of unknown codes, data management, handling and analysis.

**Target Audience:** This workshop is aimed at students and professionals interested in specific Vemco procedures and operations.

**Background required:** None

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## LEADERSHIP AT ALL LEVELS

**Instructor:** Dr. Steve McMullin, College of Natural Resources & Environmental Leadership Institute, Virginia Polytechnic Institute & State University

**Cost:** Free to registered participants

**Date/Time:** Friday, January 27, 8am–Noon

**Room:** Room H

**Max number of participants:** 55

**Description:** Leadership in an all-volunteer organization like AFS requires special skills. This workshop introduces participants to leadership in AFS and is taught by experienced AFS leaders. Topics addressed include structure and function of AFS units, getting the most out of volunteers, how to achieve your goals as an AFS leader, and how to run an effective AFS meeting.

**Target Audience:** This workshop is aimed at students and professionals in a leadership position of any kind in AFS at any level or people who may one day hold one of these positions.

**Background required:** None

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## RECORDING AND PRODUCING PODCASTS OF POWERPOINT PRESENTATION USING CAMTASIA STUDIO 7.1 (student interest)

**Instructor:** Greg Summers, Director, Oklahoma Fishery Research Laboratory, Oklahoma Dept of Wildlife Conservation.

**Cost:** Free to registered participants.

**Date/Time:** Friday, January 27, 8am–Noon

**Room:** Merge

**Max number of participants:** 32

**Description:** Workshop participants will learn the basics of how to record and produce podcasts in several different output formats for web and/or personal viewing. Each participant will be required to bring a laptop computer to the workshop. Each participant will be given a fully functional, 30-day trial copy of Camtasia Studio 7.1 provided by the software manufacturer (TechSmith) that will be loaded onto their laptop and used during the workshop. This is the same software that the SDAFS uses for producing the Spring Meeting podcasts. Training PowerPoint presentations will be recorded and then participants will use different methods of editing and producing these recording into various output formats (AVI, Flash, MPEG, MP4, et al) with different viewing options (web, YouTube, iPhone, iPad, iPod, DVD ready, et al).

**Target Audience:** This workshop is aimed at students and professionals interested in Podcast procedures.

**Background required:** None. Must bring Windows Laptop Computer to workshop.

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## **MULTI-VENDOR TELEMETRY: A COOPERATIVE APPROACH**

**Instructors:** Jacquie & Marlin Gregor, Sonotronics/ Donna Kehoe, Lotek Wireless

**Cost:** Free to registered participants

**Date/Time:** Sunday, January 29, 8:00-10:00 am

**Room:** Fuse

**Max number of participants:** 24

**Description:** The focus of this workshop is to introduce a cooperative approach to telemetry applications through the use of multi-vendor compatible telemetry equipment. Examples of successful projects that utilize this approach will be presented and discussed with participants. Examples include applications that combine fine scale response to anthropogenic perturbations with coastal migration patterns, high speed manual tracking within critical habitat and high traffic species interactions with coastal movement. We invite researchers to ask questions, discuss specific research needs and to explore new ways in which this model may be applied.

**Target Audience:** Researchers, students and professionals interested in multi-vendor compatibility to combine research at multiple scales of observation and reduce costs.

For additional information, contact Jacquie & Marlin Gregor ([mjgregor@sonotronics.com](mailto:mjgregor@sonotronics.com)) or Donna Kehoe ([dkehoe@lotekl.com](mailto:dkehoe@lotekl.com)).

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# LOCAL ACTIVITIES

There will be three options for local activities during the SDAFS Spring meeting. To reserve your space please contact Ms. Harriet Perry (harriet.perry@usm.edu).

## **Pontoon Boat Tour of Davis Bayou and Hurricane Katrina Film**

Date/Time: Friday, January 27, 10 AM – 2 PM

Cost: \$30/person (includes lunch)

Number of participants: 40

Tour scenic Davis Bayou on the GCRL's pontoon boat and view a film about Hurricane Katrina. Part of the Mississippi Coastal Preserve, Davis Bayou is a good example of non-forested estuarine marsh. The lower portion is composed of mid-level needle rush (*Juncus roemerianus*) and low level smooth cordgrass (*Spartina alterniflora*). The peninsula that forms the southern border of Davis Bayou contains these major zones as well as a dune system on the Mississippi Sound side. Brown and white pelicans can be seen using the narrow sand spit located at the tip of the peninsula (Marsh Point) and eagles and ospreys nest along the bayou shore.

Cost of tour includes a box lunch (choice of turkey, ham, club, roast beef, or vegetarian subs with chips, cookie and soft drink or water) served in the Gulf Coast Research Laboratory (GCRL) cafeteria at noon. Participants will be divided into two groups. One group of 20 will tour the bayou with a marine educator while the others watch a film on Hurricane Katrina and its impact on the Gulf Coast. Sign up for Group 1 (bayou tour at begins at 10:00 am followed by lunch and the movie) or Group 2 (movie at 10 am followed by lunch and bayou tour). Both groups will meet at the GCRL Cafeteria for coffee and hot chocolate at 10:00 am.

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## **Birding Trip to Seaman Road Lagoons, Jackson County**

Date/Time: Friday, January 27, 7:30 AM – 10:30 AM

Cost: \$20/person

Number of participants: 18

The Seaman Road Lagoons (Jackson County Wastewater facility) is a local birding “hot spot”, providing high quality habitats for a large variety of birds that visit the state throughout the year. As many as 250-275 species out of the 400 species known from the state have been recorded at this site over the past 20 years of weekly-monitoring conducted by the local Audubon Chapter. The site includes large, open shallow-water lagoons that support waterfowl and shorebirds, open pasture that support grassland birds, and emergent wetlands that support marsh birds. The open nature of the site and abundance of birds and other wildlife also support a wide range of birds of prey, including American Bald Eagles, Osprey and other raptors. This trip will be lead by Don McKee and several members of the Mississippi Coast Audubon Society.

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**Kayak Tour of Old Fort Bayou with lunch at the Shed BBQ and Blues Joint**

Date/Time: Saturday, January 28 and Sunday, January 29, 10 AM – 2 PM

Cost: \$40/person (does not include lunch)

Number of participants: 6-12 per trip

South Coast Paddling Company (SOCO), recently featured in Southern Living and Outside Magazine, offers a personalized guided tour on Old Fort Bayou. The tour guide will meet guests at The Shed BBQ & Blues Joint on Highway 57 one block north of Interstate 10. The Old Fort Bayou tour is a perfect for first timers and includes up to ten miles (dependant on the groups energy and interests) on a slow-moving blackwater stream about 14 miles upstream from the bayou's confluence with Back Bay Biloxi: birds, turtles, sandbars, oxbow lakes and plenty of interesting views. If you're lucky you'll see a pair of bald eagles or an endangered Mississippi Sandhill Crane. The upper bayou is quiet and relatively undeveloped; its western bank borders an 1800 acre natural area and the Mississippi Sandhill Crane NWR. SOCO guides are trained and certified to assure your safety and pleasure.

The Shed's not a fancy restaurant, as a matter of fact, it's not a restaurant at all...it's a full-fledged JOINT....with award winning barbeque and sauce! Paddling back to The Shed after a few hours of kayaking is really easy – the tastes and smells of southern barbeque and local brews are sure to make you smile at the end of your tour! Tour price includes guide fee, kayak, paddle and PFD. Price does not include food & drink at The Shed.

# THEME SPEAKERS



**Donny R. Lowery**, Senior Fisheries Specialist, Tennessee Valley Authority, Muscle Shoals, AL.

*Kingston Coal Ash Spill Effects on the Emory River and Watts Bar Reservoir Fishery*



**Karen Herrington**, Aquatic Species Consultation & Recovery, U.S. Fish and Wildlife Service, Panama City, FL (Presenter) and **Dr. Stephania K. Bolden**, Fisheries Biologist, National Marine Fisheries Service, Southeast Regional Office, Endangered Species Branch, St. Petersburg, FL.

*Crossing the Saltwater Interface: Management of Sturgeons in the Southeast*



**Dr. Martin O'Connell**, Associate Chair and Graduate Coordinator, University of New Orleans, Department of Earth and Environmental Sciences and Director of the Nekton Research Laboratory of the Pontchartrain Institute for Environmental Sciences, New Orleans, LA.

*Disasters, Resilience, and Long-Term Change: A Decade of Assessing Nekton Community Dynamics in the Pontchartrain Estuary*

# SYMPOSIA DESCRIPTIONS

## LIFE HISTORY CHARACTERISTICS OF ELASMOBRANCH FISHES FROM THE NORTH WESTERN ATLANTIC OCEAN

Saturday 10am-3pm, Room F

**Organizers:** Eric R. Hoffmayer, NOAA Fisheries  
William B. Driggers III, NOAA Fisheries  
James. A Sulikowski, University of New England

As a result of their k-selected life history characteristics, many elasmobranchfish stocks have been over-exploited from both directed and non-directed commercial fisheries occurring in U.S. waters. According to the Magnuson-Stevens Reauthorization Act, it is the responsibility of the National Marine Fisheries Service to end overfishing of all federally managed species, which includes many elasmobranch species, by 2010-2011. However, to properly assess these stocks, accurate life history information is critical. Without information on when fish mature, how frequently they reproduce and how many offspring they produce at one time, the population status cannot be determined and demographic and stock assessments can never be adequately conducted. The objective of this symposium is to 1) attract researchers currently conducting life history studies on elasmobranchs, 2) compare life history assessment techniques, and 3) discuss possible implications of increased variability among life history characteristics.

## HABITAT CONSERVATION IN THE SOUTHERN DIVISION

Saturday 10am-Noon, Room E

**Organizer:** Scott Robinson, Georgia Department of Natural Resources

This symposium, organized by the Southeast Aquatic Resources Partnership (SARP), will address three aspects of work by SARP and its partners while implementing the National Fish Habitat Action Plan in the Southern Division region. Presenters will discuss freshwater and coastal regional aquatic habitat assessment techniques, results, and modeling and prioritization of restoration and conservation activities. Recent regional advances in instream flow science and protection will be presented, along with a case study of development of instream flow protection in the Lower San Antonio River. Finally, riverine habitat conservation and research results for southeastern native black basses in both Texas and Georgia will be presented.

## **AN OUT OF CHANNEL EXPERIENCE: THE IMPORTANCE OF FLOODPLAIN FORM AND FUNCTION TO SOUTHEASTERN FISHERIES**

Saturday 1:30-5pm, Room E

**Organizers:** Christopher P. Bonvillain and Catherine E. Murphy, Louisiana State University School of Renewable Natural Resources

Floodplains are key components of aquatic ecosystems, providing a mechanism of energy and nutrient transfer between the aquatic and terrestrial zones. Periods of floodplain inundation provide access to valuable feeding and spawning areas for aquatic biota. However, anthropogenic modifications to floodplain morphology, function, and main stem connectivity are threatening the biotic integrity in many of these ecosystems. Although the physical and chemical characteristics of floodplain habitats vary, lessons from individual systems provide valuable insights into the role of floodplains in aquatic ecosystem function. Symposium speakers will present current research on a wide range of topics from various floodplain ecosystems throughout the southeastern U.S., highlighting their biological and ecological functions and importance.

# SPONSOR EXHIBITORS

## List of Exhibitors at the 2012 Southern Division AFS meeting

*Each of the exhibitors below sponsored this meeting at the Silver or higher level. Please stop by their tables to see their exhibits and thank them for their support of the SDAFS meeting.*

Arkansas Chapter of the American Fisheries Society  
BioSonics  
Coastal Conservation Association  
Desert Star Systems  
Forestry Suppliers  
Georgia Power  
Hach Hydromet  
LOTEK  
Louisiana Sea Grant  
Marty Wilson, artist  
Midwest Lake Electrofishing Systems  
Mississippi-Alabama Sea Grant  
Mississippi Department of Marine Resources  
Mississippi Department of Wildlife, Fisheries and Parks  
MSU-Department of Wildlife and Fisheries  
Pew Environment Group  
Smith-Root, Inc.  
Sonotronics  
Southeast Aquatic Resources Partnership  
Taylor and Francis  
University of Mississippi Office of Research  
USDA Forest Service  
US Fish and Wildlife Service  
USM-Center for Fisheries Research and Development  
USM-Department of Coastal Sciences  
VEMCO  
Vertex Water Features  
Voss Signs

# SCHEDULE-AT-A-GLANCE

## Thursday, January 26, 2012

6:30am - 8am:	SDAFS Excom Retreat Breakfast, High Tide Café
8am - noon:	Catfish Committee, Room E
8am - noon:	Striped Bass Committee, Room F
8am - 5pm:	Warmwater Streams Committee, Room G
8am - 5pm:	Alligator Gar Committee, Room H
8am - 5pm:	Reservoir Committee, Ballroom C
11:30am - 1:30pm:	Registration, Ballroom Foyer
1pm - 5pm:	Small Impoundments Committee, Room F
1pm - 5pm:	Aquaculture Committee, Merge
5:30pm - 7:30pm:	SDAFS Excom Meeting, Room E

## Friday, January 27, 2012

7:30am - 6pm:	Registration, Ballroom Foyer
8am - 5pm:	Workshop- Vemco Acoustics, Room F
8am - 5pm:	Workshop- Hummingbird Habitat Mapping, Room G
8am - 5pm:	Workshop- Catfish Sampling, Fuse
8am - noon:	Workshop- Leading at All Levels, Room H
8am - noon:	Workshop- Recording and Producing Podcasts, Merge
8am - 3:15pm:	Workshop- Telemetry, Tagging and Habitat Assessment, Room E
10am - 5pm:	Computer Central open, Boardroom
10am - 5pm:	Sponsor, Poster and raffle set-up, Ballroom B
noon - 1:30pm:	Past President's Lunch, Carnival de Brazil
1:30pm - 5pm:	Workshop- Cover Letters and Resumes, Merge
1:30pm - 5pm:	Best Student Papers, Room H
3pm - 3:30pm:	Break, Ballroom B
3:30pm - 4:30pm:	Podcast training, Ballroom C
3:30pm - 5pm:	Black Bass Symposium organizational meeting, Room E
5:15pm - 6:45pm:	SDAFS Business Meeting, Rooms G-H
7pm - 8pm:	Podcast training, Room F
7pm - 9:30pm:	Poster Session and Social, Ballrooms B-C
7pm - 9:30pm:	Raffle Display and ticket sales, Ballrooms B-C

## Saturday, January 28, 2012

8am - 9am:	Podcast training, Room F
8am - 5pm:	Registration, Ballroom Foyer
8am - 5pm:	Computer Central open, Boardroom
8am - 5pm:	Poster and Sponsor Display, Ballroom B
8am - 5pm:	Raffle display and ticket sales, Ballroom B
8am - 9:30am:	Opening Session Theme Presentations, Ballroom A
9:30am - 10am:	Break, Ballroom B
10am - noon:	<b>Symposium:</b> Habitat Conservation in the Southern Division, Room E
10am - noon:	Contributed- Conservation, Room G
10am - noon:	Contributed- Physiology, Fuse
10am - noon:	Contributed- Sturgeon, Merge
10am - 3pm:	<b>Symposium:</b> Elasmobranch, Room F
10am - 5pm:	Contributed- Freshwater Fisheries Management, Room H
noon - 1:30pm:	Student-Mentor Lunch
1:30pm - 5pm:	<b>Symposium:</b> Floodplain, Room E
1:30pm - 5pm:	Contributed- Human Dimensions, Room G
1:30pm - 3pm:	Contributed- Genetics, Fuse
1:30pm - 3pm:	Contributed- Fisheries Techniques, Merge
3pm - 3:30pm:	Break, Ballroom B
3:30pm - 5pm:	Contributed- Elasmobranchs, Room F
3:30pm - 5pm:	Contributed- Trophic Ecology, Fuse
3:30pm - 5pm:	Contributed- Invasive Species, Merge
6pm - 6:30pm:	Load buses to go to banquet, front of hotel
6:30pm - 10:30pm:	Banquet and raffle, Ocean Springs Civic Center, Ocean Springs
9:30pm - 10:30pm:	Buses return to hotel from banquet

## Sunday, January 29, 2012

8am - noon:	Registration, Ballroom Foyer
8am - noon:	Poster and Sponsor Display, Ballroom B
8am - 10:30am:	Computer Central open, Boardroom
8am - 10am:	Contributed- Life History , Room E
8am - noon:	Contributed- Marine Fisheries , Room F
8am - noon:	Contributed- River/Stream Ecology, Room G
8am - 10am:	Contributed- Habitat, Room H
8am - 10am:	Contributed- Reproduction, Merge
8am - 10am:	Workshop- Multi-Vendor Telemetry: A Cooperative Approach, Fuse
10am - 10:30am:	Break, Ballroom B
10:30am - noon:	Contributed- Toxicology, Room E
10:30am - noon:	Handoff Meeting, Merge
noon - 3pm:	Poster and Sponsor display take-down, Ballroom B
1:30pm - 3pm:	MSAFS Business meeting, Rooms E-F

# BEST STUDENT PAPER COMPETITION

## FINALISTS

Friday, January 27, 2012. 1:30 – 4:45pm, Room H  
Moderator: John Jackson

- 1:30 – 1:45      Opening remarks, John Jackson
- 1:45 – 2:00      The Effects of Oyster Harvest on Resident Oyster Reef Communities and Reef Structure in Coastal Louisiana. Steven Beck and Megan La Peyre, Louisiana State University.
- 2:00 – 2:15      Influences of Drought on Shortnose Sturgeon (*Acipenser brevirostrum*) in the Altamaha River, Georgia. Michael Bednarski and Douglas Peterson, University of Georgia.
- 2:15 – 2:30      Effects of a Mimic Artificial Oyster Reef on Select Estuarine Fishes in Marsh Ponds in Louisiana's Shallow Water Estuaries: A Before-After-Control-Impact Analysis. Steven Garner, Joris van der Ham, Kevin Boswell, Kari Klotzbach and James Cowan, Jr., Louisiana State University.
- 2:30 – 2:45      The Effect of Species Preference on Consistency of Angler Catch-Related Attitudes. Clifford Hutt and Kevin Hunt, Mississippi State University.
- 2:45 – 3:00      A Classification System for Large U.S. Reservoirs and its Relationship with the Fishery and Fish Community. Rebecca Krogman and Steve Miranda, Mississippi State University.
- 3:00 – 3:30      BREAK
- 3:30 – 3:45      Endocrine Disruption in Juvenile Fathead Minnows (*Pimephales promelas*) Exposed to Cyanobacteria. Jamie Morgan, James Herrin, Kristen Kellock, Rebecca Haynie, Susan Wild, and Robert Bringolf, University of Georgia.
- 3:45 – 4:00      Diet Ecology of Non-native Northern Snakehead (*Channa argus*) Compared to Three Co-occurring Predators in the Lower Potomac River. Ryan Saylor, Nicolas Lapointe, and Paul Angiermeier, University of West Florida.
- 4:00 – 4:15      Annual Variation in Largemouth Bass Spawning Behavior in Small Florida Lakes. Stephanie Shaw and Michael Allen, University of Florida.
- 4:15 – 4:30      Life Histories of Asian Carp in a Lower Mississippi River Backwater. Larry Southern and Jan Hoover, Mississippi State University and US Army Corps of Engineers.
- 4:30 – 4:45      Larval Crappie Densities in Relation to Environmental Variables and Stock Abundance in Arkansas Reservoirs. Lynn Wright and John Jackson, Arkansas Tech University.

# OPENING SESSION

Saturday, January 28, 2012  
8:00 – 9:30 AM, Ballroom A  
Moderator: Mark Peterson

8:00 – 8:15 Welcoming Remarks. Mark S. Peterson, Chair of 2012 SDAFS meeting.

**THEME PRESENTATIONS: FISHERIES IN RECOVERY? (ABSTRACT PAGE # IN PARENTHESES)**

8:15 – 8:40 Kingston Coal Ash Spill Effects on the Emory River and Watts Bar Reservoir Fishery. Donny R. Lowery, Tyler F. Baker, Kurt M. Lakin, Jason E. Yarbrough, and John C. Justice, Tennessee Valley Authority. (1)

8:40 – 9:05 Crossing the Saltwater Interface: Management of Sturgeons in the Southeast. Karen Herrington and Stephania K. Bolden, US Fish and Wildlife Service and National Marine Fisheries Service. (1)

9:05 – 9:30 Disasters, Resilience, and Long-term Change: A Decade of Assessing Nekton Community Dynamics in the Pontchartrain Estuary. Martin T. O’Connell, University of New Orleans. (2)

9:30 – 10:00 BREAK

# ORAL PRESENTATIONS SCHEDULE

Saturday 10am-Noon in Rooms Merge, Fuse, and E: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	PHYSIOLOGY	STURGEON	SARP HABITAT SYMPOSIUM
MODERATOR	J. HOOVER	T. SLACK	S. ROBINSON
ROOM	MERGE	FUSE	ROOM E
10:00	Thermal Tolerance of Age-0 Gulf of Mexico Striped Bass ( <i>Morone saxatilis</i> ) <i>Anderson*, Saillant (5)</i>	Movement of Pallid Sturgeon in the Atchafalaya River <i>Herrala*, Schramm, Jr. (39)</i>	Implementing the National Fish Habitat Action Plan in the Southern Division in 2011 <i>Robinson (77)</i>
10:15	The Effects of Salinity on Growth, Metabolic Rate and Ion Regulation of Juvenile Alligator Gar ( <i>Atractosteus spatula</i> ) <i>Schwarz*, Allen (82)</i>	Pallid Sturgeon Habitat Use and Selection in the Lower Mississippi River <i>Kuntz*, Schramm, Jr., Hartfield (50)</i>	An Assessment of U.S. Estuarine Habitat in Support of the National Fish Habitat Partnership <i>Blackhart, Candelmo, Greene, Imaki, Nelson (11)</i>
10:30	Physiological Effects of Terrestrial Stranding on Gulf Killifish ( <i>Fundulus grandis</i> ) <i>O'Malley*, Brown, Patterson, Green (65)</i>	Sequence Validation of Known Microsatellites of <i>Scaphirhynchus</i> Sturgeon Species from the Lower Mississippi River Basin <i>Boysen*, Dillman, Wood (14)</i>	The Status of Instream Flow Protection and Science in the Southeastern United States <i>Davis (23)</i>
10:45	<sup>1</sup> H-NMR Characterization of the Metabolic Response of Juvenile Paddlefish ( <i>Polyodon spathula</i> ) to Acute Hypoxia <i>Aboagye*, Allen (3)</i>	Influences of Drought on Shortnose Sturgeon ( <i>Acipenser brevirostrum</i> ) in the Altamaha River, Georgia <i>Bednarski*, Peterson (9)</i>	Ecological Responses to Flow Alteration in the South Atlantic Region: A Meta-analysis of Regional Literature <i>McManamay (57)</i>
11:00	Swimming Performance of Bighead Carp and Silver Carp: Methodology, Metrics, and Management Applications <i>Katzenmeyer, Hoover, Southern, Hahn (46)</i>	Analysis of Fin Rays for Aging Gulf Sturgeon ( <i>Acipenser oxyrinchus desotoi</i> ) <i>Rosati, Baremore (78)</i>	Establishing Instream Flow Recommendations on the Lower San Antonio River <i>Linam, Littrell, Robertson, Mayes, Orborny (51)</i>
11:15	Estimating Grass Carp Consumption using Bioenergetics as a Tool for Verifying Biological Control of Submerged Vegetation <i>Timmons*, Lochmann (92)</i>	Abundance and Growth Patterns of Juvenile Atlantic Sturgeon ( <i>Acipenser oxyrinchus oxyrinchus</i> ) in the Altamaha River, Georgia: Are We on the Road to Recovery? <i>Peterson, Bednarski, Peterson (69)</i>	A War of Attrition: Conservation of Shoal Bass in Alabama and Georgia <i>Sammons (79)</i>
11:30	Physiological Responses of Juvenile Channel Catfish to Elevated Temperature Environments <i>Arnold*, Allen (6)</i>		Southeast Native Black Bass Keystone Initiative: Implementing Watershed-scale Actions to Restore Guadalupe Bass ( <i>Micropterus treculii</i> ) in the Edwards Plateau Ecoregion of Texas <i>Birdsong, Krause, Leitner, Long, Robinson (10)</i>
11:45			Putting the Pieces Together to Prioritize the Landscape: A Pilot Project in the Tennessee, Cumberland, and Ohio River Basins <i>Watson (94)</i>
12:00	LUNCH		

Saturday 10am-Noon in Rooms F, G, and H: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	ELASMOBRANCH SYMPOSIUM	CONSERVATION	FRESHWATER FISHERIES MANAGEMENT
MODERATOR	J. SULIKOWSKI	C. RAKOCINSKI	T. STUBBS
ROOM	ROOM F	ROOM G	ROOM H
10:00	The History of Elasmobranch Biology from Antiquity through Modern Times <i>Castro (Keynote Speaker – No Abstract)</i>	Distribution and Ecology of the Endangered Boulder Darter ( <i>Etheostoma wapiti</i> ) in the Elk River, Tennessee <i>Potoka*, Bettoli, Shea (71)</i>	Managing a Paddlefish Population on the Coattails of a Single Year Class <i>Schooley (81)</i>
		Relative Abundance, Distribution, and Recovery Efforts for Southern Walleye in Alabama <i>Rider, Powell, Ringenberg (75)</i>	Characteristics of Two Self-Sustaining Reservoir Populations of Paddlefish in Northeast Oklahoma <i>Nealis*, Long (60)</i>
10:30	Reproductive Biology of a Resident Population of Cownose Rays in Southwest Florida: Expected and Unexpected Results <i>Poulakis*, Grier (72)</i>	Summary of Previous and New Records of the Least Darter ( <i>Etheostoma microperca</i> ) in Arkansas <i>Wagner, Kottmyer, Slay (94)</i>	Comparison of Various Minimum-Length Limits for the Largemouth Bass Fishery in the Arkansas River, Arkansas <i>Peacock*, Batten, Eggleton (67)</i>
10:45	Variability in the Reproductive Biology of the Atlantic Sharpnose Shark ( <i>Rhizoprionodon terraenovae</i> ) in the Northern Gulf of Mexico <i>Hoffmayer, Hendon, Jones, Driggers, Holland (40)</i>	Status of the Endemic Fish and Mollusks of Lake Waccamaw, North Carolina <i>Heise, Jones (37)</i>	An Evaluation of Largemouth Bass Populations in Three Georgia Reservoirs: Is Exploitation Still a Concern? <i>Bonvechio, Allen, Bowen, Wixson (13)</i>
11:00	Reproductive Biology of the Finetooth Shark ( <i>Carcharhinus isodon</i> ) in the Northern Gulf of Mexico <i>Higgs*, Hendon, Hoffmayer, Sulikowski, Stiller (39)</i>	An Evaluation of Anthropogenic and Non-anthropogenic Impacts on Smalltooth Sawfish ( <i>Pristis pectinata</i> ) Critical Habitat within the Charlotte Harbor Estuary <i>Trimm (93)</i>	Subspecies Composition of Largemouth Bass in Puerto Rico <i>Peterson*, Lutz-Carrillo, Neal (69)</i>
11:15	Preliminary Analysis of Reproductive Periodicity of the Blacknose Shark ( <i>Carcharhinus acronotus</i> ) within its Atlantic Range <i>Ford*, Gelsleichter, Frazier, Belcher, Piercy (28)</i>	Interactions between Nonnative Yellow Perch and Native Fishes in two Southeastern US Reservoirs <i>Roberts*, DeVries, Wright (75)</i>	Largemouth Bass Relationships with Flow in the Arkansas River <i>Peacock*, Eggleton (67)</i>
11:30	Reproduction of the Blacktip Shark in the Gulf of Mexico <i>Baremore, Passerotti (8)</i>	Southeastern Blue Suckers ( <i>Cycleptus meridionalis</i> ) in the Louisiana Waters of the Pearl River: Low Catches and Limited Range of Targeted Habitats Suggest Continued Concerns <i>Oliver*, Kelso, Kaller (61)</i>	Ecosystem Management in the Atchafalaya River Basin: Still Arranging Deck Chairs on the Titanic <i>Pasco, Kelso, Kaller (66)</i>
11:45	Investigating Potential Reproductive Anomalies in the Spiny Dogfish ( <i>Squalus acanthias</i> ) Along the United States East Coast <i>Knotek*, Peterson, Tsang, Buble, Driggers (48)</i>	Impacts of River Control Structures on the Juvenile Migration of the Amphidromous River Shrimp ( <i>Macrobrachium ohione</i> ) <i>Olivier*, Handy, Bauer (62)</i>	
12:00	LUNCH		

Saturday 1:30-3pm in Rooms Merge, Fuse, and E: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	GENETICS	FISHERIES TECHNIQUES	FLOODPLAIN SYMPOSIUM
MODERATOR	E. SAILLANT	M. ROBERTS	C. MURPHY
ROOM	MERGE	FUSE	ROOM E
1:30	Length of White Bass Larvae at Hatch and Five Days Post Hatch is a Heritable Trait <i>Fernando*</i> , <i>Lochmann</i> (26)	A Comparison of Liver and Belly Flap for Evaluating Striped Bass Diet using Fatty Acid Signatures <i>McGinley*</i> , <i>Hartman</i> (56)	EnviroFish: A Model to Evaluate Fish Spawning and Rearing in Riverine Floodplains <i>Killgore</i> , <i>Bruchman</i> , <i>Hunt</i> , <i>Lin</i> , <i>Johnson</i> (47)
1:45	The Naked Truth: the Effects of a Low Head Dam on the Population Genetic Structure of the Naked Sand Darter ( <i>Ammocrypta beanii</i> ) in the Pearl River <i>Camak*</i> , <i>Piller</i> (17)	Quantifying Fish Detection Probabilities with Video Cameras in Dense Submersed Vegetation <i>Wilson*</i> , <i>Crain</i> , <i>Allen</i> , <i>Cole</i> , <i>Slagle</i> (95)	Life Histories of Asian Carp in a Lower Mississippi River Backwater <i>Southern*</i> , <i>Hoover</i> (86)
2:00	Population Genetics of Two Coastal Louisiana Shrimp Species <i>Cashner</i> , <i>Piller</i> (19)	The Cast Net – The Overlooked Sampling Gear <i>Stein*</i> , <i>Galen</i> , <i>Martin</i> (87)	Entrainment of Sturgeon through the Bonnet Carré Spillway <i>Parker</i> , <i>Brantley</i> , <i>Killgore</i> , <i>Slack</i> , <i>George</i> (65)
2:15	Development of a Genetic Monitoring Program for Stock Enhancement of Mississippi Spotted Seatrout <i>Somerset*</i> , <i>Saillant</i> (85)	Estimating Delayed Mortality of Red Snapper Discards using Acoustic Telemetry <i>Curtis*</i> , <i>Stunz</i> , <i>Johnson</i> , <i>Diamond</i> (22)	Movement of Telemetry Tagged Shovelnose Sturgeon <i>Slack</i> , <i>Lewis</i> , <i>Maus</i> , <i>Killgore</i> (84)
2:30	Identifying Bottlenecks to Red Drum Recruitment in Ashley River South Carolina Using Hatchery Fish and Genetic Identification <i>Brenkert</i> , <i>Darden</i> , <i>Denson</i> (15)	Nearshore Benthic Habitat Mapping Using Side Scan Sonar <i>Hendon</i> , <i>Creel</i> (38)	Effects of Environmental Hypoxia on Population Characteristics of Red Swamp Crayfish ( <i>Procambarus clarkii</i> ) in the Atchafalaya River Basin <i>Bonvillain*</i> , <i>Rutherford</i> (13)
2:45	The Effect of Overexploitation on the Genetic Diversity of Red Snapper ( <i>Lutjanus campechanus</i> ) <i>Darden</i> , <i>Tarpey</i> (22)		The 2011 Mississippi River Flood: Atchafalaya Basin Water Quality Observations during the Morganza Spillway Opening <i>Harlan</i> , <i>Kelso</i> , <i>Kaller</i> (36)
3:00	BREAK		

Saturday 1:30-3pm in Rooms F, G, and H: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	ELASMOBRANCH SYMPOSIUM	HUMAN DIMENSIONS	FRESHWATER FISHERIES MANAGEMENT
MODERATOR	W. DRIGGERS	M. MURPHY	D. GRAHAM
ROOM	ROOM F	ROOM G	ROOM H
1:30	Reproductive Biology of the Cuban Dogfish ( <i>Squalus cubensis</i> ) in the Northern Gulf of Mexico <i>Jones, Driggers, Bethea, Gulak (45)</i>	Angler Exploitation of Black and White Crappie at Lake Conway, Arkansas <i>Schroeder, Horton, Bly (81)</i>	Larval Crappie Densities in Relation to Environmental Variables and Stock Abundance in Arkansas Reservoirs <i>Wright*, Jackson (96)</i>
1:45	Potential Utilization of Steroid Hormones Extracted from the Skeletal Muscle Tissue of the Spiny Dogfish ( <i>Squalus acanthias</i> ) and the Atlantic Sharpnose Shark ( <i>Rhizoprionodon terraenovae</i> ) to Determine Reproductive Status <i>Prohaska*, Tsang, Driggers, Hoffmayer, Sulikowski (72)</i>	Angler Effort And Harvest Characteristics Relevant To Alligator Gar Before And After A One Fish-Per-Day Creel Limit At Annual Bow-Fishing Tournaments On The Trinity River, Texas <i>Bennett, Bonds (10)</i>	Distribution Gradients of Age-0 Crappies ( <i>Pomoxis</i> spp.) within Reservoir Arms <i>Kaczka*, Miranda (46)</i>
2:00	Evaluation of Gonadal Steroid Chemiluminescent Immunoassays (CLIA) for Non-lethal Characterization of Reproductive Status for Elasmobranchs <i>Anderson*, Gelsleichter, Fraizer, Belcher (4)</i>	Evaluation of Historical Catch Results from Bass Tournaments on the Cumberland Plateau, Middle Tennessee <i>Heitman, Upp (37)</i>	Contribution of 178-mm Channel Catfish ( <i>Ictalurus punctatus</i> ) Stocked in Two Medium-size Reservoirs in Oklahoma <i>Stewart*, Long (88)</i>
2:15	Intersexuality of a Juvenile Blacktip Shark ( <i>Carcharhinus limbatus</i> ) in the Northern Gulf of Mexico <i>Hendon, Koester, Hoffmayer, Cicia (38)</i>	Applying Travel Cost Method to Striped Bass ( <i>Morone saxatilis</i> ) Angler Visitation at Lewis Smith Lake, Alabama <i>Lothrop*, Hanson, Sammons (52)</i>	Demographics of a Commercially Exploited Population of Flathead Catfish in the Wabash River <i>Moody*, Frankland, Sass, Colombo (59)</i>
2:30	Age Determination using Dorsal Spines of the Cuban dogfish ( <i>Squalus cubensis</i> ) <i>Mathers, Carlson, Driggers, III, Jones (54)</i>	Developing and Disseminating Preferred Catch and Release Methods for Louisiana Saltwater Recreational Anglers <i>Chesney, Thomas, Hawke (20)</i>	Long-term Population Responses of Triploid Grass Carp Stocked to Control Hydrilla <i>Kirk (48)</i>
2:45	Survey of Elasmobranchs in Northeast Florida Waters: Abundance, Distribution, and Identification of Potential Shark Nursery Habitat <i>McCallister*, Gelsleichter (55)</i>	The Recreational For-Hire Sector in the U.S. Gulf of Mexico: Structural and Economic Observations from the Third Decadal Survey <i>Savolainen*, Caffey, Kazmierczak (79)</i>	Hooking Mortality of Hybrid Striped Bass in a Tennessee Lake <i>Petersen*, Bettoli (68)</i>
3:00	BREAK		

Saturday 3:30-5pm in Rooms Merge, Fuse, and E: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	TROPHIC ECOLOGY	INVASIVE SPECIES	FLOODPLAIN SYMPOSIUM
MODERATOR	J. HAVRYLKOFF	P. MICKLE	C. BONVILLIAN
ROOM	MERGE	FUSE	ROOM E
3:30	Diet and Feeding-Related Morphometrics of the Blackstripe Topminnow ( <i>Fundulus notatus</i> ) and the Blackspotted Topminnow ( <i>Fundulus olivaceus</i> ) in syntopic and allotopic populations <i>Champagne*</i> , <i>Schaefer</i> , <i>Kreiser</i> , <i>Duvernall</i> , <i>Mickle</i> (19)	Age and Growth of Northern Snakehead in Potomac River Tributaries, Virginia <i>Odenkirk</i> , <i>Lim</i> (61)	Differences in Centrarchid Condition Factor among Macro- and Meso-Habitats in the Atchafalaya River Basin, Louisiana <i>Miller*</i> , <i>Kelso</i> , <i>Kaller</i> (58)
3:45	Understanding the Trophic Role of Gulf Menhaden ( <i>Brevoortia patronus</i> ) using Carbon and Nitrogen Stable Isotopes <i>Olsen*</i> , <i>Fulford</i> , <i>Dillon</i> , <i>Graham</i> (63)	Diet Ecology of Non-native Northern Snakehead ( <i>Channa argus</i> ) Compared to Three Co-occurring Predators in the Lower Potomac River <i>Saylor*</i> , <i>Lapointe</i> , <i>Angermeier</i> (80)	Hurricane Induced Water Quality Changes in the Hydrologically Altered Upper Barataria Estuary, Louisiana <i>Fontenot</i> , <i>Eddlemon</i> , <i>Boopathy</i> , <i>Ferrara</i> (27)
4:00	Isolation Effects on Fish Diets in an Intermittent Stream <i>Christian*</i> , <i>Adams</i> , <i>Adams</i> (21)	Climate Change Impacts on the Spread of Invasive Nile Tilapia in the Northern Gulf of Mexico <i>Lowe*</i> , <i>Wu</i> , <i>Peterson</i> , <i>Brown-Peterson</i> , <i>Slack</i> , <i>Schofield</i> (53)	Seasonal Gonad Development and Evidence for Reduced Spawning Activity of Spotted Gar in a Large River Floodplain Disconnected from the Main Stem River <i>Rombach*</i> , <i>Ferrara</i> , <i>Fontenot</i> (77)
4:15	Anisakid Nematodes from the Mid-water Fish Families Myctophidae and Sternoptychidae in the Western Gulf of Mexico <i>Andres*</i> , <i>Overstreet</i> (5)	Effects of Exotic Suckermouth Catfishes (Loricariidae) on Aquatic Ecosystems: A Feasibility Study Using Mesocosms <i>Hahn*</i> , <i>Hoover</i> (35)	Seasonal Diets of Spotted Gar ( <i>Lepisosteus oculatus</i> ) in the Upper Barataria Estuary <i>Manley*</i> , <i>Ferrara</i> , <i>Fontenot</i> (54)
4:30			Preserving Half a Century of Southern Ichthyology: The University of Louisiana at Monroe Museum of Natural History <i>Hoover</i> , <i>Douglas</i> (42)

Saturday 3:30-5pm in Rooms F, G, and H: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	ELASMOBRANCH CONTRIBUTED	HUMAN DIMENSIONS	FRESHWATER FISHERIES MANAGEMENT
MODERATOR	G. PARSONS	K. HUNT	L. PUGH
ROOM	ROOM F	ROOM G	ROOM H
3:30	The Chandeleur Islands Serve as a Nursery Ground for Lemon Sharks ( <i>Negaprion brevirostris</i> ) <i>McKenzie*</i> (56)	Evaluation of Fishing Summer Camps at Lucchetti Reservoir, Puerto Rico <i>Lopez, Ruiz</i> (51)	Correcting for Length Bias of Common Warmwater Sport Fish Sampled with Standardized Experimental Gill Nets <i>Ryswyk, Shoup</i> (78)
3:45	Utilization of Molecular Markers in a Preliminary Assessment of Population Structure in the <i>Mustelus canis</i> and to Distinguish between Smooth-hound Species in the Gulf of Mexico <i>Giresi*, Renshaw, Portnoy, Gold</i> (33)	Partnering with Angler Groups to Remove Excess Grass Carp from Texas Reservoirs <i>Bonds, Webb, Ott, Jr., Bennett</i> (12)	Influence of Multi-scale Factors on Fish Structural Indices in Freshwater Impoundments: Implications for Successful Fisheries Management <i>Trushel*, Jennings, Peterson</i> (93)
4:00	Examining the Effects of Stress, Gape Angle, and Jaw Muscle Mass on Bite Force in Sharks of the Gulf of Mexico <i>Rice*, Parsons</i> (74)	Interactions between Fish and Anglers: A Spatial Analysis of Fish Vulnerability to Angling <i>Matthias*, Allen, Ahrens, Beard</i> (55)	A Classification System for Large U.S. Reservoirs and its Relationship with the Fishery and Fish Community <i>Krogman*, Miranda</i> (49)
4:15	Functional Morphology of the Hammerhead Cephalofoil: Does the Head of Hammerhead Sharks (Family: Sphyrnidae) Confer an Advantage via Hydrodynamic Lift Production? <i>Gaylord*, Parsons</i> (31)	The Effect of Species Preference on Consistency of Angler Catch-Related Attitudes <i>Hutt*, Hunt</i> (42)	Adaptive Management Strategies for Allocating Hatchery Resources <i>Rachels*, Lochmann</i> (73)
4:30	Factors Influencing Shark At-vessel Mortality during Fishery-independent Bottom Longline Surveys in the U.S. Gulf of Mexico and the Western North Atlantic Ocean. <i>Lotti*, Wetherbee, Grace, Driggers</i> (52)	Meeting Conservation and Socio-economic Fisheries Objectives using Novel Management Strategies that Protect Older Fish <i>Gwinn, Allen, Johnston, Brown, Todd</i> (35)	Pond Management Approaches and Effects on Trophic-Dynamics <i>Sherman*, Dibble, Madsen</i> (83)
4:45	Shark Attack, Fishery Landings, and Environmental Conditions in Florida: Can We Predict Shark Attack? <i>Parsons</i> (66)		The Effectiveness of Different Fish Attractors in North Carolina Reservoirs <i>Baumann, Oakley, McRae</i> (8)

Sunday 8-10am in Rooms Merge, E, and F: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	REPRODUCTION	LIFE HISTORY	MARINE FISHERIES
MODERATOR	D. NIELAND	E. DIBBLE	J. FRANKS
ROOM	MERGE	ROOM E	ROOM F
8:00	Can We Expand At-Sea Sampling for Fish Reproductive Potential Using Frozen Ovaries? <i>Lang, Fitzhugh (50)</i>	Life History Traits of the Mirror Shiner ( <i>Notropis spectrunculus</i> ) in Western North Carolina <i>Olson*, Martin (64)</i>	Effects of the Deepwater Horizon Oil Spill on Deepwater Fish Populations from the Northeast Gulf of Mexico <i>Gelsleichter, Leary, Drakos, Davis, Gonzalez de Acevedo (31)</i>
8:15	Reproductive Biology of the Southern Kingfish within the Mississippi Sound <i>Clardy*, Brown-Peterson, Peterson (21)</i>	Life History of the Redfin Darter ( <i>Etheostoma whipplei</i> ) in Central Arkansas <i>Stearman*, Adams (87)</i>	Red Snapper Juvenile Recruitment during the 2010 Deepwater Horizon Oil Spill <i>Szedlmayer, Mudrak (60)</i>
8:30	Interannual Variability in Spatial and Temporal Spawning Distributions of White Bass <i>Baker*, Lochmann (7)</i>	Effects of Temperature and Salinity on Hatch Success, Development and Survival of Bigmouth Sleeper, ( <i>Gobiomorus dormitor</i> ) Larvae <i>Olivieri*, Neal (62)</i>	Acoustic Telemetry of Spotted Seatrout ( <i>Cynoscion nebulosus</i> ) at Hurricane Katrina Reef, Biloxi, Mississippi <i>McKinney, Franks, Hendon, Higgs (57)</i>
8:45	Annual Variation in Largemouth Bass Spawning Behavior in Small Florida Lakes <i>Shaw*, Allen (82)</i>	Preliminary Assessment of Age, Growth and Fecundity of Two Coastal Marsh Populations of Alligator Gar ( <i>Atractosteus spatula</i> ) in Louisiana <i>Duke*, Ferrara, Fontenot, LaFleur, Jr., Salyers (23)</i>	An Integrated Assessment of Potential Implications of Red Drum ( <i>Sciaenops ocellatus</i> ) Stock Enhancement in Florida <i>Camp*, Lorenzen (18)</i>
9:00	Induced Spawning of Wild-caught Spotted Gar ( <i>Lepisosteus oculatus</i> ) and Effects of Injecting Broodstock with Thyroid Hormones on Egg Hatch Rate, Larval Growth and Development, and Survival <i>Bollfrass*, Ferrara, Fontenot, Castillo, Mendoza (12)</i>	Accuracy and Precision of Age Estimates for Alligator Gar from Otoliths, Pectoral Fin Rays, and Scales <i>Buckmeier, Smith (16)</i>	Catch Trends Stemming from the National Marine Fisheries Service, 2011 Expanded Annual Stock Assessment Survey (EASA) <i>Campbell, Pollock, Cook, Provaznik (18)</i>
9:15	Shoal Bass Tag Retention and Spawning Aggregation Abundance in the Lower Flint River, Georgia <i>Taylor*, Peterson (91)</i>	Age and Growth of Paddlefish ( <i>Polyodon spathula</i> ) in the large rivers of western Kentucky. <i>Jackson, Rister, Flynn (44)</i>	Assessing Per-Hook Effort From Fishery-Independent Longline Surveys <i>Grace, Schroeder, Jones, Driggers, Jones (34)</i>
9:30	Intersex Fish: Not just in Wastewater Anymore <i>Bringolf, Kellock, Trushel, Ely, Jennings (16)</i>	Frequency of Strong Year-classes: Implications on Fishery Dynamics for Three Life-history Strategies of Fishes <i>Daugherty, Smith (85)</i>	The Influence of Tidal Height and Wave Energy on First-Year Oyster Reef Development on Constructed Shoreline Erosion Control Structures <i>O'Malley*, Melancon (64)</i>
9:45		Hydro-peaking Impacts on the Growth of Two Black Bass Species in the Tallapoosa River, Alabama <i>Earley*, Sammons (25)</i>	The Effects of Oyster Harvest on Resident Oyster Reef Communities and Reef Structure in Coastal Louisiana <i>Beck*, La Peyre (9)</i>
10:00	BREAK		

Sunday 8-10am in Rooms G and H: First author is presenter except where another author is underlined;  
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SESSION	RIVER AND STREAM ECOLOGY	HABITAT CONTRIBUTED	
MODERATOR	P. MICKLE	M. ALLEN	
ROOM	ROOM G	ROOM H	
8:00	Movements, Habitat Use, and Conservation of Alligator Gar ( <i>Atractosteus spatula</i> ) in a River-Floodplain Ecosystem <i>Adams, Kluender, Lewis (3)</i>	A Comparison of Mobile Fauna Associated with Constructed Oyster Reefs and Natural Oyster Reefs in a Louisiana Estuary <i>Bachelor*, Melancon (6)</i>	
8:15	Gross Morphology of the Paddlefish: Developmental Changes in Rostrum Form <i>Hoover, George (41)</i>	Effects of a Mimic Artificial Oyster Reef on Select Estuarine Fishes in Marsh Ponds in Louisiana's Shallow Water Estuaries: A Before-After-Control-Impact Analysis <i>Garner*, van der Ham, Boswell, Klotzbach, Cowan, Jr. (30)</i>	
8:30	Evaluation of Spawning Run American Shad Spatial Distribution and Habitat Use via Acoustic Telemetry Gear at the St. Johns River, Florida <i>Dutterer, Allen, Pine (24)</i>	Effects of a mimic Artificial Oyster Reef on meiofauna and small macrofauna in Louisiana's Shallow Water Estuaries: A Before-After-Control-Impact Analysis <i>Garner*, Van der Ham, Boswell, Klozbac, Cowan (29)</i>	
8:45	Fishes of the Fayetteville Shale and Factors Related to Assemblage Structure <i>Stearman*, Adams, Adams, Entekin (86)</i>	Characterizing Environmental and Physicochemical Conditions in Nursery Areas of River Herring in Chowan River, NC <i>Butler*, Overton, Dowling (17)</i>	
9:00	Effects of Varying In-stream Habitats on Headwater Stream Fish Assemblages in Southwestern Louisiana <i>Fitzgerald*, Kaller, Kelso (26)</i>	Estimating Habitat Utilization from Incomplete Movement Data <i>Struve (89)</i>	
9:15	Identifying Metrics that Respond to Stressors in a Regulated River Using a Traditional Reference Site Approach and a Novel Multivariate Approach <i>Ivasauskas, Bettoli (43)</i>	Patterns of Faunal Diversity Associated with Altered Macrophyte Coverage <i>Fleming*, Spickard, Dibble (27)</i>	
9:30	A Comparison of Fish Communities Between an Anthropogenically Modified Study Site and Two Unmodified Sites Downstream in the Pearl River Located in Central Mississippi <i>Jones (45)</i>	Spatial and Temporal Dissolved Oxygen Dynamics and Evaluation of Fish Habitat Loss Due to Hypoxia in <i>Hydrilla</i> <i>Bradshaw- Settevendem*, Rudd, Allen, Netherland (14)</i>	
9:45			
10:00	BREAK		

Sunday 10:30-12 in Rooms E, F, and G: First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.

SESSION	TOXICOLOGY	MARINE FISHERIES	RIVER AND STREAM ECOLOGY
MODERATOR	A. KUHL	J. FRANKS	P. MICKLE
ROOM	ROOM E	ROOM F	ROOM G
10:30	Endocrine Disruption in Juvenile Fathead Minnows ( <i>Pimephales promelas</i> ) Exposed to Cyanobacteria <u>Morgan*</u> , <u>Herrin</u> , <u>Kellock</u> , <u>Haynie</u> , <u>Wilde</u> (59)	Early Life History of <i>Prognichthys occidentals</i> and <i>Caranx crysos</i> Associated with <i>Sargassum</i> Habitat in the Northcentral Gulf of Mexico <u>Tilley</u> , <u>Comyns</u> , <u>Rakocinski</u> , <u>Hoffmayer</u> , <u>Perry</u> (92)	Riverine Fishes Entrained through the Birds Point-New Madrid Floodway <u>George</u> , <u>Killgore</u> , <u>Smith</u> , <u>Thron</u> (33)
10:45	Toxicological and Physiological Effects of the Surfactant Diocetyl Sodium Sulfosuccinate at Varying Salinities during the Ontogeny of the Gulf Killifish ( <i>Fundulus grandis</i> ) <u>Green</u> , <u>Gautreaux</u> , <u>Rivera</u> , <u>Bodinier</u> , <u>Galvez</u> (34)	Distribution and Abundance of Menhaden ( <i>Brevoortia</i> spp.) Larvae Captured in Ichthyoplankton Samples during SEAMAP Fishery-independent Resource Surveys in the Gulf of Mexico <u>Hanisko</u> , <u>Lyczkowski-Shultz</u> (36)	Riverine and Backwater Fishes Entrained through the Morganza Floodway <u>George</u> , <u>Killgore</u> , <u>Harvey</u> , <u>Katzenmeyer</u> , <u>Slack</u> (32)
11:00	The Effect of Oil Dispersants and Salinity on the Biodegradation of South Louisiana Crude Oil and Impacts on Gulf Killifish ( <i>Fundulus grandis</i> ) <u>Kuhl</u> , <u>Green</u> (49)	Juvenile Tarpon ( <i>Megalops atlanticus</i> ) In Mississippi and Louisiana Coastal Estuaries <u>Franks</u> , <u>Stein</u> , <u>Grammer</u> , <u>Curran</u> , <u>McKenzie</u> (29)	A Multi-Species Occupancy Approach to Assessing the Status of Stream Fishes in the Elk River, Tennessee, Following Operational Changes at Tims Ford Dam <u>Shea</u> , <u>Bettoli</u> , <u>Potoka</u> , <u>Saylor</u> (83)
11:15	The Effects of Oil Exposure on the Blood and Tissues of Spotted Sea Trout ( <i>Cynoscion nebulosus</i> ) and Gulf Killifish ( <i>Fundulus grandis</i> ) from the Gulf of Mexico following the Deepwater Horizon Oil Spill <u>Petrie-Hanson</u> , <u>Hohn</u> , <u>Pruett</u> , <u>Allen</u> , <u>Omar-Ali</u> (70)	The Louisiana/Mississippi Tarpon Project - Update <u>Stein*</u> , <u>Brown-Peterson</u> , <u>Franks</u> , <u>O'Connell</u> (88)	Fish Recruitment is Influenced by River Flows and Floodplain Inundation at the Apalachicola River, Florida <u>Dutterer</u> , <u>Mesing</u> , <u>Cailteux</u> , <u>Allen</u> , <u>Pine</u> (25)
11:30	The Deepwater Horizon Disaster – The Effects of Crude Oil on the Immune Cells of Alligator Gar ( <i>Atractosteus spatula</i> ) <u>Hohn</u> , <u>Omar-Ali</u> , <u>Allen</u> , <u>Petrie-Hanson</u> (40)	Estuarine Residence and Movements of Tripletail ( <i>Lobotes surinamensis</i> ) within the Ogeechee River-Ossabaw Sound Estuary, Georgia <u>Streich*</u> , <u>Peterson</u> (89)	Identifying Species at Threat to Flow Alteration in the Illinois River, Oklahoma <u>Ray</u> , <u>Musselman</u> (74)
11:45	Assessment of Exposure to Cytochrome P4501a1-inducing Pollutants in Pelagic Fishes from the Western North Atlantic and Gulf of Mexico through Analysis of Liver EROD Activity <u>Piercy</u> , <u>Gelsleichter</u> , <u>McCallister</u> , <u>Kerstetter</u> , <u>Hueter</u> (71)	Fine-scale Movements and Home Ranges of Red Snapper ( <i>Lutjanus campechanus</i> ) in the Northern Gulf of Mexico <u>Piraino</u> , <u>Szedlmayer</u> (90)	A 60 Year Old Trout Stream in Peril: A Case History of the Lower Illinois River Trout Stream in Northeast Oklahoma <u>Johnston</u> , <u>Burroughs</u> (44)

# POSTER PRESENTATIONS SCHEDULE

*First author is presenter except where another author is underlined; a \* indicates student presenter; # in parentheses after citation is page # of abstract.*

Poster No.          Poster Title and Authors

## **Fisheries Techniques and Human Dimensions**

- 1            Integrating Research and Extension for the Creation of a Baitfish Industry in Louisiana. Christoferson, J., J. A. Anderson, and C. C. Green (100)
- 2            Applicability of a Handheld Chlorophyll-a Fluorometer in Oxbow Lakes. Andrews, C.\*, L. E. Miranda, and R. Kroger (98)
- 3            Comparing Selectivity and Catch Rates of Gillnets and ‘Noodle’ Angling for Blue Catfish. Adkins, N.\*, B. Murphy, S. McMullin, and V. DiCenzo (97)

## **Freshwater Fisheries Management & Ecology**

- 4            Preliminary Results of Effects of Intercropping on Crayfish Communities in the Sand-Clay Hills Subsection of Mississippi: Pretreatment Data Collection and Analyses. Davis, B., and S. Adams (102)
- 5            Effects of Lake Fertilization on Recreational Hook and Line CPUE for Bluegill (*Lepomis macrochirus*): A Pilot Study. Horton, M., M. Schroeder, and R. Rowell (108)
- 6            Within Stream Population Dynamics of *Etheostoma flabellare*. Edberg, K.\*, S. Vehab, and R. Wood (103)
- 7            Managing the Flood Pulse for Optimal Fisheries Production in the Atchafalaya River Basin, Louisiana. Walker, M. (97)
- 8            Nursery Habitat Function of Small, Low-Order Tributaries: An Often Overlooked Feature of River-Floodplain Ecosystems. Naus, C.\*, R. Adams, L. Driver, T. Inebnit, and L. Lewis (109)
- 9            Implementation of a Before-After Control Impact Study Design to Examine Impacts of Natural Gas Development on the Gulf Mountain Wildlife Management Area, Arkansas. Green, J.\*, L. Stearman, G. Adams, R. Adams, and S. Entrekin (106)
- 10          The Diets of Larval and Juvenile Pallid and Shovelnose Sturgeon (*Scaphirhynchus* spp.) in the Lower Mississippi River. Harrison, A.\*, T. Slack, and J. Killgore (10)

## Life History and Genetics

- 11 Genetic Characterization of the Savannah and Pee Dee River Populations of Robust Redhorse (*Moxostoma robustum*) with Conservation Implications. Darden, T., and C. Tarpey (101)
- 12 Population Recovery of American Shad in the Edisto River, SC: Using Genetics to Characterize Population Dynamics and Stocking Contribution . Cushman, B., C. Tarpey, B. Post, K. Ware, and T. Darden (102)
- 13 Molecular Systematics and Population Subdivision within *Crystallaria asprella*: Recently Rediscovered Populations from Missouri. Wood, R., J. Ray, and K. Edberg (112)
- 14 The Reproductive Biology of the Blurred Lantern Shark (*Etmopterus bigelowi*) from the Northern Gulf of Mexico: A Preliminary Assessment Holland, T.\*, W. Driggers, E. Hoffmayer, and M. Peterson (107)
- 15 Determining the Effect of Major Histocompatibility Genotype on Parasite Load of Common Snook (*Centropomus undecimalis*). Young, J.\*, J. Whittington, and C. Hughes (113)

## Marine Fisheries Management & Ecology

- 16 The Effect of Structural Complexity, Prey Density, and ‘Predator-free’ Space on Prey Survivorship at Created Oyster Reef Mesocosms. Decossas, G.\*, A. Humphries, and M. La Peyre (103)
- 17 Evaluating Marshland Habitat for Juvenile Blue Crabs using GIS Imagery of Micro-scale Landscapes. Gibson, D. (104)
- 18 Analysis of Nekton Intertidal Distribution within Micro-Tidal Saltmarshes Based on Inundation Models. Ennis, B.\*, M. Peterson, and T. Strange (104)
- 19 Recolonization of an Ephemeral Estuarine Pond by Nekton Species. Bader, M.\* (98)
- 20 Evaluation of Habitat Utilization, Recruitment Bottlenecks and Movement of a Coastal Striped Bass Population. Farrae, D., J. Yost, K. Brenkert, T. Darden, and M. Denson (99)
- 21 Testing the Effect of Live Oyster Presence and Structural Diversity on Nekton Abundance and Diversity. Yeldell, N., S. Beck, and M. La Peyre (112)

### **Marine Fisheries Management & Ecology (continued)**

- 22 Composition of Bycatch in Commercial Traps in the Mississippi Blue Crab Fishery. Graham, D., H. Perry, and T. Floyd (105)
- 23 Length Frequency Changes of Longspine Porgy (*Stenotomus caprinus*) from 1987 to 2011: Evidence of Shrimp Trawling Bycatch Impacts? Newman, C.\*, W. Ingram, M. S. Peterson, and F. P. Mickle (110)
- 24 Resident Benthic Fish Populations of Artificial Reefs in the Mississippi Sound: Effects of Habitat Relief and Subregion. Matten, C.\*, and C. Rakocinski (109)
- 25 Comparisons of Biomonitoring Results from Davis Pond and Caernarvon Mississippi River Freshwater Diversions. Olivier, H., B. Bourgeois, P. Conzelmann, R. Draugelis-Dale, and J. Jenkins (111)
- 26 To Remove the Hook or Not: In-Situ Degradation Rates of Marine Fishing Hooks. Coker, J.\*, J. Secord, R. Sherman, and D. Kerstetter (101)

### **Physiology and Toxicology**

- 27 The Effects of Statins, Cholesterol Lowering Pharmaceuticals on Larval Sheepshead Minnow and Zebrafish. Taylor, S.\*, and R. Griffitt (111)
- 28 Effects of Deepwater Horizon Oil Spill Evaluated by Fixed Wavelength Fluorescence (FF) of Polycyclic Aromatic Hydrocarbons (PAH) Metabolites in Fish Bile of Coastal and Epipelagic Species. Leary, A.\*, J. Gelslechter, R. Ford, B. Anderson, M. Drymon, and R. Hueter (108)
- 29 Investigation of the Impacts of the Deepwater Horizon Oil Spill on Coastal Fish Populations in the Northeast Gulf of Mexico Using Measurements of Cytochrome P450 1A1 Activity. Gonzalez de Acevedo, M.\*, J. Gelslechter, C. Walker, and M. Drymon (105)
- 30 Exposure to and Effects of Cytochrome P450 1A1-Inducing Contaminants in Unique Populations of Freshwater Atlantic stingrays (*Dasyatis sabina*) Residing in Florida's St. Johns River. Breakey, A.\*, and J. Gelslechter (99)

# THEME SESSION ABSTRACTS

*Sorted alphabetically by presenter; presenter is underlined.*

## **Crossing the Saltwater Interface: Management of Sturgeons in the Southeast**

Herrington, Karen<sup>1</sup> and Stephania Bolden<sup>2</sup>

<sup>1</sup>Aquatic Species Consultation & Recovery, U.S. Fish and Wildlife Service, Panama City Field Office, 1601 Balboa Ave, Panama City, FL 32405 (Presenter)

<sup>2</sup>Fisheries Biologist, National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, Florida.

Three anadromous sturgeon are federally listed in the southeastern USA. Gulf sturgeon are managed cooperatively by the US Fish and Wildlife Service and the National Marine Fisheries Service (NMFS). Both the Atlantic and shortnose sturgeon are actively managed only by NMFS. Collectively the Services manage sturgeon across the range of eight states and 22 major rivers – a rewarding challenge. Together, we have made great strides toward the recovery of these species through strategic management and partnerships with state, academic, and NGOs. Focusing on the Gulf sturgeon, while also using examples from the East Coast, we will explore the current status of these sturgeon, threats to their continued existence, and challenges of managing across the saltwater interface, and unique approaches used to manage these remarkable species.

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## **Kingston Coal Ash Spill Effects on Emory River and Watts Bar Reservoir Fishery**

Lowery, Donny R.<sup>1</sup>, Tyler F. Baker<sup>2</sup>, Kurt M. Lakin<sup>2</sup>, Jason E. Yarbrough<sup>2</sup>, and John C. Justice<sup>3</sup>

<sup>1</sup> Tennessee Valley Authority, 110 Reservation Road, Muscle Shoals, AL 35660

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<sup>3</sup> Tennessee Valley Authority, 400 W. Summit Hill Drive, Knoxville, TN 37902

On December 22, 2008, the retention dam of an 84-acre ash settling pond at the Tennessee Valley Authority's (TVA) Kingston Steam Plant (KSP) failed. An estimated 5.4 million cubic yards of ash was released into the adjacent Emory River extending as far as 3.5 miles (ERM 6.0) upstream of KSP and approximately 5.8 miles downstream at Tennessee River mile 561.8. A comprehensive assessment of the ecological effects from the ash spill was initiated soon after the incident. Included in the assessments were fish community and sport fish surveys. Data from autumn fish assemblage surveys utilizing experimental gill nets and electrofishing and spring sport fish surveys (electrofishing) conducted prior to the ash spill are compared to post-spill results.

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## **Disasters, Resilience, and Long-term Change: A Decade of Assessing Nekton Community Dynamics in the Pontchartrain Estuary**

O'Connell, Martin T.

Nekton Research Laboratory, University of New Orleans, New Orleans, Louisiana.

Estuaries commonly experience both natural and anthropogenic disasters. These disturbances challenge those aquatic organisms that have evolved to survive harsh and variable estuarine habitats. Unfortunately with sea level rise, climate change, and increased human development of coasts, estuaries around the world will be subjected to more disasters in the coming century. In the last decade, southeastern Louisiana has been beset by hurricanes, levee failures, artificial aquatic diversions, and oil spills. Assessing the response of aquatic organisms to these disasters can provide insights as to how other estuaries will respond to similar disturbances in the future. The Nekton Research Laboratory (NRL) has been sampling in the Pontchartrain Estuary since 2000 and has developed an extensive database of the aquatic estuarine community. When comparing pre-disaster data to post-disaster data on adult nekton species (mostly fishes, shrimp, and crabs), in all cases aquatic communities exhibit short-term resilience to both natural and anthropogenic disasters. That is, there is little evidence of marked changes in community composition, species extirpation, or decreases in populations. While it is encouraging that adult estuarine organisms appear to possess adaptations that allow them to avoid direct mortality from these disasters, this short-term resiliency may instill a false sense that these communities are ecological durable. For example, when current NRL data were compared with historical data from the 1950s and 1970s, there were significant declines in key species such as Atlantic croaker (*Micropogonias undulatus*), bull sharks (*Carcharhinus leucas*), and alligator gar (*Atractosteus spatula*). Such changes could only be detected by examining and comparing long-term data sets. For resource managers in other estuaries, two lessons should be learned from the experiences of southeastern Louisiana in the last decade. First, beware the apparent resiliency of your organisms and, second, begin or continue long-term monitoring to properly determine real changes in your estuary.

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# ORAL PRESENTATION ABSTRACTS

*Sorted alphabetically by presenter; presenter is underlined; a \* indicates student presenter.*

## **<sup>1</sup>H-NMR Characterization of the Metabolic Response of Juvenile Paddlefish (*Polyodon spathula*) to Acute Hypoxia**

Aboagye, Daniel\* and Peter J. Allen

Department of Wildlife, Fisheries and Aquaculture, Mississippi State University. Box 9690, Mississippi State, MS 39762

One of the fundamental ways that fishes respond to stressors (i.e., handling, low dissolved oxygen, extreme temperatures and toxins) is by metabolic changes which facilitate the fight or flight response and combat disease. Metabolomics is the study of the unique metabolite profiles that specific cellular processes leave behind, and therefore is a tool that can be used to understand the physiological response of fish to stress. Metabolomics is a relatively new scientific field and one of its aims is to identify novel biomarker profiles that are characteristic of specific stressors. Using nuclear magnetic resonance (NMR) spectroscopy, an instantaneous profile of the low molecular weight metabolites is generated. The profile generated is then examined for patterns and analyzed using multivariate statistical techniques to reveal the subset of metabolites that change most significantly, potentially identifying diagnostic biomarker profiles. For fishes, this technique holds great potential for understanding the effects of stressors and understanding normal processes in healthy individuals. Currently, we are examining the tolerance and physiological response of paddlefish to acute hypoxia. Paddlefish, like many fishes in both freshwater and seawater habitats, are experiencing a greater contact with hypoxic conditions. To test for acute hypoxia tolerance, 6 juvenile paddlefish (60-70 cm) were subjected to normoxia (100% air saturation; 8.42 mg/l) for 30 minutes at 24°C. A second group of fish (n=6) was subjected to hypoxia (30% air saturation; 2.53 mg/l) for 30 minutes at 24°C and then blood samples were collected from each treatment for metabolomic analyses. Results will be presented in terms of physiological processes impacted and corresponding recommendations made for resource managers.

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## **Movements, Habitat Use, and Conservation of Alligator Gar (*Atractosteus spatula*) in a River-Floodplain Ecosystem**

Adams, Reid<sup>1</sup>, Edward R. Kluender<sup>1</sup>, and Lindsey Lewis<sup>2</sup>

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<sup>2</sup>United States Fish and Wildlife Service, Arkansas Field Office, 110 South Amity Rd., Suite 300, Conway, AR 72032

The mid-sized Fourche LaFave River of Arkansas confluences with the Arkansas River approximately 32 rkm upstream of Little Rock. The Fourche LaFave has one dam, a relatively intact, unleveed floodplain, and no recent navigation improvements. Periodic flooding occurs during winter and spring. This river holds a population of alligator gar, the continued success of which is probably due to connectivity with floodplain spawning locations and other habitats. During four expeditions over two winters, 32 adult

alligator gar were captured and tagged with radiotransmitters. Fish were tracked frequently from January 2009 through August 2010. Analyses reflect seasonality in use of main channel, tributary, oxbow, and inundated floodplain macrohabitats. Prior to May 2009, a mean 78.9% of individuals' locations were in the main channel of the Fourche LaFave versus other macrohabitats. During the 2009 spawning period (May-June), a mean 86.1% of individuals' locations were in floodplain tributaries. Overwintering aggregations have been documented in one particular area of the study reach since 2007, with recaptures indicating site affinity. When using the main river channel, adult gar show strong selection for the lowest velocity, shallowest depth, and in-water structure characteristic of the channel borders. An intact riparian buffer provides consistent recruitment of wood from small shrubs to large overstory hardwoods. Alligator gar benefit from the spatial heterogeneity and connectivity of habitats in the Fourche LaFave River ecosystem. Fish use tributaries and associated flooded areas for reproduction, and use the main channel during other times of the year, particularly during winter and prior to spawning. High availability of structure and shade from the riparian zone are important features at the microscale. This study has helped define the spawning season and identified the reproductive value of tributaries. Conservation efforts include modification of current fishing regulations to protect spawning individuals and efforts to maintain connectivity with tributaries.

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### **Evaluation of Gonadal Steroid Chemiluminescent Immunoassays (CLIA) for Non-Lethal Characterization of Reproductive Status for Elasmobranchs**

Anderson, Brenda\*<sup>1</sup> Jim Gelsleichter<sup>1</sup>, Bryan Frazier<sup>2</sup>, and Carolyn Belcher<sup>3</sup>

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<sup>3</sup>Georgia Department of Natural Resources, One Conservation Way, Brunswick, GA 31520

Information regarding the reproductive biology of commercially exploited sharks is vital to effective fisheries management practices. Characterization of shark reproductive cycles has historically involved culling many individuals to examine gross morphology to assign reproductive status. This practice, while needed for initial maturity assessments, can be counterproductive to the conservation of these populations. Nonlethal alternatives for determining reproductive status include using blood samples to determine sex steroid concentrations, typically using radioimmunoassays (RIA). However, RIAs are often problematic for many researchers because of the use of radioactive isotopes, the need for large sample volumes, and time and equipment needed for pre-extraction are intensive. Commercially available chemiluminescent immunoassays (CLIA) are routinely used for human plasma steroid evaluation, but have not been previously examined for use with shark plasma. CLIAs use small sample volumes, equipment is found readily in most laboratories, and pre-extraction is typically not necessary. In this study, we validated the use of commercially available CLIAs for the gonadal steroids 17 $\beta$ -estradiol and testosterone for examining reproductive endocrinology of elasmobranchs, focusing on the bonnethead shark (*Sphyrna tiburo*) and the blacknose shark (*Carcharhinus acronotus*). Plasma estradiol and testosterone concentrations measured using CLIA were compared to morphological/histological assessments of reproductive status from a subset of culled specimens in both species as well as to previous measurements of plasma steroid concentrations determined via RIA in *S. tiburo*. Measurements of plasma steroids using CLIA were generally higher than those previously measured using RIA in *S. tiburo*. However, seasonal changes in CLIA-determined plasma steroid concentrations were consistent with those determined using RIA and with morphological/histological assessments of reproductive status for *S. tiburo* and *C. acronotus*. Therefore, CLIA appears to be a reliable method for determining reproductive status in these species.

## **Thermal Tolerance of Age-0 Gulf of Mexico Striped Bass (*Morone saxatilis*)**

Anderson, Corey R.\* and Eric Saillant

Department of Coastal Sciences, The University of Southern Mississippi, Ocean Springs, MS

Once abundant in Mississippi coastal waters, striped bass went nearly extinct in the region by the early 1960s. To date there is no evidence for natural reproduction in Mississippi rivers and restoration of the species requires support from hatchery stocking. Water temperature in natural habitats has been identified as a potential limiting factor to reintroduction of the species in Mississippi, in part based on thermal tolerance data for Atlantic populations of striped bass. To determine upper thermal limits of Gulf striped bass, thermal tolerance challenges were applied in triplicate to offspring mixtures from mating sets each involving 1-2 dams crossed with 2-3 sires. Challenge protocols were based on the Critical Thermal Maximum (CTM) method and were applied on yolk sac larvae (48h post hatching) or on phase I (2.5 inch) release-sized juveniles. The effect of temperature on larval yolk resorption time was characterized at a series of elevated temperatures. Parental reconstruction based on microsatellite markers allowed evaluating the role of genetic factors by comparing the tolerance of offspring from different sires tested in the same challenge experiments. Challenge results revealed a positive ontogenetic shift in thermal tolerance from the larval (CTM  $25.4^{\circ}\text{C}\pm 1.2^{\circ}\text{C}$ ) to the phase I juvenile stage (CTM  $35.8^{\circ}\text{C}\pm 0.7^{\circ}\text{C}$ ). Available water temperature data indicated that upper thermal tolerance of age-0 Gulf striped bass is likely not exceeded in culture ponds or the lower Pearl and Pascagoula Rivers. Exposure to elevated temperature ( $22.1^{\circ}\text{C}$  to  $24.0^{\circ}\text{C}$ ) led to a significant reduction of the larval yolk resorption time resulting in a substantially shorter time-window when larvae can initiate exogenous feeding in comparison to groups maintained at a control temperature of  $19^{\circ}\text{C}$ . Thermal tolerance did not vary significantly among offspring from the 11 tested sires suggesting a moderate role of genetic factors on upper thermal tolerance of 48h old striped bass larvae.

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## **Anisakid Nematodes from the Mid-water Fish Families Myctophidae and Sternoptychidae in the Western Gulf of Mexico**

Andres, Michael J.\* and Robin M. Overstreet

Gulf Coast Research Laboratory, The University of Southern Mississippi, 703 East Beach Dr., Ocean Springs, MS 39564

Mid-water fishes of the families Myctophidae and Sternoptychidae indicate an important link in the mesopelagic foodweb as shown by some parasitic nematodes. These fishes are hosts for several nematode species in the family Anisakidae. Anisakids in intermediate crustacean host can infect odontocetes. However, mid-water fishes feed on the crustaceans and serve as paratenic hosts, hosts in which further development does not occur. Eight species of myctophids in two genera (*Diaphus* and *Lobianchia*) and four species of sternoptychids in three genera (*Argyropelecus*, *Mauroliticus*, and *Polyipnus*) were collected by bottom trawl from 12 locations in the western Gulf of Mexico onboard the NOAA R/V *Pisces* from a depth range of 65 to 468 m. The myctophid *L. gemellari* was the most common fish collected (7 of 12 locations, n~65), followed by *D. rafinesquii* (5 of 12 locations, n=30). *Polyipnus clarus* was the most common sternoptychid (4 of 12 locations, n~70). Following morphological examination for anisakid nematodes and subsequent sequencing of the ribosomal DNA internal transcribed spacer (ITS) ITS-1, 5.8S, and ITS-2 regions, we found members of three anisakid genera, in two functional groups: those that mature in a cetacean (four species of *Anisakis*), and those that mature in fishes (one species of *Hysterothylacium* and one species of *Raphidascaris*). Anisakids had a higher prevalence of infection in

myctophids (44.4%, n=126) versus sternoptychids (17.3%, n=52) with *D. splendidus* (83.3%, n=9) and *L. gemellari* (59.7%, n=56) exhibiting the two highest prevalences. Our results suggest that the myctophids may be a more important paratenic host in mid-water communities than sternoptychids located along the shelf and slope of the western Gulf of Mexico. Future work will attempt to address anisakid patterns in the Eastern gulf and dietary patterns of these mid-water fishes.

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## **Physiological Responses of Juvenile Channel Catfish to Elevated Temperature Environments**

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Channel catfish (*Ictalurus punctatus*) experience a variety of environmental temperature ranges as a result of a broad natural distribution throughout the United States, southern Canada, and northern Mexico. Considered a flagship aquaculture species, many are raised in farm ponds in the southeastern United States and are subjected to seasonal temperatures that may span from 0 -36°C. Many studies involving channel catfish have focused on the influence of winter temperatures on feed consumption and growth, however few studies have been conducted to determine the influence of high summer temperatures on similar growth and feeding variables. High summer temperatures are expected to be an increasing concern with predicted temperature increases as a result of climate change. Therefore, two studies were conducted to examine the effects of high summer temperatures. The first study examined the effects of three daily cycling thermal regimes characteristic of culture and natural environments (23-27°C, 27-31°C, and 31-35°C) on food consumption rate (FCR), food conversion efficiency (FCE), specific growth rate (SGR), overall growth, and activity in fingerling channel catfish during an 8-week period. A second study measured active and resting metabolic rates at constant temperatures (27, 31, and 35°C). For the first study, FCR, FCE, SGR, and overall growth were greater in the 27-31°C treatment compared to the cooler and warmer temperature treatments, while activity levels were highest in the 31-35°C treatment. In the second study, both resting and active metabolic rates were greater in the 35°C treatment. These data indicate that at high temperatures, growth decreases largely due to decreases in food consumption, and increases in activity and metabolic rates. The best temperatures for growth were actually at 27-31°C, which are more typical of current summer conditions. Therefore, increases in summer temperatures, such as from climate change, present challenges to the culture and management of channel catfish.

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## **A Comparison of Mobile Fauna Associated with Constructed Oyster Reefs and Natural Oyster Reefs in a Louisiana Estuary**

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Many finfish, mollusks, and crustaceans rely on the eastern oyster (*Crassostrea virginica*) and its reef-building ability for an array of ecological services. Unfortunately, coastal wetland erosion is a major threat to this essential habitat. The Terrebonne Bay Shore Protection Demonstration Project (TE-45), sponsored jointly by the Louisiana Coastal Authority (LCA) and the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA), is one initiative created to reduce the erosion rate of

shorelines while also supporting oyster reef establishment. In this project, three constructed structure types, Triton™ Gabion mats, A-Jacks®, and Reefblks™, were placed in three locations within Terrebonne Bay, Louisiana. Preliminary results after four years of this eight year project indicate that all three structure types are reducing shoreline erosion rates and establishing some degree of oyster reef development through natural recruitment. It is now important to begin assessing the ecological services of the constructed reef habitats, and specifically in this project to compare fish and crustacean diversity around the structures to nearby natural, intertidal oyster reef habitats. Gill nets and crab traps were used to sample fish and crustacean populations at the three structure types and three natural, intertidal oyster reefs. Capture data was used to determine species richness, species diversity, and overall abundance of each species captured. Repeated Measures Analysis of Variance determined there was no significant difference in fish species richness, overall fish abundance, or fish species diversity between the structure types and natural reefs. There was also no significant difference in blue crab abundance between the structure types and natural reefs. Preliminary results suggest that constructed reefs, irrespective of structure type, are providing similar suitable habitats as natural oyster reefs for associated mobile fish and crustacean communities.

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### **Interannual Variability in Spatial and Temporal Spawning Distributions of White Bass**

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Spawning behaviors and population dynamics of white bass (*Morone chrysops*) in the Arkansas River have not been documented. An assessment of the population is needed to provide a scientific basis for management. We sampled white bass during their spawning season in 2010 and 2011. The 10 primary tributaries found within Pool 4 of the Arkansas River were sampled both years. The pool was divided into three segments (upper, middle, lower). Each segment had three tributaries. Each tributary was sampled every third week during the spawning season to determine spatial variability. One tributary (Caney Bayou), known to be occupied by white bass during the spawning season, was sampled weekly to document temporal variability of the spawn. White bass were collected by boat-mounted electrofishing. Mean (SE) catch per unit effort (CPUE) was 5.5 (0.9) fish/h across the pool. Caney Bayou was the most utilized tributary, but other tributaries were also utilized during the spawning season. Spawning distributions were significantly different between years. Environmental conditions influenced which tributaries were utilized, and when white bass spawned. Water temperature appeared to influence spawning effort. Once water temperature reached 13°C, white bass CPUE in and near tributaries increased. Surface flow was not significantly related to CPUE. Overall gender ratio was 1 ♂:0.66 ♀. Two indices of population size structure were calculated. The PSD was 82.7 and the PSD<sub>p</sub> was 49.8. Average relative weight across all cohorts was 98 (0.66). The average TL for age-1 white bass was 208 (2.18) mm, and for age-3 white bass was 353 (2.15) mm. The oldest white bass collected was a 7-year-old. Total annual mortality was 54% using a catch curve regression. As habitat alterations occur and flow regimes evolve, an understanding of the critical habitats and conditions supporting favorable spawning is imperative.

## **Reproduction of the Blacktip Shark in the Gulf of Mexico**

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Reproductive parameters were estimated for the blacktip shark (*Carcharhinus limbatus*) in the U.S. Gulf of Mexico. Samples were collected from commercial longline vessels by fisheries observers and by a fishery-independent gillnet survey from 2006 -2011. Measurements of the oviducal gland, ovary, follicle diameter, and uterus were used to determine the size at maturity, seasonality, and periodicity of reproduction for female blacktip sharks. Testis weight, epididymis width, and clasper calcification were examined for males to estimate the size at maturity and seasonality of reproduction. Age at maturity will be also determined for female and male blacktip sharks for the 2012 Gulf of Mexico blacktip shark stock assessment. This study represents the first complete reproduction study for this species in the Gulf of Mexico.

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## **The Effectiveness of Different Fish Attractors in North Carolina Reservoirs**

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Fish attractors have been widely used by fisheries managers to enhance fish habitat and increase the concentration of fish at known locations. However, fish attractors are often deployed without any validation for how well they meet management goals. The objective of this project was to evaluate the effectiveness of four different types of fish attractors to concentrate fish in North Carolina Piedmont reservoirs. ANOVA using a complete block design with repeated measurements was used to compare fish abundance from three types of artificial attractors, one natural attractor, and a control area devoid of structure. Attractors encompassed a volume of approximately 3.375 m<sup>3</sup>, but the materials and general designs varied from a structure constructed from PVC pipes and plastic barrels, a structure built from PVC pipes and corrugated plastic pipes, a commercially available PVC product called the Porcupine, and a bundle of three evergreen trees. Fish abundance at unmarked attractors was evaluated once per season during a three year period using instantaneous counts from images taken by a dual-frequency identification sonar device. We found that all attractors held significantly ( $\alpha = 0.05$ ) more fish than the control area and that significantly more fish concentrated around the corrugated pipe structure as compared to the other structures. A year-by-year analyses was also performed. During years one and two, the only significant difference was between fish attractors and the control area. In year three, the corrugated pipe structure held significantly more fish than the barrel and porcupine structure, which held significant more fish than the tree structure, and all structures held more fish than the control area. This study validates the effectiveness of fish attractors to concentrate fish, highlights the benefits of artificial structures as compared to natural structure, and will help fisheries managers make informed decisions when attempting to enhance angling opportunities.

## **The Effects of Oyster Harvest on Resident Oyster Reef Communities and Reef Structure in Coastal Louisiana**

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Oyster harvest substantially disturbs oyster reef habitat in the northern Gulf of Mexico. How oyster dredging alters reef substrate and affects resident fauna has not been thoroughly examined on the sub-tidal oyster reefs of Louisiana. Reef structure and resident communities were compared on unharvested and harvested reefs during the spring, summer, and fall of 2010. Unharvested reefs had higher amounts of oyster clusters, solid reef substrate, and more large, market-size oysters while harvested reefs had higher amounts of loose shell, mixed shell/mud substrate, and elevated chlorophyll-a levels. Total organism density did not differ with harvest status and dominant species were similar, although greater invertebrate species diversity was found at harvested sites. Several species were found to associate with live oysters (*Hypsoblennius ionthas* and *Gobiosox strumosus*) and chlorophyll-a levels (*Rhithropanopeus harrisi* and *Alpheus* sp.), indicating how live oysters can influence reef microhabitat preferences by providing or removing food sources. Condition (weight:length ratio) of *Gobiosoma bosc* was greater at unharvested sites, but other fish species showed no difference. Large interstitial spaces associated with oyster clusters appear to enable organisms to reach larger sizes at unharvested reefs and promote retention of age = 0 *G. bosc*. Stable isotope values ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ) of dominant species and basal food sources were used to compare food web characteristics between sites. Marsh source contribution and trophic levels of dominant species were all elevated at harvested sites. Trophic order did not differ with the exception of zooplankton (trophic position increased substantially at harvested sites). Oyster harvest appears to decrease the number of live oysters and fragment solid reef area, resulting in elevated phytoplankton productivity, decreased benthopelagic coupling, and increased habitat heterogeneity. A larger forage base in the water column and mixed shell/mud substrate could account for increased invertebrate diversity and trophic position elevation on harvested oyster reefs.

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## **Influences of Drought on Shortnose Sturgeon (*Acipenser brevirostrum*) in the Altamaha River, Georgia**

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Based on a recent mark-recapture estimate, the Altamaha River appears to host the largest extant population of the endangered shortnose sturgeon located south of the Mid-Atlantic Bight. Like other southern systems, the Altamaha River has recently experienced several severe, prolonged droughts. Given hypothesized increases in water withdrawal and potentially, drought frequency, information relating freshwater inputs and the population dynamics of shortnose sturgeon will be critical in protecting the Altamaha River population. The objectives of this study were to assess the effects of reduced flow on 1) age-1 recruitment, 2) habitat quality, and 3) apparent annual survival. From May-August, 2004-2010, we sampled shortnose sturgeon in the Altamaha River using anchored monofilament gill and trammel nets. Recruitment was estimated using the Huggins closed-capture model to calculate age-1 abundance. We used linear regression to relate age-1 abundance to variations in annual flow regimes. To quantify the

influences of flow on temperature and dissolved oxygen, we employed a hierarchical linear modeling approach. Following this analysis, we assessed the influences of drought-induced thermal stress on apparent survival through the Cormack-Jolly-Seber open-population model. Over the seven years of our study, we captured 1582 shortnose sturgeon (143 recaptures). Estimates of age-1 recruitment varied from 30 individuals in 2008 to 2,976 in 2004. Modeling results showed that recruitment was positively correlated with high flows during December-May during the young-of-year period. Flow and temperature were negatively related, with each 25 cms decrease in flow causing a 0.09°C increase in temperature. Sustained periods of high temperature during the summer months were associated with a ~50% decrease in juvenile survival, suggesting that low flows may adversely affect recruitment of juveniles to adulthood. Our results suggest that future reductions in flow, whether caused by water withdrawal or climatic shifts, could jeopardize the long-term viability of the Altamaha River shortnose sturgeon population.

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### **Angler Effort And Harvest Characteristics Relevant To Alligator Gar Before And After A One Fish-Per-Day Creel Limit At Annual Bow-Fishing Tournaments On The Trinity River, Texas**

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Alligator gar (*Atractosteus spatula*) is the largest freshwater fish in Texas, yet has received little attention from fisheries managers until recently. The Trinity River, Texas, may contain the best remaining population of large (>1,800 mm) alligator gar in the world. Due to the suspected vulnerability of alligator gar populations in Texas, a one-fish per day state-wide bag limit was implemented 1 September 2009. Bowfishing is believed to represent a substantial portion of the recreational harvest of alligator gar, but little is known about bowfishing's impact on fish populations. To better understand pressure and harvest rates, we attended three bowfishing tournaments on the Trinity River each year during 2009, 2010, and 2011. Harvest ranged from between 2 and 30 alligator gar per tournament, with 641 anglers harvesting a total of 134 fish for all years. Mean ( $\pm$ SD) harvest rate (fish/h) of alligator gar for tournament participants was similar between years at  $0.023 \pm 0.017$  in 2009,  $0.018 \pm 0.015$  in 2010, and  $0.016 \pm 0.006$  in 2011 ( $P = 0.79$ ). Mean length of alligator gar was  $1082 \pm 298$  mm,  $1177 \pm 454$ , and  $1292 \pm 379$  mm in 2009, 2010 and 2011, respectively, and was not significantly different ( $P = 0.054$ ) between years.

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### **Southeast Native Black Bass Keystone Initiative: Implementing Watershed-Scale Actions to Restore Guadalupe Bass (*Micropterus treculii*) in the Edwards Plateau Ecoregion of Texas**

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The southeastern US harbors a diversity of aquatic species and habitats unparalleled in North America, including more than 500 species endemic to the region. Of the nine described species of black bass (genus *Micropterus*), six are endemic to the southeastern US: Guadalupe bass, shoal bass, redeye bass, Florida bass, Alabama spotted bass, and Suwannee bass. Additionally, many undescribed forms also exist in the region, with most in need of conservation measures to prevent them from becoming imperiled. Furthermore, of the black bass species with the greatest conservation needs, all are endemic to the southeastern US and found in relatively small ranges. In an effort to focus and coordinate actions to conserve these species, the Southeast Aquatic Resources Partnership (SARP) has partnered with the National Fish and Wildlife Foundation (NFWF) to develop and implement a new Keystone Initiative. The initial pilot project of the Keystone Initiative, which is jointly funded by SARP and NFWF, is focused on the restoration of Guadalupe bass (*Micropterus treculii*) in streams of the Edwards Plateau Ecoregion of Texas. Also known as the Texas Hill Country, the region is characterized by a karst landscape intersected by numerous clear, spring-fed streams that support 15 species of endemic fishes. Through the Keystone Initiative, conservation partners are working to address factors that have led to declines in populations of Guadalupe bass and other native fishes in the region including flow alteration, loss of watershed connectivity, physical habitat degradation, and competition and hybridization with introduced, non-native forms (e.g., smallmouth bass *Micropterus dolomieu*). This presentation will highlight progress of the initial pilot project, and discuss efforts that are being made to develop a substantial and long-term source of funding to implement the Keystone Initiative throughout the southeastern US.

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### **An Assessment of U.S. Estuarine Habitat in Support of the National Fish Habitat Partnership**

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The first national coastal assessment was recently completed to support the National Fish Habitat Partnership's (NFHP) science-based habitat conservation and management goals. This assessment, part of a larger effort to evaluate the condition of aquatic fish habitats across the United States, represents an unprecedented nationwide effort to describe the status and threats to estuarine habitats in the continental United States. This study synthesizes existing national datasets on anthropogenic disturbance and natural drivers affecting estuarine ecosystems, and includes indicators of land cover, hydrology, eutrophication, and water quality. A quantitative assessment of habitat components was nested into a multiscale spatial framework for the continental United States based on NOAA's Coastal Assessment Framework (CAF). A relative disturbance index was developed for each of the four indicators in each estuary spatial unit within the CAF. Composite habitat condition scores were then calculated for each unit by combining the four individual indices to determine the total current risk of habitat degradation. Results of this analysis allow regional and subregional comparisons to be made, classify relatively healthy and degraded habitats, and identify major sources of habitat degradation in U.S. estuarine habitats. Data limitations prevented some sources of habitat indicator data from being included in this iteration of the national habitat assessment; information on sedimentation, shoreline armoring, fish tissue contaminants, and biogenic habitat status will be incorporated into future assessment efforts. A primary next step for the NFHP coastal assessment is testing how habitat indicator scores predict fish composition and abundance metrics. Additional analyses at the regional level will take advantage of datasets not available at the national scale and further refine habitat condition scores. These refined analyses, using regionally-specific data but nationally-consistent methodology, will produce a second-generation coastal assessment that provides improved information to NFHP to support fish habitat conservation and management efforts.

## **Induced Spawning of Wild Caught Spotted Gar (*Lepisosteus oculatus*) and Effects of Injecting Broodstock with Thyroid Hormones on Egg Hatch Rate, Larval Growth and Development, and Survival**

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Induced spawning of fish in laboratories can provide larvae for experiments, wild stock augmentation, or production of food fish. We have developed a protocol for spawning wild-caught spotted gar (*Lepisosteus oculatus*) in laboratories and have used that protocol to determine if thyroid hormones injected into broodstock result in more robust larvae. Injection of 0.5 mL of gonadotropic releasing hormone (GnRH) per kg of fish resulted in spawning activity within 48 hours in 14 out of 20 attempts. In addition to GnRH, broodstock were also injected with thyroid stimulating hormone (TSH), thyroxine (T4), or triiodothyronine (T3) using dimethyl sulfoxide (DMSO) as a vehicle. A control group received only GnRH and DMSO. Spawning trials occurred in a 2 m diameter aerated static system containing artificial spawning substrate. Eggs were removed from each tank within 72 hrs after spawning and measured (mm). T4 levels (ng/egg  $\pm$  SE) for each following treatment groups were: Control=  $0.91 \pm 0.235$ , TSH=  $1.09 \pm 0.165$ , T4=  $5.97 \pm 1.78$ , and T3=  $5.06 \pm 0.345$  in the eggs and Control=  $0.73 \pm 0.075$ , TSH=  $0.97 \pm 0.095$ , T4=  $1.12 \pm 0.289$ , and T3=  $0.71 \pm 0.055$  in 0 days post hatch (DPH) larvae. T3 levels (ng/ larva  $\pm$  SE) for each following treatment groups were: Control=  $0.51 \pm 0.039$ , TSH=  $0.80 \pm 0.131$ , T4=  $1.08 \pm 0.480$ , and T3=  $4.18 \pm 1.541$  in the eggs and Control=  $0.82 \pm 0.119$ , TSH=  $1.02 \pm 0.411$ , T4=  $4.97 \pm 1.542$ , and T3=  $1.14 \pm 0.321$  in 0 DPH larvae. Thyroid hormones did not affect egg size, hatch rate, larval size, larval development or larval survival compared to control. GnRH can be used to induce spawning of wild-caught spotted gar. Although thyroid hormones injected into broodstock were absorbed by developing embryos, there was no effect on egg or larval size.

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## **Partnering with Angler Groups to Remove Excess Grass Carp from Texas Reservoirs**

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We partnered with organized angling groups in an attempt to remove excess grass carp from two Texas reservoirs. Triploid grass carp were holdovers from previously successful efforts to control invasive hydrilla. A portion of both grass carp populations was considered surplus for continued hydrilla control, and was negatively impacting native aquatic plant communities and our fish habitat restoration efforts. Due to difficulties associated with grass carp capture by traditional fisheries sampling gear, we collaborated with the Texas Bowfishing Association to host tournaments at Lake Jacksonville and Lake Conroe, and the Texas B.A.S.S. Federation Nation to host a rod-and-reel tournament at the latter. Bowfishing alone did not reach our goals at Lake Jacksonville (only 10 grass carp were collected), so we added the rod-and-reel component at Lake Conroe to compare relative angler capture efficiency for both collection methods. Bow anglers (N = 59) were more successful on Lake Conroe, removing 221 grass carp over 12 hours (CPUE = 0.31 f/hr). Rod-and-reel anglers (N = 93) were slightly more efficient at removing grass carp (N = 287; CPUE = 0.39 f/hr) compared to bow anglers, and appear to be a viable option for grass-carp removal, especially at reservoirs not conducive to bow angling. Although fish-

removal quotas were not met with either method, collaborative efforts led to improved working relationships between agency and constituent partners.

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## **An Evaluation of Largemouth Bass Populations in Three Georgia Reservoirs: Is Exploitation Still a Concern?**

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We evaluated the relative abundance, growth, mortality and exploitation of largemouth bass in three Georgia reservoirs. One-hundred largemouth bass were tagged with Hallprint dart tags during the spring of 2010 in both Lake Lindsay Grace and Hugh Gillis Public Fishing Area and in the spring of 2011 in Dodge County Public Fishing Area. Monetary rewards were either \$5 or \$105 per fish. An age sample was collected during tagging and total annual mortality ( $a$ ) was estimated from catch catch-curve analysis and ranged from 38% to 55%. Tag returns for the high reward tags (\$105) ranged from 30 to 47%. Tag returns on the low reward tags (\$5) ranged from 12% to 25%. Using the high reward tags (\$105), annual exploitation ( $u$ ) was estimated at 10% on Dodge County Public Fishing Area, 27% Hugh Gillis Public Fishing Area and 30% on Lake Lindsay Grace. Leaving estimates of Total Natural Mortality ( $v$ ) at 8% on Lake Lindsay Grace, 15% on Hugh Gillis Public Fishing Area and 45% on Dodge County Public Fishing Area. Despite high rates of voluntary catch release documented across much of North America's black bass fisheries; it does appear that exploitation is still a concern in South Georgia for two of three reservoirs examined. The population parameters obtained in this study will be used in a model to simulate potential length limit changes for each of the three reservoirs.

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## **Effects of Environmental Hypoxia on Population Characteristics of Red Swamp Crayfish (*Procambarus clarkia*) in the Atchafalaya River Basin**

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Crayfish harvested from the Atchafalaya River Basin (ARB) represent the majority of Louisiana wild crayfish landings. However, ARB sedimentation and anthropogenic activities have altered the historic river-floodplain connection, causing reduced water circulation and flow patterns that prompt the formation of hypoxic conditions (dissolved oxygen  $\leq 2$  mg/L) during the annual flood pulse. Although red swamp crayfish (*Procambarus clarkia*) are able to tolerate sub-optimal oxygen conditions, physiological stress caused by chronic hypoxia exposure may lead to detrimental population effects such as reduced survival, growth, and fecundity. We examined *P. clarkii* and physicochemistry from 16 sites in the lower ARB biweekly during floodplain inundation (March – July). Temporally persistent hypoxia varied greatly among sample sites. Sites were classified as hypoxic if hypoxia was recorded on at least

four sample dates. *P. clarkii* were sampled using pillow design traps baited with a commercial crayfish attractant and allowed to fish for 24 hours. Captured crayfish were enumerated, sexed, measured (carapace length), and form determined (males). *P. clarkii* catch per unit effort was significantly higher at normoxic sites (27.19) than hypoxic sites (16.78) ( $P = 0.0132$ ). However, dissolved oxygen displayed a negative relationship with carapace length ( $P < 0.0001$ ) and hypoxic sites had significantly larger individuals ( $\bar{x} = 43.06$  mm) than normoxic sites ( $\bar{x} = 41.74$  mm) ( $P < 0.0001$ ). This phenomenon may be an artifact of density dependant growth in normoxic areas and/or reduced survivorship and movement of smaller individuals in chronically hypoxic habitats.

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## Sequence Validation of Known Microsatellites of *Scaphirhynchus* Sturgeon Species from the Lower Mississippi River Basin

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To date there have been many molecular studies on species of *Scaphirhynchus*. These studies have utilized allozymes, as well as nuclear and mitochondrial DNA in an attempt to identify species, populations, and quantify effects of hybridization. Further complicating the issue is the hypothesized slow rate of molecular evolution in sturgeon, which is supported by the fact that none of these data types has proven to be of utility in the diagnoses of *Scaphirhynchus* species. The imperiled status of these species and lack of robust diagnostic markers necessitates a continued effort. Many microsatellite loci have been developed for *Scaphirhynchus* and have been used with great success to genotype individuals. Recent research however has questioned the validity of microsatellite data due to various mutational mechanisms. These mutations can lead to genotyping errors as observed allelic polymorphism could be mistaken for species or population-level variation. Thus alleles that are considered homologous may in fact be homoplastic. In this study, we sequenced alleles for microsatellites from 10 individuals of both *S. albus* and *S. platyrhynchus* as well as six individuals of *S. suttkusi*, which served as the outgroup. The sequence data were examined for microsatellite verification as well as for potential species specific nucleotide characters. Sequences from each locus were independently explored and a concatenated matrix of aligned data was also investigated. Validation of previously published microsatellite motifs and number of repeats will be reported. Genotyping errors will be calculated for implementation in future genotyping of new individuals of *Scaphirhynchus* for these loci.

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## Spatial and Temporal Dissolved Oxygen Dynamics and Evaluation of Fish Habitat Loss Due to Hypoxia in *Hydrilla*

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The fast growth and dense structure of some macrophyte species can alter water chemistry and impact fish habitat utilization. *Hydrilla verticillata* is an invasive aquatic weed which exhibits rapid, dense growth and may contribute to low dissolved oxygen (hypoxia,  $DO < 2.0 \text{ mgL}^{-1}$ ) levels during warm summer months. The management of *Hydrilla* is difficult and costly, and current block-treatment methods result in unfavorable fish habitat, such as large areas devoid of vegetation. An alternate method recently proposed is to remove *Hydrilla* in channels through dense beds, increasing 'edge' habitat to promote higher water circulation and thus increasing dissolved oxygen levels. We evaluated the spatial and temporal dynamics of dissolved oxygen in three habitats: open-water, edge, and dense *Hydrilla* beds, and assessed the percentage of habitat loss due to hypoxia. Our results showed there are significant interactions influencing DO between habitat and time of day, and habitat and month. Both, dense and edge habitats saw 100% habitat loss at the peak of *Hydrilla* growth and water temperature in September, suggesting that increasing edge habitat may not greatly influence DO concentrations during summer.

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### **Identifying Bottlenecks to Red Drum Recruitment in Ashley River South Carolina Using Hatchery Fish and Genetic Identification**

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The factors that affect red drum recruitment success in coastal estuaries are difficult for fisheries managers to identify. This project was designed to examine potential bottlenecks to recruitment in a historically underperforming tributary of the Charleston Harbor estuary, the Ashley River. The utilization of stocked hatchery fish of known genetic parentage allows managers a tool to evaluate comparative contribution to year class over temporal and spatial scales that is not possible with traditional tagging methods. Genetically unique larval (2 dph), post-settlement juvenile (20-50 mm TL), and advanced juvenile (150-250 mm TL) red drum were produced from photo-thermally conditioned wild broodstock and released in the Ashley River between 2004 and 2010. Tissue samples of age 1 red drum were collected each year using trammel net and electrofishing gear in fisheries independent sampling efforts from over 100 randomly selected sample sites in the four strata (Charleston Harbor and the Ashley, Cooper, and Wando Rivers) that comprise the Charleston Harbor estuary system. Hatchery released red drum were identified from samples using molecular genetic techniques and recruitment success was evaluated by the relative contribution of each release group within each year class while relative year class strength was evaluated using the catch-per-unit-effort index of juvenile abundance. The CPUE index is a long-term dataset that has been conducted by the SCDNR since 1991 allowing for comparison of red drum recruitment success across strata in both stocked and unstocked years. In addition, this research provided information of the growth, movement, and habitat utilization of hatchery reared red drum juveniles in their first year after release. The ultimate goal of this research was to identify environmental factors that affect recruitment and provide the components to develop a predictive model to identify year class strength, *a priori*, to more effectively manage fishery resources.

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## **Intersex Fish: Not Just in Wastewater Anymore**

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Estrogens and estrogen mimics in the aquatic environment are known to induce intersex and other forms of endocrine disruption in fish. Intersex fish can have decreased sperm production, decreased sperm motility, and decreased fertilization success compared to histologically ‘normal’ male fish. Recently, high incidences of intersex fish were reported in some rivers in the southeastern U.S.; but to date, a systematic evaluation of the extent, severity, and causes of intersex fish has not been completed in Georgia. Our objectives were to (1) assess intersex condition in black bass collected from rivers and impoundments across Georgia, and (2) determine estrogenic potency (a measure of the estrogens and estrogen-like substances) of surface waters where fish were collected. Fish (n =15-35) and water samples were collected near municipal wastewater effluent discharges in each of four rivers and from a river that does not receive major wastewater effluent discharges. Fish and water were also sampled from 12 impoundments of without major wastewater inputs to determine if a natural ‘background’ rate of intersex could be established for fish from relatively unpolluted water bodies. Gonads from all male fish were examined and the incidence and severity of the intersex condition were compared among sites. Potency of estrogens in surface waters was determined by use of an in vitro yeast-based reporter gene (YES) assay. The overall percentage of intersex for male bass collected in rivers was 30%, whereas 40% of male fish collected from impoundments were intersex. Incidence of intersex varied substantially (0-88%) among impoundments, and surface area of the impoundment was a strongly negatively correlated with intersex incidence. Severity of intersex was not predicted by impoundment surface area. Causes of intersex remain unknown, but the high incidence of intersex males in some impoundments suggests that factors other than municipal wastewater are involved.

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## **Accuracy and Precision of Age Estimates for Alligator Gar from Otoliths, Pectoral Fin Rays, and Scales**

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We estimated accuracy and precision of age estimates derived from alligator gar (*Atractosteus spatula*) otoliths, pectoral fin rays, and scales to assess the utility of each method. Using a combination of known-age and chemically-marked fish, readers correctly identified otolith annuli for 96% of the fish. Annuli in pectoral fin rays and scales were often misidentified or not apparent. Readers correctly identified annuli in 19% of the pectoral fin rays and 12% of the scales; annuli beyond chemical marks were frequently missing in these structures. While accuracy of age estimates from otoliths was superior to pectoral fin rays and scales, precision of age estimates was poor for all structures. Following the first attempt to estimate age, percent agreement between two independent readers was 49%, 43%, and 37% for otoliths, pectoral fin rays, and scales, respectively. Using chemical marks, readers were able to improve their ability to identify annuli in otoliths. As a result, percent agreement improved to 67% for otoliths that readers initially disagreed on; no improvement was observed for pectoral fin rays (38%) or scales (37%).

Based on our assessment, otoliths can provide accurate age data for alligator gar; however, correct interpretation of annular marks required substantial training. Age estimates from pectoral fin rays and scales should be used with caution. We found that annuli on these structures were more difficult to interpret and that readers frequently underestimated age.

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### **Characterizing Environmental and Physicochemical Conditions in Nursery Areas of River Herring in Chowan River, NC**

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Anadromous fishes such as blueback herring (*Alosa aestivalis*) and alewife (*A. pseudoharengus*), use sounds, rivers, and tributaries during spawning. Collectively known as river herring, these two ecologically important species spawn in Chowan River, North Carolina. River herring have been important commercially since the early 1900's, however, the population was overfished and declined to the point of moratorium by the state of North Carolina in 2007. Other factors attributed to the population decline include dams and other impediments, reduced water quality, habitat destruction, and possibly poor nutritional health. The early stages of river herring eggs and larvae are extremely susceptible to subtle changes in environmental factors and water chemistry variables. These subtle changes can lead to increased natural mortality. We used physicochemical factors (water chemistry and water quality) to characterize the nursery area used by larval river herring in Chowan River, NC. We related these physicochemical factors to spatial and temporal patterns of larval abundance. Physicochemical profiles and larval abundance were determined from nine sites including tributaries and main stem reaches of Chowan River. Samples were collected weekly from March to May 2011. The physicochemical profile of one tributary, Rockyhock Creek, and the South Chowan River site differed significantly from the other seven sampling areas. At these two sites, there were higher mean salinities of 0.141 and 0.1960 ppt, respectively. This is expected because of the proximity to Albemarle Sound, but there were also higher values of chlorophyll- $\alpha$ , chloride, nitrate, and nitrite concentrations at these sites. Evaluating water quality and water chemistry relationships using nutritional health and abundance as a marker can characterize suitable nursery habitat that managers can use for future larval river herring stocking programs.

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### **The Naked Truth: the Effects of a Low Head Dam on the Population Genetic Structure of the Naked Sand Darter (*Ammocrypta beanii*) in the Pearl River**

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Anthropogenic modifications to aquatic habitats, such as dams, can fragment lotic systems, disrupt fluvial continuity and modify flow patterns. Such structures could negatively impact riverine ecology and potentially act as barriers to gene flow. Although previous studies have examined potential negative effects of aquatic barriers on population structure and gene flow, most have focused on large species of fish that are highly vagile and have low habitat specificity. The overall goal of the study is to assess the impacts of low head dams on the genetic structure of stream fishes Etheostomatine darters in the Pearl

River basin. We examined genetic variation of the Naked Sand Darter (*Ammocrypta beanii*) within the Pearl River basin using eight microsatellite loci. Specimens were also analyzed from three control sites in the Lake Pontchartrain basin (Tangipahoa River system). A minimum of thirty specimens was sampled from a total of twelve sites across both basins. Our data suggests that there are no distinct genetic differences above and below the two low head dams (Pools Bluff and Bogue Chitto Sills) in the Pearl River basin. The implications of these results and a comprehensive summary of this data will be presented. Future work includes the addition of other species, which will provide additional data for a more comprehensive understanding of the long term impacts of dams on aquatic species.

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### **Catch Trends Stemming from the National Marine Fisheries Service, 2011 Expanded Annual Stock Assessment Survey (EASA)**

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From May to October 2011, National Marine Fisheries Service (NMFS) sampled a total of 1,171 longline and 1,939 bandit reel stations across the northern Gulf of Mexico (846 total sea days). A total of 11,454 fish were captured from 145 taxa using bottom longline gear, and 3,224 fish from 66 taxa were captured using bandit reels. Bandit reel sets were primarily deployed over high relief bottom while longline gear was set primarily over low relief bottom types. Bottom longline sets captured more diversity and abundance than the bandit reel. EASA bottom longline captured more species and total fish than did the NMFS annual bottom longline surveys, a result likely associated with the increased amount of effort and stations sampled. Catches of red snapper (*Lutjanus campechanus*) show significantly different mean lengths by gear suggesting differential habitat selection by age or size. Expanding annual surveys in this manner dramatically increases the amount of information that is directly utilized in single species stock assessments and would also be useful in an ecosystem based assessment context.

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### **An Integrated Assessment of Potential Implications of Red Drum (*Sciaenops ocellatus*) Stock Enhancement in Florida**

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Recreational fisheries are important, complex, and present perplexing management challenges. Despite this complexity, recreational fisheries can be characterized by two primary objectives—(1) maximize socioeconomic benefit by fishing and (2) sustain population and ecosystems at desired levels or states. In an attempt to satisfy these two objectives, stock enhancement is increasingly considered. The outcomes of enhanced recreational fisheries depend on relationships between biological, environmental, and socioeconomic attributes and are best understood in an integrative framework. However, there have been very few integrated assessments of enhanced recreational fisheries. In Florida, red drum (*Sciaenops ocellatus*) support highly valuable, effort-intensive recreational fisheries for which enhancement are increasingly considered. The objective of our study was to provide preliminary, integrated assessment of the potential effects of red drum enhancement in terms of multiple objectives. Specifically, we assessed

how biologically successful enhancement might affect wild red drum populations, catch rates, angling effort, angler satisfaction and economic value, and to what parameters or assumptions these results were most sensitive to. To accomplish this we used coupled socio-ecological models designed for evaluating enhancement. While analysis is still ongoing, preliminary results suggest if enhancement does augment populations of catchable fish, catch rates and angler satisfaction are likely to increase initially, leading to increased effort and economic value. However, increased effort may cause eventual decreases in catch rates and satisfaction, and may elicit negative impacts of wild red drum. Our results were sensitive to release mortality rates and the responsiveness of angling effort. Further assessment is warranted and may benefit from data-driven analysis coupled with stakeholder surveys and experimental stocking.

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## **Population Genetics of Two Coastal Louisiana Shrimp Species**

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Brown shrimp (*Farfantepenaeus aztecus*) and white shrimp (*Litopenaeus setiferus*) are important species for Louisiana's commercial shrimping industry, accounting for over half of the annual average value of fisheries within the state. Previous studies have shown that white shrimp are composed of two genetically divergent populations, with western Gulf of Mexico populations distinct from those in the eastern Gulf and Atlantic. Brown shrimp, on the other hand, show little or no population structure across this same broad geographic scale. However, these conclusions are based on limited population sampling across the range. White shrimp are more dependent on the estuaries of the Louisiana coast than are brown shrimp, which likely accounts for differences in population structure across their respective ranges. Additionally, white shrimp may be more susceptible to human-caused alterations to the estuaries than brown shrimp. The importance of these species to Gulf Coast fisheries warrants further investigation into the population genetic structure on a microgeographic scale. Therefore, we generated mtDNA (control region) sequences for more than 80 individuals of each species from samples collected along coastal Louisiana and examined population structure on both spatial and temporal scales. The results suggest a greater degree of genetic structuring of white shrimp, in comparison to brown shrimp on this smaller microgeographic scale. Furthermore, brown shrimp display a larger level of haplotypic variation than white shrimp, further supporting previous studies. The results from this study have strong implications in regards to managing shrimp fisheries and understanding population dynamics of these commercially important species.

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## **Diet and Feeding-Related Morphometrics of the Blackstripe Topminnow (*Fundulus notatus*) and the Blackspotted Topminnow (*Fundulus olivaceus*) in Syntopic and Allotopic Populations**

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The *Fundulus notatus* species complex consists of three described species: *F. notatus*, *F. olivaceus* and *F. euryzonus*. Both *F. notatus* and *F. olivaceus* have broad overlapping ranges with many populations being

found within and outside of contact zones. Contact zones are generally found in mid-reaches with *F. olivaceus* dominating headwaters and *F. notatus* in larger rivers downstream. Both species share similar ecological niches so the mechanism allowing for stable coexistence in contact zones is unknown. The purpose of this study was to examine variability in diet and feeding morphology of *F. notatus* and *F. olivaceus* in syntopic and allotopic populations across three drainages. Both *Fundulus* species were sampled in Pascagoula River, Pearl River and Neches River contact zones in the summer of 2008. Fish were genotyped and feeding-related morphometrics were taken (standard length, body width, body depth, head length, head width, head depth, interorbital distance, preorbital length, orbit length, postorbital length, gape width, gape height, maxillary length, and dentary length). Morphometric analyses were conducted to determine if there were ontogenetic shifts or sexual dimorphisms in allotopic and syntopic populations. Analyses were also conducted to determine if there were differences among species and syntopic-allotopic populations. Digestive tracts of *F. notatus* and *F. olivaceus* were examined to determine prey items. There were significant differences in feeding-related morphometrics between age classes, sexes, and syntopic and allotopic populations for both *Fundulus*. There were also significant differences in diets of various groups of *F. notatus* and *F. olivaceus*.

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## **Developing and Disseminating Preferred Catch and Release Methods for Louisiana Saltwater Recreational Anglers**

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It is well known that recreational fishing can be a significant source of fish mortality. The Louisiana Department of Wildlife and Fisheries is committed to promoting better catch and release practices for Louisiana anglers in order to conserve valuable fishery resources. One of their goals is to educate the public in a way that reduces the impacts of Louisiana saltwater recreational fishing. Although saltwater catch and release fishing is uncommon in Louisiana, regulations such as species and seasonal closures and capture of non-target species results in many thousands of fishes being released every year. An often overlooked element of catch and release fishing is how to properly handle and release fish in a way that will give a released fish the best possible chances for survival. Best handling practices vary in different fishing situations because of water depth, hook type, hook placement, the type of tackle, environmental conditions, fish type and fish size. All these factors affect the level of stress a fish experiences during capture and subsequently the condition of the fish after release. Currently, fish handling and release recommendations often come from fishing guides with little experience with fish physiology, stress responses, disease vulnerability or the after-effects of fish capture plus there is some variability in fish handling recommendations among experts. A committee of experts reviewed catch and release outreach materials from around the world and evaluated their relevance to Louisiana recreational fishing practices and made a number of recommendations to educate Louisiana anglers. Topics to be covered will include: 1) handling techniques for saltwater fishes, 2) use of landing nets 3) preferred tools and methods for de-hooking released fish 3) use and benefits of circle hooks 4) handling fish suffering from moderate to severe barotrauma and 6) fishing techniques and strategies that reduce stress of released fish.

## Isolation Effects on Fish Diets in an Intermittent Stream

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In isolated pools both abiotic and biotic interactions may strongly shape community composition. Other studies have hypothesized that as abiotic conditions become less predictable, communities should become simpler and biotic interactions weaker. Many streams in the eastern Ozark Highlands are characterized by spring-fed headwaters that have connected pools in the upper reaches and isolated pools in the mid-reaches before becoming perennial. Headwater streams in this region are characterized by a fish assemblage comprised primarily of cyprinids and percids. Sampling was conducted during March, June, and August 2011 in a headwater tributary of North Sylamore Creek. The objective of this study was to examine the effects of pool isolation on fish diets. To assess this question, we collected total available macroinvertebrates (9 orders; 45 families) and ten individuals of each target fish species (*Chrosomus erythrogaster*, *Semotilus atromaculatus*, and *Etheostoma spectabile*) from a minimum of three pools for gut analysis in both isolated and connected pools. During the sampling period, strong abiotic variation occurred within the study reach having significantly lower dissolved oxygen and pH in isolated pools compared to connected pools ( $p < 0.001$ ) and significantly higher conductivity and temperature in summer ( $p < 0.001$  and  $p = 0.03$  respectively). Chi-square goodness of fit test, Non-metric multidimensional scaling (NMS), Levin's niche breadth measure, and Pianka's niche overlap was used to analyze fish diet data and will be presented to show a comparison between isolated and connected pools.

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## Reproductive Biology of the Southern Kingfish within the Mississippi Sound

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Southern kingfish (*Menticirrhus americanus*) is an important commercial and recreational fishery along the Mississippi Gulf Coast; however annual harvest has declined over the last decade. Southern kingfish are currently unregulated in Mississippi, therefore the purpose of this study is to establish the spawning season, spawning frequency, fecundity, and age and size at maturity of this species. Specimens were collected using hook and line in several locations within the Mississippi Sound. A total of 519 southern kingfish (434 females, 85 males) were captured from April 2008 through May 2009. Of these, 503 were used for histological analysis and the otoliths were removed from the entire collection for age analysis. Gonadosomatic index results and overall ovarian maturity phases, determined through histological examination, indicated that fish begin to rapidly develop in February and March with spawning likely to start occurring in late March or early April. The spawning season appears to last through early fall and likely ends in October with spawning frequency averaging 6.93 days between spawns. Histological analysis also provides reference material to aid in identifying the reproductive phases of *Menticirrhus americanus*. Further analysis will determine fecundity and the age- and size-at-maturity.

## **Estimating Delayed Mortality of Red Snapper Discards Using Acoustic Telemetry**

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Red snapper (*Lutjanus campechanus*) is considered an ecologically and economically important reef fish species in the Gulf of Mexico. Populations are highly regulated but have failed to recover as expected and stocks remain low. One possible reason for the slow recovery is that red snapper are susceptible to pressure-related injuries (i.e. barotrauma) and estimating delayed mortality rates in deep water environments is difficult. Delayed mortality may occur from reduced fitness, reduced predator avoidance ability, or inability to forage. To determine the extent of delayed post-release mortality, we tagged 100 red snapper with Vemco V9AP accelerometer tags and released them at an oil platform at 50m depth. Unlike previous acoustic tagging experiments, fish were rapidly (1-3 min) tagged externally without anesthesia. Procedures were performed to best replicate normal fishing practices and minimize artifacts associated with tagging related surgeries (i.e. venting and use of only “survivors”). Acoustic receivers attached to the platform at depths of 30m and 50m recorded acceleration ((m/s)<sup>2</sup>) and depth (m) data for approximately 45 days. There was a significant seasonal effect in overall delayed mortality. There was also a difference among four release treatments tested: surface-released vented, surface-released non-vented, weight-descended hook, and the control group. These results suggest that temperature is highly influential in the fate of regulatory discards. The method of release may also be important. Results from these experiments enhance our understanding of post-release mortality and behavior of red snapper and provide useful information that documents the fate of regulatory discards. Estimates of delayed post-release mortality from this study can be integrated into stock assessment models to achieve better calculations of overall mortality and ultimately more accurate estimates of population size.

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## **The Effect of Overexploitation on the Genetic Diversity of Red Snapper (*Lutjanus campechanus*)**

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Red snapper has been overfished and undergone overfishing by commercial and recreational fishermen for the latter half of the 20<sup>th</sup> century. Currently, the red snapper population is estimated to be only 11-14% of a sustainable level, and has been predicted to remain in an unsustainable level for many years to come. Although protection to reduce fishing pressure and overfishing of red snapper has recently been enacted, including the moratorium to close 4,827 square-miles of ocean area, it likely will take a long time to reverse the consequences of past actions. Our research evaluates if the population reduction experienced by red snapper has resulted in (1) a decrease in genetic diversity or effective population size, and/or (2) a change in genetic composition between two periods, 1999-2000 and 2007-2009. Genetic results support the estimation of a small population census size for Atlantic red snapper and the population appears to be experiencing influences from both genetic drift and inbreeding. Genetic diversity results indicate that average heterozygosity is low, but has not substantially changed between these two time periods. The lack of a substantial decrease in diversity in light of continued reduction in census size is a positive sign for red snapper. However, the very low estimation of effective population size is perhaps less than positive, indicating genetic diversity will likely take longer to increase and the

population has a higher likelihood of large influences from genetic drift. Therefore, for red snapper, overfishing appears to have resulted in a small effective population size and low genetic diversity, leaving the Atlantic population potentially vulnerable to future anthropogenic and natural changes.

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## **The Status of Instream Flow Protection and Science in the Southeastern United States**

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The Southeastern US is a global center for aquatic biodiversity which relies on clean, ample, naturally flowing water in our streams and rivers. Pressure on these resources is increasing rapidly due to rampant population growth and climate change. The Southeast Aquatic Resource Partnership (SARP), an affiliate of the National Fish Habitat Partnership, identified changes in natural flow regimes as a regional priority threat to these valuable resources. The Southern Instream Flow Network (SIFN) and Research Agenda were developed to improve the scientific basis for protecting and restoring instream flows in the region. SIFN works with state and federal aquatic experts to develop the priority, science-based resources that were identified for the region in the Southern Instream Flow Research Agenda. The river classification framework, regional compilation of aquatic resource data, flow alteration assessment, aquatic conservation priority areas, and ecological response to flow alteration relationships will form an integrated body of information for developing science-based instream flow policies and management practices. Predicting impacts of climate change to aquatic ecosystems of the region will rely in large part on expected changes in water quantity and quality and understanding responses of aquatic ecosystems to those changes. SIFN is coordinating development of the basic resources and identifying information gaps to guide research to support this need.

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## **Preliminary Assessment of Age, Growth and Fecundity of Two Coastal Marsh Populations of Alligator Gar (*Atractosteus spatula*) in Louisiana**

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Habitat degradation and loss has reduced the range and abundance of alligator gar (*Atractosteus spatula*) and over-harvest may intensify this decline. Unfortunately, many states lack harvest rate and population size and structure data. Many state agencies have decreased legal harvest limits until research can assess the vulnerability of remaining alligator gar populations. To evaluate and compare two coastal Louisiana populations of alligator gar with different harvest rates, we are making seasonal collections from Rockefeller Wildlife Refuge (RWR) and Terrebonne Estuary (TE). RWR is closed to commercial fishing and has limited recreational harvest of alligator gar while TE has an open and unrestricted commercial and recreational fishery. Fish are collected using multifilament gill nets, jug lines, hook and line, and bowfishing. Each population is sampled seasonally, until a minimum of 50 alligator gar are collected. For each alligator gar, total length (mm), pre-pelvic girth (anterior to the pelvic fins, mm), total weight (kg) and gonad weight (g) are measured. Age, growth, fecundity, sex ratios, gonadosomatic index (GSI) and total mortality rates of the two populations will be compared. Each fish will be aged using whole otoliths.

Total fecundity will be determined by counting ripe eggs in a 10% (by weight) sub-sample of each ovary. Total mortality rates will be estimated using catch-curve regressions. Preliminary results from alligator gar collected to date for RWR (N=181) include mean total length 1201±13 mm, mean weight 10.7±0.45 kg, and mean girth 450±7 mm. Preliminary results for TE (N=145) include mean total length 1180±19 mm, mean weight 9.9±0.53 kg, and mean girth 438±8 mm. This study will allow us to better quantify the reproductive potential of coastal populations of alligator gar and to more accurately estimate productivity using population models. The results of this study will inform future management decisions regarding coastal alligator gar populations.

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### **Fish Recruitment is Influenced by River Flows and Floodplain Inundation at the Apalachicola River, Florida**

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High human demand for limited water resources often results in water allocation tradeoffs between human needs and natural flow regimes. Therefore, knowledge of ecosystem function in response to varying streamflow conditions is necessary for informing water allocation decisions. Our objective was to evaluate relationships between river flow and fish recruitment and growth patterns at the Apalachicola River, Florida, a regulated river, during 2005-2010. To test relationships of fish recruitment and growth as responses to river discharge, we used linear regression of: 1) empirical catch in fall, 2) back-calculated catch, via cohort-specific catch-curves, and 3) mean total length (TL) in fall of age-0 largemouth bass (*Micropterus salmoides*), redear sunfish (*Lepomis microlophus*) and spotted sucker (*Minytrema melanops*) against spring-summer discharge measures in Apalachicola River. Empirical catch rates in fall for all three species showed positive and significant relationships to river discharge that sustained floodplain inundation during spring-summer. Back-calculated catch at age-0 for the same species showed positive relationships to discharge measures, but possibly because of low sample sizes (n = 4-6), these linear regressions were not statistically significant. Mean TL for age-0 largemouth bass in fall showed a positive and significant relationship to spring-summer discharge; however, size in fall for age-0 redear sunfish and spotted sucker showed no relation to spring-summer discharge. Our results showed clear linkages among river discharge, floodplain inundation, and fish recruitment, and they have implications for water management and allocation in the Apalachicola River basin. Managed flow regimes that reduce the frequency and duration of floodplain inundation during spring-summer will likely reduce stream fish recruitment.

## **Evaluation of Spawning Run American Shad Spatial Distribution and Habitat Use via Acoustic Telemetry Gear at the St. Johns River, Florida**

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The St. Johns River, Florida supports the southernmost spawning population of anadromous American shad (*Alosa sapidissima*). Previous research has suggested that spawning habitats of migrating shad could be influenced by variation in water levels. Thus, a greater understanding of the linkage between American shad spawning habitat and water levels in the St. Johns River is needed as demand for freshwater sources in Florida may lead to greater reliance on the this system for water supply. We used acoustic telemetry tags in conjunction with active and passive detection methods to follow American shad during spawning migrations in 2009 - 2011. Near continuous monitoring of telemetry tagged American shad allowed us to infer areas of high and low-use for between-year comparisons of spatial distribution and habitat use under contrasting water-level conditions observed during our study (low water level: 2009 and 2011; high water level: 2010). Overall, spatial distribution patterns of telemetered shad during each year were largely similar; however, we observed some key differences related to seasonal water level conditions. Most notably, the upstream range for telemetered shad within the St. Johns basin was lower during low water years compared to high water years. During the 2011 spawning season, we compared basic microhabitat parameters between used and available habitats. We found that when habitat selection occurred, telemetered shad selected for greater depth and higher flow velocities relative to available habitat conditions. Results from this study showed linkages between American shad spawning and river flow and levels in the St. Johns River. Large-scale reductions in discharge and water level could restrict access to spawning reaches or reduce the availability of habitat with sufficient flow velocities necessary for American shad spawning. Therefore, water use and regulation in the St. Johns River should take into consideration effects on American shad spawning habitat.

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## **Hydropeaking Impacts on the Growth of Two Black Bass Species in the Tallapoosa River, Alabama**

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Located in east-central Alabama, the Tallapoosa River has been extensively impounded for flood control, navigation, hydropower and water supply. The most upstream dam, Harris Dam, was constructed in 1983, and is operated as a hydro-peaking facility. This alteration in the flow regime has not been fully investigated. To examine the impact of growth on black bass species, 100 Alabama Bass and 50 Redeye Bass were collected from two areas impacted by hydropower peaking flows (17-21km and 52-62 km below Harris Dam), and an unregulated portion above Harris Dam. This allowed for the effects of flow variation to be examined across a gradient of flow variability. All fish collected were measured (TL), weighed (g), sexed, and the sagittal otoliths were extracted. Otoliths were then broken through the nucleus, mounted onto slides using thermoplastic cement and ground until a thin section was present. Using an image-analysis system otoliths were aged and measured from the focus to the outer edge of each annuli. Growth increments were then calculated for each growth year. River discharge information was

obtained from the corresponding USGS gauges. Mean daily flows and the rate of change were examined by growth year and quarterly for each year. A multiple regression analysis was used to examine the relationship between river flow and length increments. Results on the impacts of hydro-peaking flows on the incremental growth of these species will be presented.

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### **Length of White Bass Larvae at Hatch and Five Days Post Hatch is a Heritable Trait**

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Current practice for hybrid striped bass (white bass *Morone chrysops* x striped bass *M. saxatilis*, HSB) fingerling production in tanks is to initially feed rotifers to larvae, as their gape after yolk sac absorption is usually insufficient to accept *Artemia sp.* as a first feed. We measured length of white bass larvae to determine which traits in the female brood stock would result in larger fry, because elimination of the rotifer feeding stage would allow for a decrease in complexity and increase in efficiency of HSB hatchery operations. In 2010 and 2011 separate cohorts of 2 to 6 year old white bass were induced to spawn by human chorionic gonadotropin injection after a 12-month photothermal regime. Eggs were incubated in McDonald hatching jars. Samples of larvae were taken at hatch and at 5 days post hatch (dph) and preserved in 4% buffered formalin. The notochord and fin fold length of the preserved larvae were measured using digital photomicroscopy. Notochord and fin fold lengths were summed to determine total length, which was then subjected to an ANOVA to determine which factors influenced total length. Analysis of the 2010 spawning found that larval total length at hatch varied between dams ( $P < 0.001$ ). Analysis of the 2011 spawning confirmed this, and further found that total length at hatch varied with age and weight of the dam, but total length at 5 dph varied only with the dam's age ( $P < 0.001$ ). The fastest growing and largest larvae at hatch were produced by 2-year old fish in the 2011 spawning, but the largest larvae at hatch were not the fastest growers. Our data suggest that larval length at hatch and growth rate are independently selectable traits in managing white bass brood stock.

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### **Effects of Varying In-Stream Habitats on Headwater Stream Fish Assemblages in Southwestern Louisiana**

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Although watershed land use effects on in-stream fish habitat have been widely studied, low-gradient, coastal Louisiana streams have been poorly described in the literature. Coastal Louisiana rivers are characterized by short distances between headwaters and saltwater termini, and land uses in these watersheds range from agricultural production of rice, crawfish, and sugarcane to extensive private and federal forestlands managed for timber production. We report the results of the first year of a two-year study examining differences in headwater fish assemblage composition among streams within two spatially-isolated, neighboring watersheds differing in stream habitat composition and land use. The objectives of this study are to 1) determine how in-stream habitat variables, broad-scale ecoregional landscape differences, and associated land uses affect the abundance and species composition of resident

fish assemblages; and 2) assess the relative contribution of geomorphologic and anthropogenic factors to divergence of local fish assemblages from a historic common taxonomic pool. In this presentation, we examined in-stream habitat variables such as depth, flow, and woody debris presence combined with three-pass electrofishing depletion estimates at thirteen 100-m stream sites distributed in the two basins. We used a combination of principle component analysis, non-metric multidimensional scaling, and general linear mixed modeling to determine if trends were present in the habitat, fish composition, and species trait data. Preliminary results suggest sites differ in fish taxonomic composition based on similarity indices with closed canopy, clear streams characteristic of the Calcasieu basin exhibiting dissimilarity with open canopy, turbid streams found in the Mermentau basin. Important habitat variables included canopy cover, water velocity, woody debris, water temperature, and turbidity. Future work will link land use characteristics to differences in physicochemical and fish data between drainages to provide insight on the interactions of land use, in-stream habitat types and fish species assemblages in headwater streams in southwestern Louisiana.

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### **Patterns of Faunal Diversity Associated with Altered Macrophyte Coverage**

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Lakes in the Mississippi Alluvial Valley (MAV) in western Mississippi contain aquatic plant assemblages that provide essential habitat for fish and invertebrates. Macrophyte complexity and abundance have been linked to scale dependent patterns of abundance and diversity of aquatic fauna. Starting in 2008, a three year study was conducted to document the effects of macrophyte management regimes on aquatic communities. During this study, estimates of macrophyte percent coverage and density were recorded at a series of locations within seven MAV lakes. From March until August of each year, aquatic invertebrates along with juvenile and small fish were also collected at these sites. Large variance observed in the response of the aquatic community during this study demonstrates that a number of non-mutually exclusive factors may be responsible for patterns of diversity in these lakes. Long term study to incorporate response lag times may be the best method for uncovering mechanisms of community maintenance. Understanding how habitat availability and extent structures aquatic faunal assemblages is imperative for management of these systems.

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### **Hurricane Induced Water Quality Changes in the Hydrologically Altered Upper Barataria Estuary, Louisiana**

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The predictable annual floodpulse of large rivers facilitates the lateral transfer of energy and nutrients between the mainstem river and floodplain. However, decomposition of organic matter during periods of high water and high temperatures often decreases dissolved oxygen levels of the inundated floodplain. The upper Barataria Estuary (UBE) is the southern-most western floodplain of the Mississippi River that has been disconnected from the Mississippi River by flood-control construction. As a result, water levels

in the UBE are primarily a function of local precipitation and are not subject to a predictable annual floodpulse. The UBE experiences prolonged hypoxic conditions throughout the year (including winter), which appears to be the result of increased organic carbon associated with large precipitation events. To better understand the relationship among water level (m), temperature (C), dissolved oxygen (DO; mg/L), pH, nitrate (mg/L), phosphate (mg/L), total chemical oxygen demand (TCOD; mg/L), soluble chemical oxygen demand (SCOD; mg/L), and number of colony forming units (CFU) for aerobic and anaerobic bacteria, we sampled three UBE sites every other week from July 2007 to June 2008. Although we had completed our study, Hurricane Gustav passed over the UBE on 1 September 2008 and all of the above parameters were measured at all three sites on 7 September. We compared water quality variables measured after Hurricane Gustav to the mean annual values from July 2007 to June 2008. Temperature, nitrate, TCOD, and SCOD were higher following Hurricane Gustav and DO and pH were lower following Hurricane Gustav. We did not detect a difference in the abundance of aerobic or anaerobic bacteria between the two periods; however, bacterial abundance was highly variable throughout the year. An increase of organic carbon input in the UBE is associated with hypoxic conditions, probably due to an increase in bacterial respiration.

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### **Preliminary Analysis of Reproductive Periodicity of the Blacknose Shark (*Carcharhinus acronotus*) within its Atlantic Range**

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The blacknose shark (*Carcharhinus acronotus*) is a common small coastal shark species found in nearshore waters along the southeast coast of the United States, from North Carolina into the Gulf of Mexico and extending further south into the Bahamas. There has been some debate in recent years over the reproductive periodicity of *C. acronotus* in waters off the U.S. coast. Earlier studies have suggested that Gulf *C. acronotus* reproduce on an annual basis whereas the Atlantic populations of this species may reproduce biennially. The goal of the present study was to re-evaluate the reproductive periodicity of the Atlantic populations of *C. acronotus* with the intent on clarifying these differences. This was accomplished by examining male and female reproductive tracts in animals caught via fishery dependant and fishery independent gillnet and longline surveys conducted throughout the Atlantic range of *C. acronotus*. Based on these data, spermatogenesis appears to occur between late May to early July with peak sperm production occurring in June and July. In females, follicular development is likely complete by late June-early July with ovulation occurring shortly afterwards. Mating appears to occur between mid-June and early July based on the presence of fresh mating scars on females captured during this time. Current data suggests that gestation begins late July with parturition occurring late May to early June the following year. As observed in earlier studies, reproductive periodicity appears to be largely biennial. However, evidence for concurrent follicular development and pregnancy was observed in several females, suggesting that at least a portion of the Atlantic population may reproduce on an annual basis.

## Juvenile Tarpon (*Megalops atlanticus*) In Mississippi and Louisiana Coastal Estuaries

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Prior to 2006, juvenile tarpon (*Megalops atlanticus*) were rarely documented from Mississippi and Louisiana estuaries. Our collections of juvenile tarpon (Mississippi, n=196, 50-285 mm FL; Louisiana, n=85, 82-184 mm SL) from coastal wetlands during 2006 – 2011, as well as documented reports of juveniles provided by collaborating fishers, indicated that young tarpon are more prevalent within the region than previously thought. We collected juveniles from tidal sloughs and shallow ditches from September to December using cast nets. Surface water temperature (°C), salinity (psu) and dissolved oxygen (D.O., mg/L) ranged 10.5 – 32.1°C, 0.0 – 32.0 psu, and 1.0 – 7.93 mg/L, respectively, for all specimens combined, and revealed that habitats occupied by juvenile tarpon were characterized by a wide range of primary environmental factors. The diet of Louisiana juvenile tarpon consisted primarily of sailfin molly (*Poecilia latipinna*) and sheepshead minnow (*Cyprinodon variegatus*), whereas stomach contents from Mississippi juveniles contained primarily unidentified fish remains, along with penaeid and palaemonid shrimp. The recent collection of juveniles in six successive years and their apparent widespread occurrence within Mississippi and Louisiana coastal wetlands suggest regional spawning activity and availability of suitable tarpon nursery habitat. Over-wintering survival of juveniles in local waters and subsequent life history events are additional aspects of our research. Our ongoing studies of juvenile tarpon within the two states will provide critical information on life history aspects, including reproductive success, and habitat requirements of tarpon in the northern Gulf of Mexico.

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## Effects of a Mimic Artificial Oyster Reef on Meiofauna and Small Macrofauna in Louisiana's Shallow Water Estuaries: A Before-After-Control-Impact Analysis

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We sought to assess the enhancement potential of mimic artificial oyster reefs (MAORs) on trophic dynamics of juvenile estuarine fishes in shallow nursery areas (i.e., marsh ponds). To test the impact of MAOR addition on prey communities of juvenile fishes, meiofaunal and small macrofaunal communities were sampled from mud and marsh edge sites every other month for two years (March 2009 -11) following a Before-After-Control-Impact (BACI) design. After monitoring for one year, four mud sites were converted to MAORs by evenly distributing limestone cobble onto the sediment surface. Samples were then collected for an additional year. Meiofaunal communities were numerically dominated by nematodes and harpacticoid copepods but showed order of magnitude declines in response to MAOR addition. Shannon-Weaver diversity indices ( $H'$ ) increased significantly at MAOR sites from six to 13

taxa, but the majority of new immigrant taxa were observed only in the last sample collected. Between group dissimilarity analyses in PRIMER (SIMPER) indicated nematodes, copepods, tenaids, gastropods, and ostracods contributed to more than 95% of the cumulative dissimilarity between habitat types. Small macrofauna communities were numerically dominated by *Palaemonetes pugio*, *Callinectes sapidus*, and *Litopenaeus setiferus*, all of which decreased in density in response to MAOR addition. Shannon-Weaver diversity indices for small macrofauna decreased at MAOR sites after MAOR addition from 21 to 8 species. Of the eight species present at MAOR sites only *Gobiosoma bosc*, *Opsanus beta*, and *Archosargus probatocephalus* increased in mean densities, lengths and weights at MAOR sites. Although there were increases in meiofaunal diversity, as well as increases in the density and size of some small macrofauna associated with MAORs, decreases in the abundance and diversity of predominant benthic taxa suggests an overall negative impact on prey resources potentially available to juvenile estuarine fishes.

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### **Effects of a Mimic Artificial Oyster Reef on Select Estuarine Fishes in Marsh Ponds in Louisiana's Shallow Water Estuaries: A Before-After-Control-Impact Analysis**

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We sought to assess the enhancement potential of mimic artificial oyster reefs (MAORs) on trophic dynamics of juvenile estuarine fishes in shallow nursery areas (i.e., marsh ponds). Trophic dynamics were investigated by comparing the gut contents and condition (energy density) of four abundant estuarine fishes collected from mud and marsh edge sites every other month for two years (March 2009 – 11) following a Before-After-Control-Impact (BACI) design. After monitoring for one year, four mud sites were converted to MAORs by evenly distributing limestone cobble onto the sediment surface. Samples were then collected for an additional year. Four fish species were collected: Atlantic croaker (*Micropogonias undulatus*), bay whiff (*Citharichthys spilopterus*), white trout (*Cynoscion arenarius*), and pinfish (*Lagodon rhomboides*). Based upon percent IRI, fish diets were dominated by insect larvae, calanoid copepods, amphipods, mysids, and polychaetes, but the relative proportions of each prey item differed among species. Statistical analyses of gut contents showed no period\*habitat effect for any fish species but a significant month\*habitat effect was observed in Atlantic croaker and pinfish diets. Energy density analyses also showed no significant period\*habitat effect for any fish species but energy densities were significantly different between months for all fishes except white trout. Only pinfish exhibited higher energy densities at MAOR sites after MAOR deployment and increasing energy densities from May through September as Atlantic croaker, bay whiff, and white trout presumably sacrificed energy storage to maximize growth. Diets dominated by pelagic prey and reduced energy densities suggest MAORs provided no enhancement of prey resources and poor habitat quality. Diet and condition analyses from the select juvenile fishes mirror declines in the benthic community observed previously and may be attributable to a lack of colonization by sessile invertebrates and relative immaturity of MAORs in this study.

## **Functional Morphology of the Hammerhead Cephalofoil: Does the Head of Hammerhead Sharks (Family, Sphyrnidae) Confer an Advantage via Hydrodynamic Lift Production?**

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All hammerhead shark species possess a unique head morphology (a cephalofoil; i.e., “head-wing”) that is deeply compressed dorsoventrally and expanded laterally with the eyes situated distally at each lateral end. It has long been hypothesized that this feature may confer an advantage by producing a hydrodynamic lift force contributing to the shark’s ability to maintain vertical station in the water column. While the head does strongly resemble a wing in profile, empirical evidence concerning a lift effect remains extremely minimal. Using computational fluid dynamics (CFD), multivariate statistics, and a working knowledge of shark morphology, we modeled fluid flow around all eight extant hammerhead species, and two carcharhinid species for comparison (i.e., *Carcharhinus leucas*, and *Carcharhinus limbatus*). Subsequent statistical analyses using two-block partial least squares and multivariate regression were then conducted as a confirmatory step. Shark specimens for CFD analysis were obtained from a variety of sources including fishing tournaments, private fishermen, commercial fishing vessels, and museum collections. Two-part molds were constructed of each species’ head using type-I silicone (interior) and plaster of Paris (exterior). Plaster models were cast of each species. Physical models were digitized using a Faro-Arm laser scanner, and resulting digital data were imported using Geomagic Studio 10 software at Mississippi State University. Unsteady, 2<sup>nd</sup>-order Navier-Stokes solutions were computed using the U<sup>2</sup>NCLE unstructured flow solver (a parallel flow simulation code developed at Mississippi State University’s HPCC which solves the Unsteady Reynolds-Averaged Navier-Stokes equations) to predict the flow field and force and moment coefficients for adults of all species at an attack angle ( $\alpha$ ) of 0°. Simulations were likewise conducted across a range of  $\alpha$ , and the resultant polar diagrams were plotted using MS Excel (Figures X, Y, and Z). Ongoing data analysis will result in a more complete picture of the cephalofoil’s hydrodynamic properties. As new data are still being assimilated, we present our preliminary findings for initial consideration.

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## **Effects of the Deepwater Horizon Oil Spill on Deepwater Fish Populations from the Northeast Gulf of Mexico**

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As the largest oil spill in history in U.S.-controlled waters, the Deepwater Horizon Oil Spill resulted in extensive contamination of Gulf of Mexico waters. This poses significant health risks to numerous marine wildlife populations, especially deepwater species residing in offshore waters within and/or adjacent to the primary contamination zone. Given the population-level impacts that have occurred in some wildlife species as a result of chronic exposure to oil constituents from prior oil spills (e.g., Exxon Valdez oil spill), it is critical to monitor the health of the Gulf’s deepwater fauna to assess the full impacts of the Deepwater Horizon Oil Spill on these animals. Therefore, to address this problem, the goal of this study was to determine if deepwater fish assemblages in the northeast Gulf of Mexico are being exposed

to and are experiencing effects of exposure to polycyclic aromatic hydrocarbons (PAHs), the most toxic constituents of oil. To accomplish this, we examined 4 biomarkers of PAH exposure and effects in multiple deepwater elasmobranch and teleost species collected from areas impacted by the Deepwater Horizon Oil Spill: 1) activity of the PAH-metabolizing Phase I biotransformation enzyme, cytochrome P450 1A1 (Cyp1A1); 2) biliary concentrations of PAH metabolites; 3) the occurrence of covalent associations between PAH metabolites and DNA; and 4) chromosomal abnormalities. PAH biomarkers were compared with those measured in deepwater fish collected from unimpacted reference locations on the west Florida shelf. Cyp1A1 activity was significantly greater in fish from oil-impacted locations compared with those from reference sites, suggesting that deepwater fish are exhibiting physiological effects of oil exposure. However, evidence for cell- and organ-level effects was minimal, perhaps indicating that heightened oil exposure and metabolism is still below the threshold necessary to elicit higher level responses.

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### **Riverine and Backwater Fishes Entrained through the Morganza Floodway**

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On May 14, 2011 the Morganza Spillway was the last floodway to be open during the historic Mississippi River flood to relieve pressure on the Mississippi River levees in Baton Rouge, LA and New Orleans. The structure was open only once prior to 2011 during the 1973 flood. The ERDC Fish Ecology Team and Corps rangers from the New Orleans District sampled the Morganza Spillway on July 14 and 18, 2011 for the federally listed pallid sturgeon. Sampling occurred both above and below the structure using boat-electroshocker. Seining was only conducted in the forebay. Areas where dead fish were present in scoured pools or on land were surveyed on foot for a total of nine 1/2 man hours. Because of massive numbers of dead fish present, we only kept track of species and ranked them in three categories (abundant, common, and rare). A total of 35 species of fishes comprising 14 families were observed or collected. Dominate fish observed were silver carp, gizzard shad and bigmouth buffalo. Common fishes included gar, catfishes, silversides, and sunfishes. Rare fishes consisting of few individuals were skipjack herring, mullet and flathead catfish. No sturgeon were observed or captured. The absence of sturgeon is likely due to the position of the Morganza Structure relative to the Mississippi River. The structure is set back a considerable distance from the River. In addition, fish originating from the Mississippi River must travel through backwaters in the floodplain, over a low elevation levee, and through an agricultural field before encountering the structure. These barriers likely hamper movement towards the structure. Consequently, it is our opinion that entrainment of pallid sturgeon, which is an obligate riverine fish, through the Morganza spillway would be a rare event.

## **Riverine Fishes Entrained through the Birds Point-New Madrid Floodway**

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The Birds Point–New Madrid Floodway was opened for a second time in its history on May 2, 2011, during a record high flood on the Mississippi River. Heavy snows and unusually heavy spring rains caused both the Mississippi and Ohio Rivers to flood. To avoid flooding in Cairo, IL and other places upstream, the US Army Corps of Engineers used explosives to open three crevasses in the frontline levee of the Birds Point-New Madrid Floodway. On May 16-19, 2011, the ERDC Fish Ecology Team and personnel from the Memphis District and Missouri Department of Conservation sampled in the vicinity of the three crevasses to evaluate potential entrainment of the federally endangered pallid sturgeon and other riverine fish species. A total of 19 species of fishes were collected using trawls, hoopnets, trotlines and gillnets. Silver carp was the most abundant fish, followed by blue catfish and shortnose gar. Rare fishes represented by a single individual included shovelnose sturgeon and stone catfish. After the river receded, there were many scour holes in the vicinity where the levees had been blown; some were 12.2 meters (40 ft) deep carved out by the Mississippi River. These scour holes were sampled in a continuing search for pallid sturgeon. During this time, repairs to rebuild the levee and fill the scour holes were on-going. As scour holes were drained or pumped, mixing of anoxic waters at the bottom of the holes caused massive fish kills so much of our fish survey was conducted on foot. In some scour holes not disturbed, we sampled using gillnets and boat electro-shocking. A total of 27 species of fishes were collected or observed. Silver carp was the most abundant fish. Of the 25 river sturgeon collected, all were shovelnose; no pallid sturgeon were observed during the entire study.

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## **Utilization of Molecular Markers in a Preliminary Assessment of Population Structure in the *Mustelus canis* and to Distinguish between Smoothhound Species in the Gulf of Mexico**

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Smooth-hound sharks of the genus *Mustelus* are not federally managed (as of December 2011), but NOAA has recognized the need to collect data for effective management of smooth-hound resources in U.S. waters. Within the Gulf of Mexico, there are at least three nominal species of *Mustelus*, each of which is listed on the IUCN's Red List of Threatened Species; *M. canis* as Near-Threatened, *M. norrisi* and *M. sinuamexicanus* as data deficient. Elucidating the spatial distribution and population structure of these species is crucial for effective management planning and conservation of smooth-hound resources. I have developed thirty-two nuclear-encoded microsatellites from an enriched genomic library of *M. canis* to test the hypothesis that there are genetically divergent stocks of *M. canis* throughout their U.S. range. The microsatellites were tested for cross-amplification on tissue samples from individuals of *M. norrisi* and *M. sinuamexicanus* to assess differences in allele size ranges and heterogeneity of allelic richness and gene diversity between species. Effective at the opening of the fishing 2012 fishing season, legislation will require fisher-people to report landings of smooth-hound sharks and will put a yearly Federal fishing quota on landings of these sharks. Here, I will present preliminary information on stock structure of *M. canis* and a genetic assay for delineation of smooth-hound shark species in the Gulf of Mexico. The final

results of this study may be used in future management planning and conservation of smooth-hound shark resources in U.S. waters.

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### **Assessing Per-Hook Effort From Fishery-Independent Longline Surveys**

Grace, Mark A., Charles Schroeder, Lisa M. Jones, William B. Driggers, Christian Jones, Kristin Hannan, and Travis Holland

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Conventional analysis of fishery-independent longline data usually standardizes catch-per-unit-effort by hook hour units, with effort defined by gear deployment and retrieval events. Aggregate effort data do not necessarily reflect actual effort since each hook is not deployed for an equal amount of time. With current technological advances it is possible to integrate a number of data elements that characterize longline gear deployments and retrievals and associated catch events on a per-hook basis. Per-hook effort can be assessed by examining a variety of longline-effort related variables including catch complexities and abiotic factors.

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### **Toxicological and Physiological Effects of the Surfactant Dioctyl Sodium Sulfosuccinate at Varying Salinities during the Ontogeny of the Gulf Killifish (*Fundulus grandis*)**

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The Gulf killifish (*Fundulus grandis*) is the most abundant and ecologically important fish in coastal marsh habitats of the Gulf of Mexico; a region severely contaminated with crude oil from the BP Deepwater Horizon oil spill. In response to the oil spill, an estimated 7 million liters of the dispersant Corexit 9500A were applied in the northern Gulf of Mexico. In this study, we have focused on the Toxicological and physiological effects in killifish of exposure to the surfactant, dioctyl sodium sulfosuccinate (DSS), the major component of Corexit products. DSS is most toxic at hyperosmotic salinities (30 ppt and 24 ppt), moderately toxic at an isosmotic salinity (i.e., 12 ppt), and least toxic at the hypoosmotic salinity (i.e., 5 ppt). As such, we used immunohistochemical techniques to understand the influence of salinity on DSS toxicity under isosmotic and hyperosmotic conditions. The cellular distribution and/or abundance of the gill transport proteins Na<sup>+</sup>/K<sup>+</sup> ATPase (NKA), Na<sup>+</sup>/K<sup>+</sup>/2Cl<sup>-</sup> co-transporter (NKCC) and cystic fibrosis transmembrane regulator channel (CFTR) were affected by DSS exposure. These results suggest DSS influence hypoosmoregulatory capacity. In comparison, gill cytochrome P450A1 (CYP1A) expression was not affected suggesting the differential effects of DSS on gill protein expression. DSS has been previously demonstrated to alter absorption rates across membranes and we believe that effect was demonstrated within these estuarine fish across a salinity gradient. Ongoing efforts are focused on determining the interactive effects of Corexit 9500A and salinity on the degradation of South Louisiana Crude Oil, and their influence on early life stage development of Gulf killifish.

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## Strategies to Achieve Conservation and Socio-economic Fisheries Objectives by Protecting Older Fish

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Sustainability of recreational fisheries is a global concern; however, diverse socio-economic and conservation objectives can obscure effective management strategies. Management with length-based harvest regulations is common, but such policies often create trade-offs among conservation (e.g., protecting stocks from overfishing) and fishery objectives (e.g., maximizing yield). Minimum-length limits maximize biomass yields by focusing harvest on the oldest/largest fish, but may do so at a cost to conservation benefits derived from a natural age structure. Harvest window length regulations focus harvest on younger more abundant ages, but have had little evaluation in the fisheries literature for jointly meeting fisheries and conservation needs. We evaluated harvest windows and minimum-length limits for meeting multiple conservation and fisheries objectives across a range of fish life-history strategies using an age- and size-structured population model. Our results indicated that harvest windows and minimum-length limits are both effective at compromising between numbers harvested and catch of trophy fish while conserving reproductive biomass. However, harvest windows have the potential to produce greater numbers harvested and greater catches of trophy fish while conserving reproductive biomass and a more natural age-structure of the stock. Additionally, harvest windows provide a more efficient fishery in the presence of discard mortality. These benefits of harvest windows over minimum-length limits come at a cost to total biomass yield. Our results were true across a range of exploitation rates, fish species and life-history strategies. Thus, harvest windows that compromise between harvest and trophy catch represent a viable option to reduce conflict and achieve both conservation and recreational fisheries objectives.

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## Effects of Exotic Suckermouth Catfishes (Loricariidae) on Aquatic Ecosystems: A Feasibility Study Using Mesocosms

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Suckermouth catfish (“plecos”) are herbivorous armored fishes from South America established in HI, TX, and FL. In summer 2011, we evaluated fish survivorship and likelihood of successful long-term experiments and identified response variables indicative of environmental impacts. Fishes used occur in Florida: golden topminnow (*Fundulus chrysotus*), combination of exotic sailfin catfish (*Pterygoplichthys* sp.) and armadillo del rio (*Hypostomus* sp.). Eight 1150-liter mesocosms, with undergravel filters (9-15 liter/min flow), were maintained at water volumes of 750 liters, providing 475 liters of accessible habitat,

and 'planted' with 0.15 ( $\pm$  0.01) kg of water lettuce. There were two replicates each of four treatments: 1) native control, 10 golden topminnow; 2) exotic control, 8 catfish; 3) low density mix, 5 topminnow and 4 catfish; 4) high density mix, 10 topminnow and 8 catfish. Mesocosms were stocked 07 Jun, monitored weekly for water quality and photographed, then deconstructed 08 Aug. Fish were fed daily and dead replaced. Mortality was moderate: 10% topminnow, 17.5% catfish. At the end of the experiment, water quality varied little among treatments and direct impacts on fish were not observed. Periphyton was lush in native controls, absent in other treatments. Growth of water lettuce was higher in both controls (0.65-0.97 kg  $\uparrow$ ) than in low density (0.55-0.60 kg  $\uparrow$ ) and high density mix (0.56-0.59 kg  $\uparrow$ ). Changes in turbidity were negligible in native controls ( $<$  0.6 NTU  $\downarrow$ ), variable in exotic control (1.6 NTU  $\uparrow$ , 0.01 NTU  $\downarrow$ ), moderate in low density mix ( $>$  2.4 NTU  $\uparrow$ ), and high in high density mix ( $>$  6.0 NTU  $\uparrow$ ) due to sustained growth of phytoplankton. Results suggest that suckermouth catfishes shift algal production from periphyton to phytoplankton, and reduce nutrients available for macrophytes. Future mesocosm studies should evaluate interactive effects of catfish with other herbivores (e.g., snails) and monitor changes in nutrients.

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### **Distribution and Abundance of Menhaden (*Brevoortia* spp.) Larvae Captured in Ichthyoplankton Samples during SEAMAP Fishery-independent Resource Surveys in the Gulf of Mexico**

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Three species of menhaden (*Brevoortia* spp.) occur in the GOM. Gulf menhaden (*B. patronus*) range from the Yucatan Peninsula in Mexico, across the western and northern Gulf to Tampa Bay, Florida. Finescale menhaden (*B. gunteri*) range from Mississippi Sound southwestward to the Gulf of Campeche in Mexico and yellowfin menhaden (*B. smithi*) range from Chandeleur Sound, Louisiana, southeastward to the Caloosahatchee River, Florida. These species play important ecological roles in the northern GOM, and support the second largest fishery (by weight) in the United States with Gulf menhaden accounting for 99 percent of the catch. Previous studies of the planktonic life stages of menhaden in the GOM were presented by Fore in 1970 and Shaw et al. in 1985. Since 1982, The Southeast Area Monitoring and Assessment Program (SEAMAP) has supported collection and analysis of ichthyoplankton samples from fishery-independent resource surveys in the GOM. In this study we describe the distribution and abundance of menhaden larvae from SEAMAP samples over the time period from 1982 to 2009 and examine the feasibility of developing a larval index of relative abundance for use as a population index for stock assessment.

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### **The 2011 Mississippi River Flood: Atchafalaya Basin Water Quality Observations during the Morganza Spillway Opening**

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The Mississippi River Flood of 2011, which led to the second opening of the Morganza Spillway on the Atchafalaya River since construction, presented a unique opportunity to collect data on water quality at

many historic sample sites throughout the Atchafalaya River Basin (ARB). Since 2005, we have conducted bi-weekly physicochemical surveys of Henderson Management Unit, Buffalo Cove Management Unit and the East Grand Lake area of the ARB. We report the initial observations of the opening event along with a preliminary investigation of how 2011 water quality during the flood pulse differed from previous years. Results indicate that the water quality response to the 2011 flood event was not atypical as compared to other flood events. However, future channel bathymetry collections may indicate sediment accumulation and geomorphical responses that were not detected in water quality collections.

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### **Status of the Endemic Fish and Mollusks of Lake Waccamaw, North Carolina**

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One of the defining goals of the North Carolina Wildlife Action Plan is to improve our understanding of species diversity in North Carolina, and to enhance our ability to make sound conservation decisions. In 2009, the North Carolina Wildlife Resources Commission (NCWRC) initiated a quantitative monitoring study in Lake Waccamaw. The 3,615 hectare Carolina bay lake harbors 17 species of rare fish and mollusks, and is unique because of its water chemistry (near neutral pH) and large size, as compared to other natural bay lakes. Three species of fish, including the federally listed Waccamaw Silverside, are endemic to Lake Waccamaw. Our monitoring catch-per-unit-effort data suggest that most of the fish populations are persisting except for the Broadtail Madtom (*Noturus* sp. undescribed) which is extremely rare in the lake. Endemic species of mussels and snails persist in Lake Waccamaw, although the densities of many of these animals are lower than historical surveys indicate. These results are playing an important role in guiding our management strategy for rare fish and mussel species in Lake Waccamaw.

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### **Evaluation of Historical Catch Results from Bass Tournaments on the Cumberland Plateau, Middle Tennessee**

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The Fairfield Glade Bass Club generally is composed of retired anglers, and their bass tournaments are held on small, private impoundments on the Tennessee Cumberland Plateau. We examine the catch rates of tournaments from 2006 through 2011 and compare these with open tournaments in the region and nation. The lakes ranged in size from 13 to 260 acres. Catch rates ranged from 0.15 to 0.42 fish per hour and averaged 0.32 fish per hour. Anglers caught 0.32 pounds/hour (range 0.20 to 0.38 pounds per hour). Catch rate of fish >14 inches was 0.08 fish per hour.

## **Intersexuality of a Juvenile Blacktip Shark (*Carcharhinus limbatus*) in the Northern Gulf of Mexico**

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Intersexuality, or the presence of both male and female sex characters in an individual, is not novel in elasmobranchs. However, the low number of elasmobranch species that have been reported as exhibiting tissue of both sexes implies that its occurrence is typically anomalous. In the Gulf of Mexico no records of intersexual elasmobranchs have been recorded, and in our more than a decade of sampling in the coastal waters of Mississippi, we have never encountered a hermaphroditic specimen. In June of 2009 a juvenile blacktip shark (*Carcharhinus limbatus*) was caught on bottom longline gear south of Cat Island off the coast of Mississippi. Externally this animal appeared to be an immature male, developing in line with normal male *C. limbatus* of similar length. Internally, however, a complete immature female oviduct with developed oviducal gland was found. Only the left gonad was developing, while the right gonad appeared to be atrophied. Length of the developed gonad was slightly higher than what has been reported for similar sized, normal males of *C. limbatus*. The histology of the gonadal tissue revealed it to be testicular with the presence of seminiferous tubules throughout. Surprisingly, spermatogenesis did appear to be occurring implying that the individual was mature, although no other indicators suggested mature status. We believe this finding of a hermaphroditic blacktip shark to be extremely rare and the first documented intersexual shark noted in Gulf of Mexico waters.

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## **Nearshore Benthic Habitat Mapping Using Side Scan Sonar**

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Habitat mapping using side scan sonar has historically been confined to offshore continental shelf waters, but recent technological advances have enabled its implementation in shallow-water coastal areas. We used an integrated system of an Imagenex Sportscan side scan sonar, SonarWiz.Map mapping software, a WAAS-differentiated global positioning system (GPS), and a field laptop to acoustically map benthic habitats in the Grand Bay National Estuarine Research Reserve, a shallow Mississippi bay system. Digital acoustic imagery of target habitats of submerged aquatic vegetation (SAV) and oyster shell complexes was acquired and viewed in real-time using SonarWiz.Map software, and post-processed data were imported into ArcGIS for analysis. We subsequently validated the acoustically-derived habitat delineations using a ponar grab in shallow portions (< 5.0 foot water depth) of the survey area and by physical poling of the bottom substrate in deeper ( $\geq$  5.0 foot) waters, where insufficient light penetration prohibited the proliferation of SAV. Field validation confirmed the accuracy of our interpretation of the side scan sonar imagery, and we recommend the use of this integrated acoustic system for a wide range of benthic habitat mapping purposes. Future work will include application of this technology to locate and/or delineate important nearshore habitats, such as natural and artificial reefs, throughout Mississippi coastal waters.

## **Movement of Pallid Sturgeon in the Atchafalaya River**

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Sixty-three adult pallid sturgeon (*Scaphirhynchus albus*) were captured from the Atchafalaya River System and implanted with ultrasonic transmitters from February 2007 to April 2011 and tracked with mobile receivers and sentinel (constantly recording) receivers. Fish followed various patterns of movement, but a pattern of moving downstream in late spring and then migrating back upstream in winter/spring 1.5-2 years later was most prevalent. Short-term (18-72 h), local movement rates averaged 0.19 kilometers/hour and ranged from 0-1.21 kilometers/hour. Movement rates were negatively related to surface current velocity and positively related to change in river stage and surface water temperature. Origin residency (percentage of time a fish was at the location where detected for 24 hours) averaged 73% and ranged from 53-100%. Origin residency was negatively related to river stage and surface current velocity. Diel trends in movement were not apparent. The lack of movement during short time periods suggests the fish are relatively stationary during the time periods between long-distance relocations.

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## **Reproductive Biology of the Finetooth Shark (*Carcharhinus isodon*) in the Northern Gulf of Mexico: A Preliminary Assessment**

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Among sharks within the genus *Carcharhinus*, intraspecific variability in important life history parameters is becoming well established. While differences in growth rates and size/age at maturity could be expected to occur among conspecifics across broad clines, recently, it has been shown that significant differences in reproductive cycles among individuals can occur on much smaller spatial scales than previously known. For example, it was observed that female finetooth sharks (*Carcharhinus isodon*) in the northern Gulf of Mexico (GOM) can reproduce on annual or biennial cycles; however, the degree to which this occurs among the population is unknown. Because of this uncertainty and the limited information on the reproduction of finetooth shark in the region, the objective of this study is to provide a detailed account of the reproductive biology of finetooth sharks in northern GOM waters. Adult finetooth sharks are currently being collected monthly from Louisiana to the Florida panhandle by gillnet and bottom longline sampling, and detailed reproductive information is being collected. With a more complete understanding of the reproductive biology of finetooth sharks in the northern GOM, accurate

estimates of important life history parameters (e.g. size at maturity, fecundity, etc.) will be made available for developing effective future management plans.

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### **Variability in the Reproductive Biology of the Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*) in the Northern Gulf of Mexico**

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Reproduction is one life history characteristic that must be understood in order to foster successful management of cartilaginous fishes. Without information regarding when individuals in a population mature and their frequency of reproduction, population demography or stock assessments cannot be adequately implemented. Recently, significant variability in the reproductive cycle several Carcharhinid sharks inhabiting the Gulf of Mexico have been observed, suggesting that the reproductive biology within this family needs to be reassessed. The Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, represents an ideal candidate for examining temporal fluctuations in reproductive parameters due to the relatively fast generation time of this species. The objectives of this study were 1) to provide an updated synopsis of the reproductive biology of Atlantic sharpnose sharks from the coastal waters of the northern Gulf of Mexico, 2) compare our findings with those of past studies, and 3) provide contemporary baseline data that could be used to assess the effects of anthropogenic impacts on the reproductive biology of the species. Our data demonstrate that Atlantic sharpnose sharks currently exhibit a protracted mating period, as indicated by the presence of reproductively active adults from March through October. The observed variability in the reproductive cycle of Atlantic sharpnose sharks in the northern Gulf of Mexico could be related to several factors including spatial variability and density dependent factors.

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### **The Deepwater Horizon Disaster – The Effects of Crude Oil on the Immune Cells of Alligator Gar (*Atractosteus spatula*)**

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In response to the Deepwater Horizon disaster, investigations of the effects of crude oil on fish health were made. Oil exposure has been associated with devastating infectious disease outbreaks in wild populations of fish. The links between these outbreaks and oil exposure suggest an associated perturbation of fishes' immune systems. As part of a comprehensive study we determined leukocyte differential changes in peripheral blood in alligator gar sampled from salt water marshes near Terrebonne Bay, LA. These findings were compared to controlled crude oil exposure trial where alligator gar was exposed to 3 different concentrations of crude oil. Peripheral blood and kidney samples were analyzed by

flow cytometry and verified by peripheral blood leukocyte differentials after a 48 hour exposure time to crude oil and after a seven day recovery period. Leukocyte populations were differentiated by forward and side scatter properties and populations were sorted to validate data. Histological analyses are currently underway to give further insight on the effects of crude oil on alligator gar tissues health and inflammatory responses. Alligator gar peripheral blood showed increases in granulocytes including eosinophils due to oil exposure consequently reduced numbers of granulocytes were observed in the kidney of the same fish. Lymphocyte counts in the kidney were also lower in oil exposed fish compared to control fish. These initial observations indicate that fish exposed to oil show a strong immune cell response and prolonged exposure is believed to exert stress that could lead to higher disease susceptibility.

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### **Gross Morphology of the Paddlefish: Developmental Changes in Rostrum Form**

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The rostrum of the paddlefish (*Polyodon spathula*) is an electro-receptive “antennae” used to detect plankton, but ancillary properties are likely during different developmental stages of the fish. Previous studies have shown significant morphological variation among adults within a population and among juveniles from different populations, but no study exists for a wide size range of paddlefish within a single population. We examined 87 paddlefish, 58-1050 mm eye-fork length (EFL), from the lower Mississippi River Basin: 70 preserved specimens in the University of Louisiana at Monroe Museum of Natural History and 17 live specimens from the Bonnet Carré water diversion at Norco, LA. Data were collected for 10 rostrum characters (size, shape, development of ampullae and stellate elements) and 28 body characters (size, shape, fin placement). Relative length of paddlefish rostrum decreased with increasing EFL. Rostrum width was greatest mid-shaft for fish < 245 mm EFL, greatest near the apex for fish 245-670 mm EFL, and greatest near the base for fish > 670 mm EFL. Juveniles, then, can be characterized as having a long elliptic (leaf-shaped) rostrum, sub-adults a mid-sized spatulate (spoon-shaped) rostrum, adults a short linear (paddle-shaped) rostrum. These developmental forms coincide with stage-specific traits: particle-feeding of juveniles, streamlining of sub-adults, and disproportionate mass in adults. They also coincide with variation in physical properties of the rostrum: thin (< 6 mm) and flexible in juveniles, thick (20-36 mm) and rigid in adults. Our data suggest that the rostrum could have a hydrodynamic function in sub-adults (e.g., as a keel) and a mechanical function in adults (e.g., counterbalance to maintain horizontal position during feeding).

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## **Preserving Half a Century of Southern Ichthyology: The University of Louisiana at Monroe Museum of Natural History**

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The fish collection of the University of Louisiana at Monroe Museum of Natural History (ULM-MNH) continues to expand its holdings and activities at a time when the roles of many academic regional museums have been de-emphasized. System for growing, maintaining, and utilizing this collection is the same as that of larger national institutions like the American Museum of Natural History: 1) initial holdings support teaching, research, and outreach activities; 2) activities are documented in publications; 3) documentation justifies financial and logistic support for expeditions and acquisitions that maintain and increase holdings; 4) increased holdings expand museum activities. Nucleus of the ULM-MNH holdings was formed from personal collections made by NHD in Oklahoma during summer 1962 then transported to ULM (née Northeast Louisiana State University). Collection was used in teaching students who obtained additional specimens as course requirements. These provided comparative material for research by graduate students and outside researchers doing taxonomic and field surveys studies, who deposited all reference material, most from Louisiana, Arkansas, and Mississippi. Specimens of unusual taxa, remarkable size, or peculiar anatomy were displayed encouraging deposition of additional specimens by students, alumni, visitors. These activities were documented in various publications: brochures, species checklists, holdings catalogs, and the state reference "Freshwater Fishes of Louisiana" (1974). Institutional and outside support enabled field courses and cross-country collecting trips throughout the southeast, and acquisition of static/defunct collections (private and academic) of regional, national, and international material. Growth, from 44 to 1654+ species and from 205 to 71,000+ lots, has been approximately linear over the greater history of the collection. Existing holdings now enable a greater range of museum activities. In 2012, these included: displays open daily to the general public; seminars and educational workshops; on-site research opportunities; collaboration on an updated state field guide; planned move to a larger, permanent facility.

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## **The Effect of Species Preference on Consistency of Angler Catch-Related Attitudes**

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The justification for the study of catch-related attitudes has been that an understanding of recreational angler attitudes towards catch will aide fisheries managers in the determination of management goals for fisheries resources by identifying whether anglers are most interested in harvesting fish, high catch rates, and/or catching large fish. However, a potential drawback to how catch-related attitude scales have been implemented to date is that the scales have been presented as measuring attitudes towards fishing in general while fisheries management is traditionally done at the species level. For example, Sutton (2003) found that while anglers with negative attitudes towards retaining fish were more likely to release fish they caught, their intention to do so was moderated by whether or not the fish in question was their preferred species. We used data from a statewide survey of licensed anglers in Texas, and a follow-up survey of catfish anglers to examine the consistency of responses on a catch-related attitudes scale in both generic (statewide survey) and species-specific (catfish angler survey) contexts, and determine whether

the consistency of responses varied across species preference groups. We separated anglers based on their most preferred freshwater game fish to pursue, and identified three groups of anglers [bass anglers (N = 180), catfish anglers (N = 135), and crappie anglers (N = 93)] large enough for analysis purposes. Using a series of paired t-tests, we found that catfish and crappie anglers had significantly higher scores on the catching large fish attitude scale in the catfishing specific context, while bass anglers had significantly higher scores on the harvesting fish scale in the catfish specific context. These results suggest that anglers may hold different catch-related attitudes towards different species of fish, and that angler catch-related attitude scale responses should not be extrapolated beyond their most preferred species.

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## CANCELLED

### **Intersex Condition of Shoal Bass (*Micropterus cataractae*) in the Flint River, Georgia**

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We examined male shoal bass (*Micropterus cataractae*) from the Flint River, Georgia, to determine the prevalence of intersex. During March and April of 2010, we sampled 61 shoal bass from six sites along the Flint River. Testes were examined histologically and classified as intersex if the presence of oocytes was noted. Using a severity index we compared samples collected on different dates, from different locations and according to age and testes weight. No significant variations were noted among any of the groupings. The data suggests that intersex condition in shoal bass does not appear severe enough to warrant significant concern at this time and may be a natural phenomenon.

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### **Identifying Metrics that Respond to Stressors in a Regulated River Using a Traditional Reference Site Approach and a Novel Multivariate Approach**

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The fish communities at five sites on the Caney Fork River below Center Hill Dam were sampled seasonally Fall 2009 – Summer 2011. Over 60 species were present in the tailwater, and their distributions were influenced by a strong environmental gradient caused by hypolimnetic discharge and hydropeaking operations. Multimetric indices of biotic integrity are useful for quantifying the impact of environmental stressors on a fish community. We utilized two methods to select, from a suite of over 30 candidate metrics, those that best describe the response of fish communities at the five sites to stressors in the Caney Fork tailwater. The first method involved a traditional reference-site approach, whereas the second method involved a novel approach utilizing multivariate statistics (the BVSTEP procedure in the Primer 6 software package). The reference-site approach selected a suite of seven metrics and the

multivariate approach selected five metrics; three metrics were mutually selected. In regards to describing the response of the Caney Fork fish community to environmental degradation, there is little evidence indicating that one index would perform better than the other. However, the multivariate approach provides an intuitive and unbiased alternative to traditional metric selection procedures.

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### **Age and Growth of Paddlefish (*Polyodon spathula*) in the Large Rivers of Western Kentucky**

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Paddlefish (*Polyodon spathula*) support a lucrative commercial fishery in the large rivers of western Kentucky. With increasing harvest over the past decade, the Kentucky Department of Fish and Wildlife Resources implemented a ride-along program with commercial fishermen to collect data on their harvest during the 2009-2010 fishing season. Twenty four trips with seven different fishermen and numerous visits to local fish markets resulted in data from 2,200 paddlefish harvested from the Ohio, Mississippi, Tennessee (Kentucky Lake), and Cumberland (Lake Barkley) Rivers. We used age estimates from jaw bones (N=576) to assess age structure, growth and mortality of paddlefish from the Ohio River (N=287) and Kentucky Lake and Lake Barkley (N=273). A subsample of jaw bones (N=25) were sent to paddlefish experts in Arkansas and Idaho to assess the precision of age estimates between readers with varying levels of experience using the coefficient of variation (26.4%) and age bias analysis. Aging between two independent readers was more precise (CV=5.99, N=576). Age classes 1-15 and 1-16 were represented from the Ohio River and both reservoirs, respectively. Seven to nine year old fish dominated the age structure of the Ohio River while the most common age in the reservoirs was seven. Annual mortality was higher in the Ohio River (43%) than in the reservoirs (34%) and Ohio River mortality estimates were higher than an estimate recorded in 2006 (21%). However, the lack of precision in age estimation warrants caution in the use of associated population metrics.

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### **A 60 Year Old Trout Stream in Peril: A Case History of the Lower Illinois River Trout Stream in Northeast Oklahoma**

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Tenkiller Ferry Reservoir is a 12,900 acre Corps of Engineers reservoir on the Illinois River in Sequoyah County, Oklahoma. The dam was completed in 1952 and the project began hydropower production in 1953. Rainbow trout (*Oncorhynchus mykiss*) were first stocked in 1952, and were established as the primary mitigation for the loss of the warm water fishery in the last 8 miles of the Illinois River below the dam. The Lower Illinois River became a year-round trout fishery in 1965. It is one of only two year-round trout fisheries in Oklahoma. Studies conducted both prior to the final construction of the dam, and many years since recommend a minimum flow ranging from 50 cfs to 125 cfs to support trout and the downstream aquatic community. No minimum flow or storage of water has been allocated to the trout stream. The water in Tenkiller Ferry Reservoir is now over 100 percent allocated, mainly to power companies and local municipalities. The fishery has historically survived on dam leakage and more recently a temporary donation of water rights from a local industry. In 2010, The Corps of Engineers

began a dam maintenance project that has stopped the majority of the leakage. The diminished volume of water results in frequent violations of state water quality standards, and during the warmer months, water temperatures reach levels lethal to rainbow trout. Trout stockings were recently suspended for only the second time in 60 years as a result of insufficient water quantity and extremely low dissolved oxygen. Local businesses and landowners are concerned about reduced business revenue and a decline in property value. Both state and federal legislators are becoming involved to try to find a solution to the problem.

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### **Reproductive Biology of the Cuban Dogfish (*Squalus cubensis*) in the Northern Gulf of Mexico**

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In the northern Gulf of Mexico, the Cuban dogfish (*Squalus cubensis*) is the most commonly encountered squalid shark in deepwater trawl and longline catches; however, its reproductive biology remains almost completely unknown. To obtain basic reproductive data for *S. cubensis*, 72 males and 176 females were collected throughout the northern Gulf of Mexico while conducting fisheries-independent surveys and port sampling. The median STL at 50% maturity for males was 386 mm. All mature males, regardless of date of capture, had semen present in the ductus deferentes and seminal vesicles. The median STL at 50% maturity for females was 464 mm. Ninety-two percent of all adult females captured were gravid, with brood sizes ranging from 1-4 (mean = 2.14, S.D. = 0.77). Gravid females were collected in all months sampled and constituted 92% of all adult females captured. During mid-late fall, when the majority of samples were collected, embryos were observed in all stages of development, from blastodisc to term fetuses. During the same period, the diameter of the largest ovarian follicle ranged from 5 – 31 mm (mean = 14.96, S.D. = 5.12). The above data indicate that males are capable of reproducing throughout the year and the female segment of the population exhibits asynchronous reproduction with no resting stage.

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### **A Comparison of Fish Communities between an Anthropogenically Modified Study Site and Two Unmodified Sites Downstream in the Pearl River Located in Central Mississippi**

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The Pearl River, located in central Mississippi, has been modified by low-head dams, construction of Ross Barnett Reservoir (RBR), and flood control levees as it flows towards the Gulf of Mexico. The lowhead dam below RBR slows the flow and creates a pool effect, which is different from the downstream reaches. My research compares the fish community above the lowhead dam in Jackson to fish communities of two downstream sites, Georgetown and Wanilla. The fish populations were sampled with high and low frequency electrofishing and seining. Shannon's and Simpson's species diversity indices, individual species length frequency comparisons, riverine fish guild comparisons, and catch rates were used to analyze the three study sites. Species diversity declined from upstream to downstream sample sites. Length frequencies for channel catfish (*Ictalurus punctatus*) and longear sunfish (*Lepomis megalotis*) showed no statistical difference between sites. Spotted bass (*Micropterus punctulatus*) and spotted gar (*Lepisosteus oculatus*) length frequencies differed statistically between Jackson and

downstream locations. Blue catfish (*Ictalurus furcatus*) and flathead catfish (*Pylodictus olivaris*) length frequencies differed between Jackson and Wanilla locations. The number of obligate riverine species increased from upstream to downstream sites while no trend was observed among facultative riverine and lacustrine fish guilds. Flathead and blue catfish dominated the low frequency catch at 17.4 and 5.1 catch per mile (CPM), respectively. Gizzard shad (*Dorosoma cepedianum*), longear sunfish, and spotted gar dominated the high frequency samples. The habitat generated by the lowhead dam appears to be less favorable for intolerant riverine species which need swift water for completion of their life cycle, while other fish populations thrive in the slack water environment.

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### **Distribution Gradients of Age-0 Crappies (*Pomoxis* spp.) within Reservoir Arms**

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A better understanding of age-0 crappie (*Pomoxis* spp.) distributions in reservoirs may improve management of this economically and socially valuable recreational fishery. Age-0 crappies were collected in large arms of four reservoirs within the Yazoo Basin of northwest Mississippi. Our objective was to test if distribution of age-0 crappies changed from the mouth of the arms upstream towards the inlet of tributaries, paralleling observed changes in habitat composition. Crappies were collected using trap nets placed approximately equidistant along the length of arms during late summer (DOY 200-230). An analysis of covariance indicated crappie catch rates were significantly ( $P \leq 0.10$ ) related to net position along the arm, as well as to the interaction between net location and reservoir. The statistics suggested that catch rates increased towards the back of the arms, but the rate of increase differed among arms. Because habitats in arms of reservoirs represent a flooded valley, shoreline habitats near the mouth of an arm are essentially flooded upland environments, whereas habitats near the back of the arms represent the floodplain of the incoming stream and include more stream riparian or wetland environments. Analyses of GIS coverages indicate that the change in age-0 crappie distribution in reservoir arms may be attributable to a gradient in habitat structure. Our results suggest ways to manage nearshore habitats in reservoir arms to promote crappie recruitment.

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### **Swimming Performance of Bighead Carp and Silver Carp: Methodology, Metrics, and Management Applications**

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Bighead carp (*Hypophthalmichthys nobilis*) and silver carp (*H. molitrix*) are native to China but have established expanding populations in the Mississippi Basin. Their voracious appetites and dense populations threaten native species and local economies that depend on native fisheries. The purpose of these experiments is to quantify swimming performance to aid in risk management. Three metrics were used: rheotaxis, endurance, and behavior. Three size classes were tested: small juveniles (36-69 mm total length [TL]), large juveniles (72-116 mm TL) and sub-adults (141-334 mm TL) at speeds ranging from

20-150 cm/s. More than 200 fish were tested, most singly but some in groups of three or five individuals. Juveniles were tested in a 100 liter Blazka swim tunnel, sub-adults in a 1200 liter Brett swim tunnel, both of which provide rectilinear flow. Data was analyzed using frequency of positive rheotaxis, regression models describing the linear or curvilinear relationship between water velocity and swimming endurance, and types and frequency of locomotor behaviors. Rheotaxis was high (> 85% of fish tested) and slightly higher in bighead carp than in silver carp. Swim speeds (200-min sustained, 1-min prolonged, and 0.1-min burst) were greater in larger fish than smaller fish and were greater in bighead carp than in silver carp. Differences between species in endurance were lower for large juveniles (< 15 % of regression predicted values) than were differences between species in sub-adults (> 30% of regression predicted values). Disparities in swim speeds were highest for burst swimming. For both species, primary behavior was pelagic free-swimming, secondary behavior was tail-bracing. Metrics for groups of bighead carp were greater than for individuals. Results suggest that engineering specifications for control measures (e.g., length and velocity of hydraulic barriers) should be based on swimming performance of groups of large bighead carp.

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### **EnviroFish: A Model to Evaluate Fish Spawning and Rearing in Riverine Floodplains**

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EnviroFish is both a modeling approach and computer software. As a modeling approach, EnviroFish estimates the value of floodplain habitat suitable for fish reproduction under a given set of hydrologic and hydraulic conditions. As software, EnviroFish is a Java computer program facilitating the application of the modeling approach. The EnviroFish approach integrates hydrology, hydraulics, land use, and empirically-based knowledge of fish reproductive strategies in riverine floodplains to predict a biological response to different flooding scenarios suitable for standard federal planning processes. EnviroFish can be used to calculate Habitat Units for specific floodplain habitats, with each habitat providing different values for spawning and rearing fishes. In order of least to most preferred habitats, are agricultural fields, fallow fields, bottomland hardwood forests, and floodplain waterbodies. Area can be weighted using a Habitat Suitability Index (HSI), which reflects the biological value of a land use for fish reproduction. Habitat Units are computed by multiplying the average daily flooded area (ADFA) by the associated HSI value--the approach typically used in the Habitat Evaluation Procedures to assess impacts and benefits of water resources projects. EnviroFish was initially developed for flood control projects in the lower Mississippi River Valley. However, the approach is applicable to any alluvial river system where floodplain fish spawning habitat is being managed, mitigated, or restored, by determining applicable land use categories and HSIs for representative fish species. A user's manual has been prepared that discusses the biological basis of EnviroFish, elements of the model, running the software, application considerations, and example problems.

## **Long-term Population Responses of Triploid Grass Carp Stocked to Control *Hydrilla***

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*Hydrilla (Hydrilla verticillata)* has spread to reservoirs across much of the country and ranges from Florida to California and as far north as the Pacific Northwest and New England. Triploid grass carp (*Ctenopharyngodon idell*) have been successfully used as the primary management tool in at least 10 southeastern reservoirs. These fish have been used with less success in Florida due to long-term depletions of non-target vegetation, and there has been little interest in triploid grass carp use across the rest of the country. Monitoring triploid grass carp populations after successful control of hydrilla is important to 1) determine maintenance stocking strategies that prevent hydrilla regrowth from tubers and to 2) evaluate potential adverse impacts (e.g., elimination of non-target aquatic vegetation). Triploid grass carp populations in Mountain Island Lake and Lake Norman, North Carolina were monitored after control of hydrilla and compared to a similar population in the Santee Cooper reservoirs, South Carolina by comparing population parameters derived use of both scales and otoliths. The populations in the piedmont, North Carolina reservoirs exhibited high mortality and stunting after control of hydrilla. These piedmont systems, absent hydrilla, support paltry levels of submersed vegetation and may not be able to even support grass carp populations estimated at one fish per every eight surface acres of the reservoir. In contrast, the coastal plain, Santee Cooper triploid grass carp population had much greater survival and growth rates - possibly because of forage provided by abundant floating and non-target submersed aquatic vegetation. Because of the highly different responses of triploid grass carp following control of hydrilla, long-term monitoring is suggested. Monitoring can be improved by yearly stocking of token numbers of triploid grass carp which allows for estimation of survival. Skilled bowfishers have repeatedly provided cost-efficient collections compared to conventional sampling using nets or electricity.

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## **Investigating Potential Reproductive Anomalies in the Spiny Dogfish (*Squalus acanthias*) along the United States East Coast**

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Spiny dogfish (*Squalus acanthias*) are a k-selected species, which display a long gestation period, low fecundity, and late maturation. Increased fishing pressure from 1987 to 1996 along the U.S. east coast resulted in the stock collapsing below mandated biomass threshold levels. Despite the implementation of a strict management plan in early 2000, the aforementioned life history characteristics of this shark suggested that the population was incapable of rebounding until 2020. However, between 2005 and 2008 a four-fold increase in the biomass of spiny dogfish was observed, an anomaly that is biologically unrealistic for this species. One possible explanation for the biomass increase may be related to the

reproductive biology of this species. Although previous research has suggested a 22-month gestation period along the U.S. eastern seaboard, past studies have been geographically isolated, are antiquated, and have not analyzed the reproductive cycle over the purported 22-month gestation period. To better understand how the reproductive biology may be contributing to the observed population increases, we have begun monthly collections of female dogfish from distinct regions along the U.S. east coast including New England, New Jersey, and North Carolina. Thus far, a total of 618 female dogfish; 343 from New England, 181 from New Jersey, and 94 from North Carolina have been collected. Preliminary data suggests that regional variability in reproductive events (i.e. parturition), as well as an overall shorter gestation period may exist for this species along the U.S. east coast.

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## **A Classification System for Large U.S. Reservoirs and its Relationship with the Fishery and Fish Community**

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In order to prioritize conservation efforts, the Reservoir Fish Habitat Partnership needs information regarding the condition of reservoir fish habitats. Classification of U.S. reservoirs provides a framework within which to assess fish habitat condition. Using a combination of ecologically-based spatial partitioning and cluster analysis, we developed a classification system for large reservoirs. First, we conducted an online survey of fisheries biologists to evaluate habitat of reservoirs ( $\geq 100$  ha) in the conterminous U.S. Questions covered numerous habitat attributes – including availability, water quality, water regime, and degradation processes – as well as selected aspects of the fish community and recreational fishery. A total of 1,276 useable responses were received. Second, we examined several extant systems of spatial partitioning reflecting ecological differences among regions (i.e., Omernik's Level II and III ecoregions, EPA Wadeable Streams Assessment, and Landscape Conservation Cooperatives). Using habitat variables from the survey, we conducted cluster analysis within each region of each partitioning system. Our goal was to balance recognition of inherent ecological differences (by using a partitioning system) and recognition of natural groups within the data. Our final classification system utilized EPA Wadeable Streams Assessment regions and yielded 24 unique reservoir classes that showed various types and levels of habitat impairment. Lastly, relationships between reservoir classes and fish variables were explored using canonical discriminant analysis.

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## **The Effect of Oil Dispersants and Salinity on the Biodegradation of South Louisiana Crude Oil and Impacts on Gulf Killifish (*Fundulus grandis*)**

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Chemical dispersants like COREXIT are an important technology in the remediation of oil spill in the aquatic environment and facilitate the chemical, physical, and biological degradation of crude oil. Further, it has been demonstrated that environmental salinity is an important factor in the effectiveness of the dispersants on the breakdown of crude oil. Thus the purpose of this work is to investigate the effect of a dispersant on the degradation of Crude Oil and study the effects of varying oil degradation on

toxicological and physiological response in a common estuarine fish. We hypothesize that biodegraded oil in the presence of dispersant will persist longer and have greater toxicity than non-dispersed oil. Laboratory mesocosms were designed with oxic water at salinities of 4, 12, or 18 g/L overlying sediment that has an oxic surface layer and an anoxic subservice, simulating various estuarine conditions seen along the Gulf coast. Mesocosm water was spiked with various combinations of ~ 2.7g/L of Crude Oil and ~0.25g/L of COREXIT 9500. Treatments consist of water mixed with crude oil alone, COREXIT alone, a combined exposure to crude oil and COREXIT, and a control and allowed to biodegrade in mesocosms for 1, 4, and 16 weeks prior to harvesting water for analytical analysis and acute toxicity testing. Acute toxicity was assessed using a 96-hr static-renewal acute toxicity bioassay and the common Gulf killifish (*Fundulus grandis*). Results of these projects are ongoing, however, oil alone has shown to be non-lethal at 1 and 4 weeks while dispersed oil demonstrated marked increased lethality. These results indicate that dispersants increase the acute toxicity of oil after both one and 4 weeks of weathering at all salinities. Further examinations will determine the extent of sub lethal effects from these exposures using biochemical and molecular tools.

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### **Pallid Sturgeon Habitat Use and Selection in the Lower Mississippi River**

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The pallid sturgeon (*Scaphirhynchus albus*) is an endangered riverine sturgeon with historical distribution restricted to the Missouri and lower Mississippi river basins. Although rare, pallid sturgeon in the lower Mississippi River remain self-sustaining, and information about habitat use is important to conserve this species. Seventy-four pallid sturgeon were collected, implanted with acoustic tags, and actively tracked in a 40-km reach of the lower Mississippi River from March 2009 through April 2011. Thirty-five individual fish were found at least once for 165 total detections. Fifty percent of pallid sturgeon detections were in relatively narrow ranges of depths (6.2-13.6 m) and surface current velocities (0.64-1.05 m/s). Pallid sturgeon selected island-tip habitats and to a lesser degree natural bank, sandbar, and wing dike habitats. Although frequently used, pallid sturgeon exhibited negative selection for main channel and revetted bank habitats. Habitat use was associated with river stage and water temperature and appears to be seasonal.

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### **Can We Expand At-Sea Sampling for Fish Reproductive Potential Using Frozen Ovaries?**

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In order to estimate reproductive potential in a stock exhibiting indeterminate fecundity, best practices may include sampling from multiple sources over an extended spawning period and across the stock range. Thus more sampling may be desired from on-board observers who can freeze samples when

constrained from using preservatives. Our objective was to compare reproductive measures from red snapper (*Lutjanus campechanus*) ovaries that were either frozen and later preserved (10% neutral buffered formalin), or immediately preserved in formalin. Weight regressions were made for conversion purposes. Histological comparisons were made, largely to gauge the ability to estimate spawning fraction and determine gamete stage. A comparison/conversion was also conducted for batch fecundity. We found that red snapper ovary weight relationships were essentially 1:1 for fresh, frozen, or thawed weights across a 250 g range. Histological quality factors were significantly different ( $p < 0.0001$ ) based upon a paired Wilcoxon test confirming the value of initial formalin preservation over freezing. However, there was 90% agreement on leading gamete stage and 82% agreement on presence/absence of postovulatory follicles between the two approaches suggesting that adequate information may be gained from frozen tissue. Results will be presented on postovulatory age interpretation and batch fecundity relationships.

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### **Establishing Instream Flow Recommendations on the Lower San Antonio River**

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Senate Bill 2, enacted in 2001 by the 77<sup>th</sup> Texas Legislature, established the Texas Instream Flow Program, whose purpose is to perform scientific studies to determine flow conditions necessary for supporting a sound ecological environment in the state's major rivers. This presentation will highlight the work performed on the Lower San Antonio River Basin, including how fish habitat-flow relationships, along with information and data generated from other disciplines participating in this ongoing study, are being used to guide instream flow recommendations.

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### **Evaluation of Fishing Summer Camps at Lucchetti Reservoir, Puerto Rico**

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During June 2011, 2, 6-day angler recruitment summer camps were held at Lucchetti Reservoir to expose local youth to the reservoir, recreational fishing opportunities there, and basic information about fish and fishing resources. A total of 36 children participated. Age distribution of participants was 10-11 years for first camp and 12-15 years for second camp. During each camp a series of workshops and field trips were conducted. Camp effectiveness was evaluated through a post-camp telephone survey with participants. The survey measured participants' return rate to the resource, preferences and information retained from the materials presented at the camp. About 61% (n=21) of the participants completed the survey. When combining data from both camps, 23% of the participants returned to the Reservoir after the camps, however participants from the camp containing older children returned at a higher rate. The majority preferred to fish from a boat (86%) and to use rod and reels (87.5%). Catfish and bass were their favorite species to catch. Participants from the second camp preferred outdoors activities such as camping and fishing while the younger group preferred playing sports. A higher percentage of the younger children were able to correctly answer questions about material that was presented during the

camps. In conclusion, the younger participants appeared to absorb more information but were less likely to return to the resource and participate in outdoor activities, while the older participants had a higher rate of return to the resource, and more preferred outdoor-related activities. Future summer camps should be carefully evaluated to determine the effectiveness of the camps at recruiting youth into fishing on short and long-term basis.

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### **Applying Travel Cost Method to Striped Bass (*Morone saxatilis*) Angler Visitation at Lewis Smith Lake, Alabama**

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Lewis Smith Lake is an 8,853 ha recreational fishery within the Black Warrior River basin near Jasper, Alabama. A recent study found that striped bass (*Morone saxatilis*) do not significantly impact largemouth bass (*Micropterus salmoides*) and Alabama bass (*M. henshalli*) through competition and predation, though many anglers still believe this to be true. Alabama Division of Wildlife and Freshwater Fisheries annual stocking of striped bass in Lewis Smith Lake costs are compared with the regional economic gain from the existence of this fishery. The objectives of this study were to: 1) estimate total fishing effort and trip expenditures by species; 2) estimate distribution of striped bass expenditures and tax revenue into local communities; 3) estimate striped bass angler consumer surplus; and 4) understand the socioeconomic characteristics of striped bass anglers. A combination of nonuniform probability sampling and travel cost method was used to place an economic value on the striped bass fishery. Effort was estimated at 233,756.31 hours for all species. Anglers primarily targeted largemouth and Alabama bass for 66% of the total effort, striped bass with 23%, and crappie (*Pomoxis* spp.) with 10%. Striped bass anglers went on 10,206 trips during the 12 month sample period and had the highest expenditures on a per visit basis. A cost-benefit analysis revealed that annual stocking costs were justified when compared with state and local tax revenue generated from striped bass angler expenditures.

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### **Factors Influencing Shark At-vessel Mortality during Fishery-independent Bottom Longline Surveys in the U.S. Gulf of Mexico and the Western North Atlantic Ocean**

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Many elasmobranchs have life histories and reproductive strategies that make them vulnerable to fisheries overexploitation. The U.S. commercial bottom longline fishery utilizes gear soak times up to or in excess of 12 hours and this soak period has been shown to correlate to at-vessel mortality for many shark species, especially those that use obligate ram ventilation. The NOAA/NMFS/Southeast Fisheries Science Center, Mississippi Laboratories bottom longline survey utilizes only 1 hour soak times per set, however, even with this soak time at-vessel mortality still occurs. The purpose of this research was twofold: 1.To

determine mortality rates for seven shark species commonly-caught by commercial bottom longline fisheries in the Gulf of Mexico and western North Atlantic: tiger shark (*Galeocerdo cuvier*), nurse shark (*Ginglymostoma cirratum*), bull shark (*Carcharhinus leucas*), scalloped hammerhead (*Sphyrna lewini*), spinner shark (*Carcharhinus brevipinna*), blacknose (*Carcharhinus acronotus*) and Atlantic sharpnose (*Rhizoprionodon terraenovae*); 2. Investigate specific biological, technical, and/or environmental factors correlated to at-vessel mortality. Preliminary results have shown that dissolved oxygen (DO)(ppm) is negatively correlated with at-vessel mortality for scalloped hammerhead, spinner, blacknose, and sharpnose sharks. In addition, fork length is negatively correlated with at-vessel mortality for scalloped hammerhead, blacknose, and Atlantic sharpnose. At-vessel mortality and correlated factors are expected to be exacerbated by increased soak times. Considering commercial soak times are several times greater than the survey soak time used in the NOAA/NMFS study, reducing soak times and avoiding areas of low dissolved oxygen in commercial shark fisheries would decrease shark at-vessel mortality in the commercial bottom longline fishery. Also, the distinctions found between correlations to mortality among these species could facilitate future species-specific management for sharks.

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### **Climate Change Impacts on the Spread of Invasive Nile Tilapia in the Northern Gulf of Mexico**

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Fundamental niche maps derived from controlled experiments can greatly improve our ability to predict the distribution, dispersal ability, and survival success of nonindigenous fishes in North America. Such studies can provide the basis for better-informed management policies and monitoring programs. In this study, we focus on Nile tilapia (*Oreochromis niloticus*); one of the most widely cultured species throughout the world and a species that has escaped local aquaculture facilities to become established in coastal Mississippi. Logistic regression models were developed from experimental data to predict the probabilities of Nile tilapia survival, growth, and reproduction across a salinity gradient (0-60, by increments of 10) at typical summer temperature (14 °C) and winter temperature (30 °C). Models were combined with universally kriged salinity data derived from multiple long-term data sets to map the species' fundamental niche in Mississippi coastal waters during normal salinity years (averaged from January 1992 to March 2011) as well as emergent salinity patterns under different scenarios of climate change (based on discharge rates for the Pearl, Wolf, Biloxi and Pascagoula rivers during extremely wet and dry years). Mapping results show that Nile tilapia is capable of surviving and dispersing throughout Mississippi's coastal waters during normal summers, but growth and reproduction are limited to freshwater and oligohaline waters near river mouths. Likewise, overwinter survival is restricted to river mouths, and both growth and reproduction are negligible during winter regardless of salinity. During extremely wet and dry years in the summer, the areas where Nile tilapia could survive, grow, and reproduce increased (2-47%) and decreased (87-92%), respectively. In the winter, survival habitats decreased by 86% in dry years and increased 368% in wet years. These results should be considered in the siting of future aquaculture facilities and monitoring efforts.

## Seasonal Diets of Spotted Gar in the Upper Barataria Estuary

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The upper Barataria Estuary (UBE) no longer receives an annual floodpulse due to hydrological modifications that separated the estuary from the Mississippi River. Separation of the UBE from the Mississippi River has reduced the lateral exchange between the interior bayous and floodplain. Food availability for opportunistic feeders such as spotted gar (*Lepisosteus oculatus*) may be altered in the UBE as compared to a functional large river floodplain. The purpose of this study is to quantify the seasonal diets of spotted gar and estimate the seasonal relative abundance of crayfish in the UBE. Twenty spotted gar were collected monthly in Spring, Summer, and Fall 2011 using 25.4 mm bar mesh gill nets that were deployed parallel to the bank for one hour intervals. Weekly crayfish catch per unit effort was calculated as the number of crayfish (*Procambarus* spp.) collected per 15 Gee minnow traps baited with commercially available bait and deployed overnight. Stomach contents of each spotted gar were identified to the lowest possible taxon, and were categorized as fish, crayfish, shrimp, amphibian, reptile, insect, detritus, unidentifiable, or empty. Overall mean percent empty stomachs was 36.4 and did not differ among seasons. Based on multivariate analysis of variance spotted gar diets differed among Spring, Summer, and Fall. Fish were more abundant in the diet in Spring and Summer than the Fall and insects were more abundant in Fall than the Summer and Spring. The abundance of crayfish and shrimp in the diet was similar for all three seasons, even though crayfish were more abundant in Spring than in Fall. In other studies, crayfish were a major component of spotted gar diets, although in our study fish and insects dominate the spotted gar diet in the UBE. The lack of a predictable floodpulse may limit spotted gar access to floodplain prey items in the UBE.

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## Age Determination Using Dorsal Spines of the Cuban Dogfish (*Squalus cubensis*)

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The genus *Squalus* contains more than twenty small (<1.5 meter) shark species, characterized by the lack of an anal fin and the presence of an ungrooved fin spine on both dorsal fins. Species in this genus are difficult to distinguish morphologically, though recent taxonomic work has identified significant speciation in Indo-Pacific waters, with eleven new species listed. In the northern Gulf of Mexico, the genus is represented by at least two species. Although misidentification is common, the Cuban dogfish, *Squalus cubensis*, is thought to be the most frequently caught. Several *Squalus* species are harvested from Brazil to Argentina, however, the Cuban dogfish has little to no commercial value to US fleets, and therefore catches could be grouped with other squalid species under the title of “spiny dogfish.” Though adequate stock assessment requires life history data, little information exists for *S. cubensis* than for more valuable species such as *S. acanthias* and *S. megalops*. Limited studies suggest that the Cuban dogfish reaches a maximum known total length of 110 centimeters and matures between 50 and 75 cm. The use of vertebrae for age determination is well documented in shark species. However, the squaliform sharks

provide another calcified structure in the form of the first and second dorsal spines. Several studies have obtained age information from these spines, and *S. acanthias* is almost exclusively aged using this structure. The dorsal spines were used to determine age for *S. cubensis* (n=100). Band counts on the enamel cap of the dorsal spine were used for age determination.

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### **Interactions between Fish and Anglers: A Spatial Analysis of Fish Vulnerability to Angling**

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Most stock assessment models assume that fish populations are comprised of fish that are equally vulnerable to angling. However, vulnerability to angling is influenced by genetic traits, habitat selection, seasonal and diel movements, angler behavior, angler effort, and fish learning. Cox and Walters hypothesized that there is a portion of the population that is invulnerable to angling at any given time. We evaluated this hypothesis with a field study comparing fish distribution to spatial patterns in angler effort. A total of 81 largemouth bass were implanted with radio tags, 64 were tagged onshore and 17 were tagged offshore in October 2010. Fish were found an average of 34 times from November 2010 to October 2011. Thirty three fish were caught and released and eleven were harvested. A total of 316 bass anglers were mapped with over 90% fishing within 50 m from shore, indicating that fish located offshore were substantially less vulnerable to angling than fish near the shoreline. The biweekly movement rate between shoreline habitat and the offshore habitat was 0.15 (0.13 to 0.17), which means that 15% of the onshore fish moved offshore, and vice versa, every two weeks. This indicates that there was a portion of the population that was relatively invulnerable to angling, which could influence the utility of regulations to protect stocks from overfishing.

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### **Survey of Elasmobranchs in Northeast Florida Waters: Abundance, Distribution, and Identification of Potential Shark Nursery Habitat**

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It is widely accepted that essential fish habitat (EFH) plays a crucial role in the life-history of many marine species. For many shark species, EFH includes nearshore and estuarine waters that serve as nursery habitat where sharks are born and/or juveniles spend the early part of their life. Examination of the literature shows the presence of shark nurseries in most major estuaries along the Atlantic and Gulf Coasts of the United States, however, there is a noticeable gap in data from the Northeast region of Florida. In May 2009 a long term bottom longline survey was initiated to assess the use of estuaries in Northeast Florida as shark nursery habitat. A total of 314 longlines were set in Nassau and Cumberland Sounds from June 2009 – October 2011 and 632 sharks, comprising 11 species, were caught. Atlantic sharpnose sharks (55.7%) and blacktip sharks (15.3%) were the most abundant species in both Cumberland and Nassau Sounds. Young of the year and juvenile individuals were caught for 9 of the 10 species. The data from this survey represents the first attempt to characterize the abundance and distribution of sharks in northeast Florida waters and to identify potential shark nursery habitat in this area.

## **A Comparison of Liver and Belly Flap for Evaluating Striped Bass Diet using Fatty Acid Signatures**

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The process of fatty acid conservation from prey to predator has been well studied in aquatic systems. Predators incorporate prey fatty acids, often with little to no modification into their own tissues. This fact has been the basis for trophic studies in many different systems. However, there has been little research to determine which tissue/s in carnivorous fish offer the clearest picture of trophic dynamics. The goal of this study was to compare fatty acid incorporation between liver and adipose tissue in striped bass (*Morone saxatilis*). To accomplish this goal, striped bass were fed a baseline diet of bay anchovy (*Anchoa mitchilli*) for four weeks, followed by six weeks of being fed a diet consisting of spot (*Leiostomus xanthurus*). After six weeks, striped bass were fed Atlantic menhaden (*Brevoortia tyrannus*). There was an increase in lipid content in both adipose and liver tissue once the diet was switched to menhaden. The entire fatty acid signature did not change to reflect the new diet of menhaden, but certain marker fatty acids were indicative of the switch. While both tissues recorded the diet change, adipose tissue sampling offers a possible non-lethal approach versus liver tissue.

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## **The Chandeleur Islands Serve as a Nursery Ground for Lemon Sharks (*Negaprion brevirostris*).**

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Anecdotal evidence suggested that immature lemon sharks (*Negaprion brevirostris*) occur at the Chandeleur Islands in southeastern Louisiana. From May 2009 to August 2011, the Nekton Research Laboratory at the University of New Orleans regularly sampled habitats at the Chandeleur Islands to confirm the presence of immature individuals of this species. During these efforts, 126 (59 males and 67 females) immature lemon sharks (neonates, young-of-the-year, and juveniles) were collected. Each shark was PIT tagged and a tissue sample was taken for genetic analyses. Sizes ranged from 56 – 177 cm tail length. Based on a review of current literature, recapture data, and microsatellite analysis it was possible to classify the Chandeleur Islands as a elasmobranch nursery ground under the definition presented by Huelgel *et al.* (2007). Current literature suggests that the Chandeleur Islands are the only area in the northern Gulf of Mexico where neonatal lemon sharks have been recorded. Results from a combination of SPOT 5 satellite tags, PIT tags, and FLOY tags show that immature *N. brevirostris* at the Chandeleur Islands remain in the vicinity of the islands for at least several months. To determine the extent of site-fidelity, microsatellites were analyzed using COLONY. These results show that for the 126 sharks there were only 52 mothers, 19 of which returned across years to pup a new litter. The combination of this information indicates that the Chandeleur Islands are the northern-most documented nursery ground for this species. Special care should be given to this habitat especially considering the potential impacts of the 2010 Deepwater Horizon oil spill and subsequent oil prevention measures. Further genetic research is being conducted to determine if there is any separation between this population and other known nursery grounds.

## **Acoustic Telemetry of Spotted Seatrout (*Cynoscion nebulosus*) at Hurricane Katrina Reef, Biloxi, Mississippi**

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Spotted seatrout, *Cynoscion nebulosus*, is a highly prized recreational fish that inhabits nearshore estuarine waters of the Gulf of Mexico. Preliminary mobile hydrophone surveys in Biloxi Bay, Mississippi suggest that spawning capable males utilize an artificial structure (Hurricane Katrina Reef) composed primarily of concrete rubble throughout their spawning season. The objective of this study was to examine the movement patterns, use and fidelity of spawning capable spotted seatrout at the reef during the 2011 spawning season, May - September. An array of eight Lotek WHS 2000 receivers was deployed around the reef in May and monitored until December for acoustic transmissions from mature spotted seatrout that were caught on site (using hook and line) and were surgically implanted with Lotek MM-R8-SO transmitters in May and June. When possible sex was determined during surgery - nineteen fish were implanted (4 males, 12 females, and 3 sex unknown). The mean total length of the fish was 48.11 cm ( $\pm 9.2$ ). Data indicate significant movement of tagged fish around the entire reef and a high degree of fidelity to the site. Future research on spotted seatrout at Katrina Reef should include hydrophone surveys in conjunction with the movement data to document and verify spawning activity.

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## **Ecological Responses to Flow Alteration in the South Atlantic Region: A Meta-Analysis of Regional Literature**

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We recently compiled literature to provide a body of knowledge on empirical and theoretical relationships between flow and ecology in the South Atlantic region and support efforts to develop ecological limits of hydrologic alteration and environmental flow standards. Our goals were to 1) conduct a literature review, 2) develop a database of meta-data associated with each source of information, 3) summarize the key findings, and 4) conduct a qualitative and quantitative analysis of generalized relationships between altered flow and ecology. We gathered information through database searches, internet searches, and contacting representative agency personnel within the South Atlantic region. We found a total of 186 sources that provided a qualitative or quantitative relationship between flow and ecology within states encompassing the South Atlantic region. We found that ecological responses to natural flow variation were highly variable regardless of the direction and magnitude of changes in flow. One exception was drought, which was primarily associated with more negative than positive ecological responses. In contrast to natural flow variation, ecological responses to anthropogenic-induced flow alterations were consistently negative regardless of the direction and magnitude in flow alterations. Reservoir operations were predominantly associated with negative ecological responses. We used regression trees and random forests to determine what predictors were most important in determining the direction and magnitude of ecological responses to changes in flow. Our results suggested that ecological group and the source of flow change (natural versus anthropogenic) were the most important predictors of ecological responses. In addition, the degree of flow alteration (% change) and the flow sub-component were important predictors

of ecological responses. This study provides an initial framework to understand potential ecological responses to changes in flow, more research is needed to isolate quantitative, predictable relationships.

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### **Differences in Centrarchid Condition Factor among Macro- and Meso-Habitats in the Atchafalaya River Basin, Louisiana**

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The Atchafalaya River basin (ARB), a 5,000 km<sup>2</sup> river-floodplain system in south-central Louisiana, is comprised of lakes, natural bayous, canals and bottomland swamps. The ARB supports a viable recreational fishery, with anglers pursuing members of the Centrarchidae family including largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), warmouth (*Lepomis gulosus*) and longear sunfish (*Lepomis megalotis*). In this presentation, we examine the relationships between each species' Fulton condition factor with distinct macro- and meso-habitats throughout the ARB and physicochemical parameters. Macrohabitats were divided into 4 classifications, including natural bayous, lakes, open canals and dead-end canals. Mesohabitats were defined as wood derived structure (brushpiles, live cypress trees, deadfalls, stumps) and aquatic vegetation derived habitat (submerged and floating vegetation). Throughout the months of August-September 2011, 12 sites were sampled and a total of 922 centrarchids were included in these analyses. Statistical analyses included analysis of variance and general linear mixed models. Mean condition of largemouth bass, black crappie and bluegill was higher in lake, natural bayou and open canal macrohabitat than dead-end canal macrohabitat, while a significant difference was not detected for longear sunfish or warmouth. Mean condition of largemouth bass, black crappie and bluegill was significantly higher among wood derived mesohabitat than aquatic vegetation mesohabitat, while there was no difference for longear sunfish and warmouth. The general liner mixed model revealed that largemouth bass and bluegill condition was influenced by DO differential between surface and bottom and current velocity, whereas black crappie condition was influenced by current velocity and channel width. In conclusion, many centrarchids throughout the ARB were in better condition when associated with wood derived mesohabitat, while the lowest condition factors were characterized by centrarchids sampled in dead-end canal macrohabitat.

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## Demographics of a Commercially Exploited Population of Flathead Catfish in the Wabash River

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Flathead catfish, *Pylodictus olivarius*, are a popular game fish in the Midwestern United States. In the lower 322 km of the Wabash River, flathead catfish are commercially harvested by Illinois and Indiana fishers. Current management regulations are different between the two states. Illinois and Indiana have minimum size limits of 381 and 254 mm respectively. Indiana is in the process of changing their minimum size limit to 381 mm and allowing only one fish over 889 mm to be harvested. Our project will assess the current status of flathead catfish in the Wabash River to inform potential management options for the state of Illinois. We sampled flathead catfish using AC and DC electrofishing during the summer of 2010 and 2011. In 2011, we also set hoopnets and trotlines. To estimate age, we removed pectoral spines from all fish greater than 200 mm. Catch per unit effort (CPUE) was higher for DC electrofishing (32.7 fish/hr) compared to AC electrofishing (2.8 fish/hr). Hoopnetting had a CPUE of 1.1 fish/net night and trotline proved ineffective for flathead sampling. Hoopnetting captured larger fish than either gear type. We aged 68 flathead catfish from 2010. Mean age and length of the flathead catfish was 2.9 years and 363.49 mm. DC electrofishing seems to be a more effective way to sample flathead catfish than AC electrofishing. However, in order to capture larger fish sampling must include hoopnetting.

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## Endocrine Disruption in Juvenile Fathead Minnows (*Pimephales promelas*) Exposed to Cyanobacteria

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Early-life exposure of male fish to estrogens such as natural and synthetic hormones in treated municipal wastewater is known to cause endocrine disruption, including intersex (oocytes in testicular tissue). Recent data from our lab indicated that intersex fish are also found at a high rate in small impoundments (ponds) that do not receive wastewater and have no other known source of estrogens. However, another recent study suggested that the cyanobacteria *Microcystis aeruginosa* may produce phytoestrogens. Cyanobacteria blooms are common in eutrophic ponds so our goal was to determine if cyanobacteria are estrogenic to fish. In a lab study, juvenile fathead minnows (*Pimephales promelas*) exposed to live and dead *Microcystis* were stimulated to produce vitellogenin, a protein biomarker of estrogen exposure, while other common algal species did not induce this estrogen-sensitive response. We then measured vitellogenin in juvenile fish exposed to a range of *Microcystis* concentrations to determine the dose-response characteristics. Results of a preliminary field study were less conclusive but indicated that vitellogenin is up-regulated in some eutrophic ponds. Our work indicates that environmentally relevant concentrations of *Microcystis* caused an estrogenic response in fish which may, at least in part, explain the high levels of intersex found in ponds.

## Red Snapper Juvenile Recruitment during the 2010 Deepwater Horizon Oil Spill

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Small artificial reefs (1.3 m<sup>3</sup>) were built and surveyed in the northern Gulf of Mexico to examine juvenile red snapper *Lutjanus campechanus* recruitment in 2010 and 2011. These surveys coincided in both time and place with the Deepwater Horizon oil spill in 2010, which allowed comparisons during and after the spill. Red snapper were counted and sizes estimated by SCUBA visual surveys. The first reef set (n=10, Jul 2010) was quickly (Aug 2010) populated by age-1 red snapper (mean±SD = 6.8±3.5/m<sup>3</sup>), and showed low age-0 red snapper abundances (1.0±1.4/m<sup>3</sup>). The second set (Aug 2010) placed reefs 0.5 km (n=10) and 6 km (n=10) inshore from the first set. These inshore reefs showed significantly higher abundances of age-0 red snapper in Sept 2010 (17.0±8.5/m<sup>3</sup>) and Oct 2010 (22.5±7.7/m<sup>3</sup>). In the third set (Jul 2011) reefs were placed 0.5 km east (n=10), 30 km east (n=10), and 30 km west (n=10) of the 2010 inshore reefs. Age-0 red snapper were significantly more abundant (66.6±29.2/m<sup>3</sup>) on the west site in early Aug 2011. However, low dissolved oxygen (< 0.4 ppm) levels were measured at the west site in late Aug 2011 and showed significantly lower red snapper densities (2.4±7.6/m<sup>3</sup>) compared to the center (58.7±29.5/m<sup>3</sup>) and east site (11.1±5.5/m<sup>3</sup>). Dissolved oxygen levels increased to 6.3 ppm in Oct 2011, but age-0 red snapper densities were still significantly lower at the west site (8.9±5.0/m<sup>3</sup>) compared to the center (37.2±18.0/m<sup>3</sup>) and east sites (13.7±5.7/m<sup>3</sup>). These patterns suggested that recruitment had not recovered from the earlier low DO event at the west site. In the present study age-0 red snapper abundance patterns appeared to be driven by dissolved oxygen levels, and the presence of age-1 red snapper, and at this time it may be difficult to identify any possible oil spill effects on these recruits.

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## Characteristics of Two Self-Sustaining Reservoir Populations of Paddlefish in Northeast Oklahoma

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Oklahoma has several self-sustaining populations of paddlefish (*Polyodon spathula*) that support sport fisheries. The most important of these is in Grand Lake O' The Cherokees (Grand Lake). The Oklahoma Department of Wildlife Conservation (ODWC) established the Paddlefish Research and Processing Center (RPC) on Grand Lake in 2008. This installation increased communication with paddlefish anglers who complained of decreased fish size on Grand Lake. Simultaneously, population monitoring on Keystone Reservoir (Keystone) showed that paddlefish there tended to be larger than from Grand Lake. Our objectives for this study were to: 1) estimate and compare characteristics of these two paddlefish populations, and 2) determine differences in primary productivity, zooplankton structure, and fishing pressure between reservoirs. Paddlefish gillnetting data from winter 2010 showed no significant difference in relative abundance between the populations however, differences in fish size were observed. Mean lengths for both male and female fish from Keystone were longer than those from Grand Lake. Post-season paddlefish angler surveys indicated that in 2010 58% of respondents fished for paddlefish in Grand Lake, while 9% fished in Keystone. Age, growth, and mortality are being evaluated, as are differences in reservoir productivity and zooplankton structure.

## Age and Growth of Northern Snakehead in Potomac River Tributaries, Virginia

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Northern snakehead *Channa argus* were first documented in the Potomac River system in 2004. Since that time, their population has expanded in range and number, yet relatively little is known about key population parameters including age and growth. Lack of known age fish with which to compare otoliths from wild fish has hindered verification, and northern snakehead otoliths are particularly irregular, sometimes opaque, and show great variability in morphology between individuals. We compared growth increments (mm/d) of recaptured T-bar anchor tagged fish ( $n=34$ , median time-at-large 159 days) to otolith annuli from fish sacrificed in 2011 ( $n=104$ ). Otolith transverse perspectives were viewed “cracked” with transmitted light while immersed rather than with surface readings of whole otoliths – the predominate prior methodology. Readings from fish aged 1-4 suggested initial growth was much faster than previously reported before reaching an asymptote, but length at age was highly variable. Annual growth increments for fish aged 1-4 (mean length at age of 402, 566, 633, and 732 mm TL, respectively) were converted to estimated daily growth (mm/d) which was reasonably similar to daily growth of recaptured tagged fish. For example; fish tagged between 400 and 500 mm TL ( $n=15$ ) grew an average of 0.55 mm/d, while the growth increment for age 1 and 2 otolith fish was 0.45 mm/d. Generally, minimal growth was observed after fish attained 700 mm TL (age 4), although one individual was 864 mm TL (age 4) and exceeded the Von Bertalanffy  $L_{inf}$  of 826 mm ( $K$  was 0.46). Age 7 was the oldest individual observed (647 mm TL).

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## Southeastern Blue Suckers (*Cycleptus meridionalis*) in the Louisiana Waters of the Pearl River: Low Catches and Limited Range of Targeted Habitats Suggest Continued Concerns

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Riverine fisheries management programs often do not focus on non-sport fish such as catostomids, yet many suckers have become threatened or endangered throughout river systems in the United States because of habitat alterations. In the Pearl River, sedimentation, dam construction, and modifications have negatively impacted habitats used by southeastern blue suckers *Cycleptus meridionalis*, a species of concern in both Louisiana and Mississippi. The principal objective of this project is to investigate habitat use and demography of historically commercially important southeastern blue suckers in the lower Pearl River. During electrofishing surveys in 2010 and 2011, we observed significantly lower catch rates for southeastern blue sucker (Mean CPUE = 0.0435/minute) relative to three other common benthic Pearl River fishes, including smallmouth buffalo *Ictiobus bubalus* ( $P<0.0005$ ), channel catfish *Ictalurus punctatus* ( $P<0.0001$ ) and flathead catfish *Pylodictus olivaris* ( $P<0.005$ ). However, CPUE for southeastern blue suckers was similar to quillback *Carpionodes cyprinus* ( $P=.999$ ) and highfin carpsucker *Carpionodes velifer* ( $p=0.999$ ), suggesting that river modifications may have affected the entire catostomid assemblage in the lower Pearl River system (river redhorse *Moxostoma carinatum* may also have been extirpated from this portion of the river over the last century). A mark and recapture population analysis has yielded a low population estimate for southeastern blue suckers, which combined with the low CPUE

values for other catostomids indicates that suitable habitat availability may be limiting populations of benthic suckers in the southern Pearl River. Movements and habitat use of radio-tagged southeastern blue suckers indicate a strong affinity for deeper, outside river bends with accumulations of large woody debris, with extended periods of little movement from these habitats. Bathymetry mapping of the lower Pearl River will allow us to quantify the availability of these apparently preferred habitats and identify reaches where management activities could improve habitat conditions for this species.

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### **Effects of Temperature and Salinity on Hatch Success, Development and Survival of Bigmouth Sleeper (*Gobiomorus dormitor*) Larvae**

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*Gobiomorus dormitor* is found in tropical coastal habitats throughout the Caribbean and the southernmost tip of the United States. It is typically considered to be obligatorily diadromous, requiring both fresh and salt water throughout its life cycle. Landlocked populations have been identified, including in Carite Reservoir, Puerto Rico. In Puerto Rico, management of native euryhaline species has been hindered by the presence of dams that impede upstream migrations. The landlocked bigmouth sleeper population presents an opportunity to reestablish native fisheries above dams in Puerto Rico, hatchery propagation is required. Previous studies have had limited success with artificial propagation and rearing of bigmouth sleeper. We hypothesized temperature and salinity affected hatch success, larval development and survival rates in those studies. In the current study, our objectives are to 1) Compare hatch success of bigmouth sleeper eggs at different temperatures and salinities, 2) Measure and compare larval development, growth and yolk sac consumption at different temperatures and salinities, and 3) Determine survival rates of bigmouth larvae at different temperatures and salinities. Fertilized bigmouth sleeper eggs (n=100) will be hatched at three different temperature (23, 26, 29°C) and five salinities (0, 5, 10, 15, 20 ppt), with three replicates for each treatment. This study will determine the effects of temperature and salinity on the hatching success, survival and larval development of bigmouth sleeper yolk sac larvae. Our research will provide insight into the possibility of successfully rearing bigmouth sleepers for conservation and management purposes.

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### **Impacts of River Control Structures on the Juvenile Migration of the Amphidromous River Shrimp (*Macrobrachium ohione*): Possible Solutions for the Restoration of Upstream Populations**

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*Macrobrachium ohione* is an amphidromous species (i.e., freshwater organisms with marine larval development) that has experienced population declines along their northern distribution in the Mississippi River System, possibly due extensive river modifications. Prior to the implementation of Old River Control (ORC) structures in Louisiana, it is hypothesized that juvenile *M. ohione* were capable of

migrating between the Atchafalaya River (AR) and Mississippi River (MR). This study tests the hypothesis that ORC prevents recruitment of juveniles from the AR into the MR. The relative densities of juvenile migrants were sampled using unbaited traps placed in the channels above and below the river control structures. According to model selection based on Akaike Information Criteria, the location of traps and channel discharge as main effects provided the most information about the density of migratory shrimps. Densities of juvenile shrimps were as great as ~ 1700 (shrimps/m<sup>2</sup>)/hour when trapped in channels with discharge below the structures. These results suggest that juveniles are using the currents from the channels to cue their upstream migration, but are halted below the structures. This work also examines ability of *M. ohione* juveniles to climb up structures (e.g., shrimp ladder), a behavior observed in other amphidromous species but unexpected in this less robust species. Juvenile migrants repeatedly displayed the ability to climb, with the most shrimps observed climbing when water discharge on the ladder was 65 and 140 cm/s. Climbing performance was influenced by the ladder's incline, with the greater number of shrimps climbing at angles of 30° & 40°. These results indicate that juvenile migrants have the ability climb up and over control structures if presented with a suitable shrimp ladder. Installation of shrimp ladders or migratory conduits at river control structures may be a viable solution to restoring *M. ohione* populations in the upper MR.

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### **Understanding the Trophic Role of Gulf Menhaden (*Brevoortia patronus*) Using Carbon and Nitrogen Stable Isotopes**

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Gulf menhaden (*Brevoortia patronus*) play multiple roles in the Gulf of Mexico coastal ecosystem as filter feeders and as an important food source for many recreationally and economically important finfish. As filter feeders, they feed on a large variety of plankton and detritus and provide an important ecosystem service by grazing various plankton species and potentially lessening the affects of eutrophication in certain areas. Gulf menhaden also support a large commercial fishery, and little is known about the impact of fishing on the role of this species in the food web. Determining their feeding habits is very important in determining the affects that these fish have on the ecosystem. This study examines the trophic dynamics of Gulf menhaden and how they differ spatially, temporally, and ontogenetically using stable carbon and nitrogen isotopes. Fish were collected by gill net, cast net, and purse seine at various locations throughout the Northern Gulf of Mexico; including Pascagoula Bay, Mississippi Sound and Bay Saint Louis from sites that represent various strata throughout the summer and fall of 2010 and 2011. A large size-range of fish including juveniles (50-100mm), sub-adults (100-200mm) and adults (>200mm) were collected to examine ontogenetic shifts. Four size fractions of plankton/ detritus were also collected covering the total size range of filterable particles. Stable nitrogen and carbon isotopes were examined in the fish and plankton samples to determine trophic level and carbon source. Results thus far have shown distinct carbon isotope values ( $\delta^{13}\text{C}$ ) for juvenile fish as compared to carbon isotope values for sub-adult and adult fish. We also see distinct nitrogen isotope values ( $\delta^{15}\text{N}$ ) in juvenile fish as compared to nitrogen isotope values for sub-adult and adult fish which either suggests differing trophic levels or differing nutrient sources between age-0 fish and older age classes.

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## **Life History Traits of the Mirror Shiner (*Notropis spectrunculus*) in Western North Carolina**

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The life history of *Notropis spectrunculus* (Mirror Shiner) was investigated using seven monthly collections at four locations (Hominy Creek, Pigeon River, two on the Tuckasegee River) in the Tennessee River drainage in western North Carolina. Specimens were collected by seining deep eddies below runs and examined to identify age, growth, reproductive patterns, and feeding habits. The largest *Notropis spectrunculus* male collected was 71 mm SL and 2.39 g total weight. The largest female collected was 77 mm SL and 2.96 g total weight. Sexual maturity occurred at approximately one year of age. The oldest specimens collected were in their third year, and both males and females were collected of this age. Spawning occurred in late spring and early summer with 13-331 mature oocytes (mean = 115.53, SD = 75.36) and male breeding coloration present in specimens collected in May, June, and July. Gut contents consisted mainly of insect parts, primarily Coleoptera and Diptera.

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## **The Influence of Tidal Height and Wave Energy on First-Year Oyster Reef Development on Constructed Shoreline Erosion Control Structures**

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This thesis project assesses the effects of tidal inundation frequency and high-energy wave habitat on initial *Crassostrea virginica* recruitment and oyster reef development. Plastic mesh bags of clean oyster shell were placed at different intertidal heights on the high-energy windward side of three constructed marsh shoreline erosion control structures, Triton™ Gabion mats, A-Jacks®, and Reefblks™, all located on the northern shore of Terrebonne Bay, Louisiana. Plastic mesh bags of shells were also placed for comparison on the interior side of the ReefBlks™ and at a nearby low-energy natural intertidal oyster reef. Frequency of tidal inundation was documented with the use of constant recorders placed adjacent to the structures, and wave energy documented with the use of PVC pipe sediment traps and plaster-of-paris clod cards. Wind direction and speed was documented using the nearby weather station at the Louisiana Universities Marine Consortium (LUMCON). The shell bags were collected after 13 months and assessed for oyster length frequency, density and biomass and the abundance and biomass of its principal sessile competitors, the barnacle, *Balanus* sp., and the hooked mussel, *Ischadium recurvum*. Reef community formation was hypothesized to differ between high and low frequency aerial exposure and between high and low wave energy habitats. Preliminary results suggest confirmation of this hypothesis, that oyster reef development is hindered by the combination of aerial exposure and wave energy. Mussels in particular appear to be negatively impacted by aerial exposure. Understanding how water energy and aerial exposure influence oyster reef development will provide managers with information on how to more confidently ensure the success of future oyster reef shoreline protection projects.

## Physiological Effects of Terrestrial Stranding on Gulf Killifish (*Fundulus grandis*)

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The Gulf killifish, *Fundulus grandis*, is a common estuarine baitfish species of the Gulf Coast that may naturally undergo periods of terrestrial stranding due to tidal changes. In order to survive stranding, Gulf killifish must be able to deal with effects associated with respiration in addition to the possible accumulation of toxic metabolites, including urea, ammonia, and lactic acid. The current study was designed in order to examine effects of stranding on survival, respiration and the accumulation of urea, ammonia, and lactic acid. Fifty Gulf killifish ( $7.5 \pm 0.2$  g, mean  $\pm$  SEM) were wrapped in moist cheesecloth in plastic containers and placed in a temperature controlled incubation chamber ( $20.8 \pm 0.03$  °C). Ten fish per stranding period were sampled at terrestrial stranding periods of 0, 3, 6, 9, and 15 hours. Five fish were sampled for standard metabolic rate (SMR) during an aquatic recovery period and the remaining five were sampled for plasma and tissue. Plasma samples were used to determine urea, ammonia, and lactic acid concentrations. The oxygen partial pressure (PO<sub>2</sub>) was measured in torr at a constant temperature by respirometer. Gill tissues were preserved in RNAlater from each individual for anticipated molecular analysis at a later date. No statistical difference was observed among urea, ammonia, or lactic acid concentrations and hours of stranding ( $p \geq 0.05$ ). In many species, terrestrial stranding proves lethal relatively quickly, possibly due to critical increases in high concentrations of these plasma metabolites. Absence of a significant increase in ammonia and urea plasma concentrations may be indicative of the ability of Gulf killifish to survive sustained stranding periods and eliminate metabolites in alternative ways. Respirometry data indicated metabolic modifications. Further molecular analysis will attempt to determine the mechanisms allowing mobilization of metabolites and modification of oxygen uptake throughout stranding.

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## Entrainment of Sturgeon through the Bonnet Carré Spillway

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The Bonnet Carré Spillway diverts flood waters from the Mississippi River into a floodway that empties into Lake Pontchartrain to reduce river stages at New Orleans. The spillway has been opened twice over the past four years. During both openings, the U.S. Army Corps of Engineers (Corps), Louisiana Department of Wildlife and Fisheries (LDWF), and Nicholls State University evaluated entrainment of the federally-endangered pallid sturgeon (*Scaphirhynchus albus*) through the structure. In both cases, sturgeon were captured during the first week after closing with sampling continuing for numerous weeks. Multiple sampling gears were used including electroshocker, seines, trawls, and gill nets. Three primary areas of the floodway were sampled regularly: stilling basin, canals (primarily Barbours and Y), and lakes. The 2008 hydrograph exhibited a slow decline over a period of four weeks, whereas the 2011 hydrograph dropped to almost zero discharge in the floodway within a week. The greater magnitude of discharge through the floodway in 2011 may have been one contributing factor by displacing sturgeon to a greater extent. However, the abbreviated period of flow in the canals during 2011 also contributed to sturgeon catch patterns. Water velocity in the canals below the structure essentially went to zero within a week

after the 2011 closure and water levels dropped precipitously throughout the floodway. Rapid decreases in discharge below the structure, which happened in 2011, will probably result in more sturgeon becoming stranded and non-recoverable. Gradual decreases in discharges, like 2008, will provide rheotactic cues for sturgeon to move upstream towards the structure, congregate, and become easier to catch. Regardless of the discharge patterns, it has been demonstrated twice under different circumstances that rapid rescue of entrained pallid sturgeon can be successfully accomplished to minimize impacts to this endangered species.

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## **Shark Attack, Environmental Conditions, and Fishery Landings in Florida: Can We Predict Shark Attack?**

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Fisheries surveys in the northern Gulf of Mexico between 1997 and 2000 identified significant year-to-year variation in relative abundance of sharks. Additionally, both shark overall body condition and feeding success showed significant variation over the same period of time. In an attempt to identify the causes of this variation, I examined various biotic and abiotic factors over the period 1995 to 2010, and found significant relationships between rainfall, fisheries landings and shark attack. Rainfall was found to be correlated with landings of potential shark prey species and with shark attack. Shark attack was inversely correlated with both rainfall and with threadfin shad (*Harengula* sp.) landings. During low rainfall years, shark attacks increased significantly. Shark attack was significantly correlated with inshore recreational landings of sharpnose sharks (*Rhizoprionodon terraenovae*). When landings of sharpnose sharks were high in inshore waters, shark attacks were also elevated. Sharpnose sharks are suggested as an indicator species that might be used to identify high shark attack years. A model is suggested wherein decreased rainfall reduces prey abundance/availability and results in reduced shark body condition. Reduced body condition may result in sharks expanding their normal feeding grounds thereby increasing shark/human encounters.

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## **Ecosystem Management in the Atchafalaya River Basin: Still Arranging Deck Chairs on the Titanic**

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The Atchafalaya River Basin (ARB) is the largest bottomland hardwood swamp in the United States, with strong recreational, commercial and cultural ties to the people of Louisiana. Although managed primarily as a floodway by the U.S. Army Corps of Engineers, a tremendous diversity of aquatic organisms use the extensive system of canals, bayous, and lakes in the ARB, historically yielding significant harvests of crawfish as well as commercial and recreational finfishes. However, anthropogenic alterations have exacerbated water-quality issues typically associated with floodplain swamp ecosystems, and these problems have been compounded in the last two decades by the passage of several hurricanes. Additional challenges are related to the establishment of several exotic aquatic plants, and the complex and often stochastic interactions among these factors continue to present significant challenges in the management of the ARB. We will outline the problems currently facing the ARB ecosystem, including flooding,

hypoxia, sedimentation, and invasive species, and relate these factors to the diversity and productivity of biotic resources in this unique ecosystem.

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## **Largemouth Bass Relationships with Flow in the Arkansas River**

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Hydrology can affect the recruitment and growth rates of sport fish populations. Long-term electrofishing data collected in the Arkansas River's Lake Dardanelle from 1991-2009 suggested a strong inverse relationship between largemouth bass *Micropterus salmoides* catch per unit effort (CPUE) and mean adjusted flow from the previous year. This relationship suggested a probable link between largemouth bass recruitment and Arkansas River hydrology. However, the cumulative effects that river hydrology may have on growth throughout the life of a cohort have not been intensively studied. In 2004, 2005, and 2010, annual growth increments were generated using largemouth bass (n = 2,201) collected from throughout the Arkansas River within Arkansas. Between sampling periods, the lower Arkansas River experienced hydrological extremes during three consecutive years (2007-2009), with 29% of the days annually exceeding 2,800 m<sup>3</sup>/s. Using age-1 through age-6 cohorts (n = 2,121), largemouth bass growth increments were positively correlated with growth years (March through February) containing longer durations of lower flows (<425 m<sup>3</sup>/s). Two-way ANOVA analyses using backcalculated age and growth year classifications (i.e., high, medium, and low flows) as main effects also suggested significant (P<0.05) hydrologic effects on growth. Significant (P<0.05) interaction between backcalculated age and growth year classifications further suggested that flow affected growth differently across ages, with more pronounced effects on the age 1-3 cohorts. Decreased annual growth occurring during 2007-2009 was consistent with detectable decreases in mean total length in 2010 compared to the 2004-2005 period. Age-4 and age-5 cohorts were significantly (P<0.05) smaller than corresponding cohorts from 2004 and 2005, with weight differences being more dramatic. Results presented here suggest that high-flow events that are typically beneficial to largemouth bass populations in large river-floodplain systems may be dampened or non-existent in more highly regulated, impounded river systems such as the Arkansas River.

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## **Comparison of Various Minimum-Length Limits for the Largemouth Bass Fishery in the Arkansas River, Arkansas**

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Largemouth bass (*Micropterus salmoides*) on the Arkansas River have been regulated by a 381-mm minimum-length limit (MLL) regulation since 1 January 1998; however, little evaluation of this regulation has been conducted. During 2004-2005 and 2010, largemouth bass were collected from throughout all navigation pools in the Arkansas River. All fish were aged using sagittal otoliths, and population metrics were calculated to conduct simulation modeling using the Fisheries Analysis and Simulation Tools (FAST) software. Model parameters were developed using data from all three years of

collections. Model predictions of fishery yield, average size of harvested fish, and number of preferred-sized ( $\geq 381$ -mm TL) fish in the population versus fishing mortality were compared among the current MLL and three alternative limits: 430 mm (higher than the current MLL), 330 mm (lower than the current MLL), and 254 mm (representing no MLL). At the relatively low levels of fishing mortality present in the Arkansas River fishery ( $\mu \sim 0.12$ ), fishery yield would be improved with a lower or no MLL. Conversely, the current 381-mm and larger 430-mm MLLs have potential to improve mean size of harvested fish and overall population size structure. A sensitivity analysis shows modeling was most sensitive to natural mortality rates and the slope of a weight-length equation. At the present time, the current 381-mm MLL regulation appears to be an appropriate management strategy for the Arkansas River largemouth bass fishery, providing an overall balance among fishery yield, mean size of harvested fish, and population size structure.

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### Hooking Mortality of Hybrid Striped Bass in a Tennessee Lake

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Hybrid striped bass (striped bass *Morone saxatilis* ♀ x white bass *M. chrysops* ♂) have been stocked into reservoirs in the southeastern U.S. since 1978 and have gained widespread acceptance as a sportfish. These fisheries are growing in popularity and anglers are voluntarily practicing catch and release fishing, but the fate of released hybrid striped bass is unknown. The objective of this study is to describe hooking mortality of hybrid striped bass in Percy Priest Lake, Tennessee. Hybrid striped bass (N = 45; > 373 mm total length) were caught using traditional angling gear in water temperatures ranging from 14.0 to 32.2 °C. Ultrasonic transmitters equipped with floats were externally attached to each fish and fish were released immediately back into Percy Priest Lake. Fish were tracked for 5-7 days post-release to assess short-term and delayed mortality. One day after release, hybrid striped bass moved from 0.31 to 9.65 km (mean = 2.97, SD = 2.59) away from where they were released. On day two, hybrid striped bass moved an additional 0.44 to 7.79 km (mean = 3.06, SD = 2.32). In a logistic regression model, mortality was positively related to water temperature. Mortality of angled hybrid striped bass pooled over all water temperatures was 27%. Most of the mortality occurred at water temperatures above 26 °C. Additional sampling in 2012 will determine whether hooking mortality differs between fish caught on live bait versus artificial lures.

## **Abundance and Growth Patterns of Juvenile Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Altamaha River, Georgia: Are We on the Road to Recovery?**

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Historically, Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, supported a lucrative commercial fishery throughout the eastern coastline of North America. However, decades of overharvest have decimated most populations. In response, the Atlantic States Marine Fisheries Commission closed this fishery in 1998, and today, this species is being considered for listing under the Endangered Species Act. Unfortunately, the effects of the fishery closure are unclear because of a lack of quantified data on recent population trends. Recent studies have shown, however, that assessments of juvenile population dynamics may provide a quantified measure of population status, and ultimately, population trend. The objectives of this study were to assess 1) annual abundance and 2) growth of juvenile Atlantic sturgeon in the Altamaha River, Georgia. From May-August 2004-2011, we used anchored gill nets and trammel nets to sample juvenile Atlantic sturgeon throughout the Altamaha Estuary. At the end of each sampling season, we constructed length-frequency histograms to identify age-1 and age-2 individuals in the catch. We then calculated the abundance of each age class using the Huggins closed-capture model. To assess cohort and individual-specific differences in growth, we used a hierarchical linear modeling approach. Over the eight years of the study, age-1 population estimates varied from 433-6225 individuals while age-2 population estimates varied from 130-5200. We also documented a strong positive trend in total juvenile abundance, increasing from a low of 1194 in 2004 to >5,000 in 2010 and 2011. Analysis of juvenile growth showed a decrease in growth rates in response to increasing juvenile abundance, providing evidence of density-dependence and resource limitation. Our findings suggest that the Altamaha River Atlantic sturgeon population is recovering and that juvenile abundance may be nearing carrying capacity. Future studies will focus on factors affect habitat supply and potential intraspecific interactions of juvenile cohorts in the lower estuary.

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## **Subspecies Composition of Largemouth Bass in Puerto Rico**

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Largemouth bass *Micropterus salmoides* in Puerto Rico are the result of a few introductions from mainland North America over the last century. Initial introductions came from populations within the native range of the northern subspecies *M. s. salmoides* while more recent introductions came from populations within the native range of the Florida subspecies *M. s. floridanus*. The subspecies specific genetic composition of contemporary populations on the island may represent the effects of recent hatchery propagation or natural selection. If *M. s. salmoides* genotypes and alleles remain prevalent on the island in the face of stocking pressure it could suggest selection for a favored genotype. If instead *M. s. floridanus* is the dominant form the answer would be less clear. Largemouth bass (n=418) were sampled from 12 reservoir populations and the sole hatchery stock on the island and then genotyped at 6 diagnostic microsatellite loci. Among the reservoir populations Florida subspecific alleles ranged from

0.77 to 0.95 (mean 0.85, SD 0.07). Florida subspecific genotypes ranged from 0.03 to 0.64 (mean 0.29, SD 0.22) and no northern subspecific genotypes were recovered. All populations showed lower levels of Florida subspecific alleles and genotypes than the hatchery stock (alleles 0.98, genotypes 0.80). A reduction in Florida subspecific alleles and genotypes above 400 meters ( $P=0.05$ ) could indicate selection against the Florida phenotype at cooler climates or merely geographic locales that have received less stocking pressure. The prevalence of the Florida subspecies and hybrids in all populations does not discriminate between the hypotheses of a favored genotype vs. stocking pressure.

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### **The Effects of Oil Exposure on the Blood and Tissues of Spotted Sea Trout (*Cynoscion nebulosus*) and Gulf Killifish (*Fundulus grandis*) from the Gulf of Mexico following the Deepwater Horizon Oil Spill**

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The Deepwater Horizon disaster is unprecedented. Comparison to the 1989 Exxon Valdez oil spill (EVOS) in Prince William Sound, Alaska can be made. A few studies examined the health status of affected fish. Fish population declines began in the year following the EVOS and increased occurrence of fish diseases occurred in the years following the EVOS. Our study examined how crude oil and contaminant aromatic hydrocarbons may affect the fish immune system, resulting in increased disease susceptibility. Spotted Sea Trout were sampled in early November 2010 at locations that experienced some degree of oil exposure during the active phase of the spill, but at the time of sampling there was not an obvious oil slick. Ethoxyresorufin-O-deethylase (EROD) activity is performed by cytochrome P450 A1, an evolutionarily conserved enzyme involved in clearance of hydrocarbons. This enzyme is induced following exposure to hydrocarbons, such as those found in crude oil. The levels of EROD in Gulf trout were significantly greater than EROD activity levels in control fish of the same species that were reared in an inland facility and never exposed to a hydrocarbon source. These results strongly suggest that the Gulf fish were exposed to hydrocarbons. Peripheral blood leukocyte differentials and histological analyses were also performed. Gulf killifish were sampled from salt water marshes near Terrebonne Bay, LA. Cytochemical staining of frozen control killifish spleens demonstrated splenic melano-macrophage centers were much larger, darker, and higher in number in the spleens of oil-exposed killifish, suggesting non-specific enhanced immunological and stress responses occurred in these fish. Our report suggests the potential for oil spills to alter the function of the immune system of fish and increase the risk of infectious diseases.

## Assessment of Exposure to Cytochrome P4501a1-inducing Pollutants in Pelagic Fishes from the Western North Atlantic and Gulf of Mexico through Analysis of Liver EROD Activity

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We examined liver samples taken from pelagic fishes captured in the western North Atlantic and Gulf of Mexico for evidence of exposure to cytochrome P4501a1 (Cyp1a1)-inducing pollutants, such as polycyclic aromatic hydrocarbon (PAHs), polychlorinated biphenyls (PCBs), and polychlorinated dibenzodioxins (PCDDs). A key purpose of this research was to determine if pelagic fish populations in the northeast Gulf of Mexico are exhibiting physiological effects associated with exposure to PAHs from the Deepwater Horizon Oil Spill. Exposure to Cyp1a1-inducing contaminants was determined through measurements of ethoxyresorufin-*O*-deethylase (EROD) activity in fish livers. Samples obtained from the Atlantic Ocean provided a comparison for those taken from the oil exposed portions of the Gulf of Mexico. Our preliminary results show low levels of EROD activity in teleosts and elasmobranchs captured from both sampling areas. These data suggest low impact of PAHs in pelagic fishes potentially exposed to oil spill waters.

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## Distribution and Ecology of the Endangered Boulder Darter (*Etheostoma wapiti*) in the Elk River, Tennessee

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The boulder darter (*Etheostoma wapiti*), a federally-listed endangered species, is a warmwater benthic fish that is currently known to occur in ~120 km of the Elk River. Since the construction of Tims Ford Dam in 1970, coldwater releases and altered flow regimes caused by operations at Tims Ford Dam have resulted in habitat alteration and reduced range of *E. wapiti*. In 2007, the Tennessee Valley Authority implemented an adaptive management process for operations at Tims Ford Dam to determine the optimal combination of spilling, sluicing, and hydroelectric generation that creates conditions suitable for the persistence of *E. wapiti*, continued hydropower generation, and the maintenance of a tailwater trout fishery. Recently implemented operational modifications are anticipated to improve spawning and rearing conditions for *E. wapiti* and provide an additional 48 river km for potential recolonization. Currently, multiple locations in the Elk River are being backpack electrofished and seined to determine *E. wapiti*'s current distribution and provide information regarding population responses to the operational changes. Due to the rarity of *E. wapiti*, occupancy models that account for incomplete detection are being developed to create a baseline distribution model. Information regarding *E. wapiti*'s distribution will be integrated into an Elk River Structured Decision Making model for determining best management practices for the conservation of several endangered species occupying the main channel of the Elk River.

## **Reproductive Biology of a Resident Population of Cownose Rays in Southwest Florida: Expected and Unexpected Results**

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As currently understood, cownose rays (*Rhinoptera bonasus*) occur in coastal and open-water habitats of the western Atlantic from southern New England to Brazil, including the Gulf of Mexico. They are present in Chesapeake Bay for six months and in the northern Gulf of Mexico for nine months of the year. Because cownose rays are present year-round in southwest Florida, we wanted to determine if the entire reproductive cycle was being completed within an estuary in this region (Charlotte Harbor). In addition to recording 'standard' reproductive parameters (e.g., seasonality of testis and ovary size), we documented spermatogenesis and oogenesis using acrylic histology. Rays of both sexes were caught in all months and were represented by neonate, juvenile, and adult life stages, including gravid females. All rays were <1 m disk width (DW) and most were <800 mm DW. Based on clasper calcification, testis size, and histology, males in southwest Florida were mature by 680 mm DW. Testis weight peaked in April. Ovary weight and maximum oocyte diameter peaked between April and June when mating, ovulation, and fertilization primarily occurred. The largest embryo was 383 mm DW (26 April). Brood size is normally only one individual. Very small juveniles (<405 mm DW) were found in the estuary between March and October. The reproductive cycle consists of an 11–12 month gestation period and an annual ovarian cycle. Unexpectedly, germinal epithelia were actively producing follicles in embryos. These data (1) indicate variability when compared to other populations and highlight the need to collect life history information range-wide for broadly distributed species and (2) suggest that folliculogenesis in *Rhinoptera* occurs primarily before parturition. Recent documentation of the morphologically similar *R. brasiliensis* in the Gulf of Mexico, including our study area, may affect interpretation of some of these data.

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## **Potential Utilization of Steroid Hormones Extracted from the Skeletal Muscle Tissue of the Spiny Dogfish (*Squalus acanthias*) and the Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*) to Determine Reproductive Status**

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Currently, circulating levels of plasma steroid hormones have been used as a non-lethal method to determine reproductive maturity and reproductive cycles in elasmobranchs. However, this method can prove problematic to perform on large and/or endangered species, because of difficulties involved with specimen handling. These constraints make it imperative for new techniques to be developed for studying the reproductive biology of elasmobranchs. Previous work conducted on other vertebrates has shown that

steroid hormones can be successfully extracted from muscle tissue. The process of collecting muscle tissue samples is quick, minimally invasive, and may be conducted without removing the animal from the water, facilitating its use on larger, and/or endangered species of elasmobranchs. The focus of this presentation will be the development of a valid method for extracting steroid hormones from the skeletal muscle tissue of the aplacental viviparous spiny dogfish, and the placental viviparous Atlantic Sharpnose shark. For each species 40 females are currently being collected from the Gulf of Maine, and the Gulf of Mexico and will consist of 10 immature individuals, to act as control replicates, 10 early-gestation individuals, 10 mid-gestation individuals, and 10 near parturition individuals. Sample collections of spiny dogfish and Atlantic sharpnose sharks began in October 2010, and the remaining samples will be collected throughout the following year. To verify the use of this tissue for reproductive analysis, steroid hormone levels extracted from skeletal muscle tissue will be compared to the concentrations and patterns of those same steroid hormones extracted from plasma, via radioimmunoassay. Preliminarily, the results suggest that a trend exists between the concentrations of steroid hormone levels in the plasma to those in the skeletal muscle tissue.

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### **Adaptive Management Strategies for Allocating Hatchery Resources**

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Fisheries managers initiate stock enhancement programs for various ecological and political reasons. Hatchery resources are commonly partitioned among stocking programs that benefit wild sport fish populations in need of enhancement, and programs that respond to public demand for fish. Demand for hatchery fish can exceed the ability of hatcheries to produce fish of the requested sizes and numbers. Therefore, allocation of limited hatchery production can be a challenge for managers. Sometimes, a request for hatchery fish is guided by historical data on recruitment, not on conditions at the time of stocking. The decision to stock should be responsive to the current state of natural production. We present an approach to partition allocation of hatchery largemouth bass according to density of wild age-0 largemouth bass in spring or fall, depending upon whether fingerlings (25-50 mm) or advanced fingerlings (~150 mm) will be stocked. The allocation method takes into account system size, and the proportion of a system that is littoral (i.e., age-0 largemouth bass habitat). The allocation method has four advantages: 1) The method is adaptive, because it is based on the current state of reproduction and nesting success within each system, 2) The method is equitable in that it considers the relative need for hatchery fish in each system, 3) The method evolves by increasingly tailoring a specific system's needs as more data are collected, and 4) The method potentially reduces recruitment variability within and among stocked systems. Furthermore, a strategy for allocation of hatchery production that is adaptive and transparent could be useful in informing the public regarding management decisions.

## Identifying Species at Threat to Flow Alteration in the Illinois River, Oklahoma

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A better understanding of how flow regime influences aquatic systems is necessary to adequately assess the impacts of hydrologic changes on aquatic organisms, particularly fishes. Impairment of the quantity and quality of Oklahoma waters could have serious consequences on the associated fish assemblages, particularly those species that use shallow-water habitats during a portion of their life stage. The objectives of this study were to identify changes in the hydrologic regime of the Illinois River (1930s-present) and identify fishes using shallow-water habitats that might be at risk to further dewatering. We used the Indicators of Hydrologic Alteration software to assess changes in flow parameters in the Illinois River from 1930-2011. The median and coefficient of variation differed for several flow parameters including variability in daily flows and 7-day minimum flows. Historic fish collections indicated several small-bodied fish species collected regularly from the Illinois River have not been found in current records. General linear models indicated use of channel units by small-bodied species currently found in the Illinois River depended on the time period of sample (summer versus autumn) indicating species susceptible to possible loss of habitat will vary seasonally. Several species, including slender madtom (*Noturus exilis*), banded darter (*Etheostoma zonale*), stippled darter (*Etheostoma punctulatum*), and orangethroat darter (*Etheostoma spectabile*) were more likely to be present in shallow channel units than pools; however, *E. spectabile* appear to shift to a more general use of channel units in late autumn. These data will be used to help assess threat to various species as water demands increase in the future, a useful tool for long-term monitoring programs.

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## Examining the Effects of Stress, Gape Angle, and Jaw Muscle Mass on Bite Force in Sharks of the Gulf of Mexico

Rice, Kyle W.\* and Glenn R. Parsons

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The force generated by the jaws of an organism can be a good indication of diet, intra-specific hierarchy, jaw function, ontogenetic shifts and evolution of the jaw-cranial musculoskeletal system. Due to the concealing nature of the oceanic environment and the difficulty of sampling sharks, there is a lack of knowledge concerning much of their biology and ecology, including bite force. The goal of this study was to use to determine bite force for the common species of sharks in the Gulf of Mexico, and determine if bite force varied at different gapes, sex, and testing methods. Sharks were collected by hook-and-line and gill netting during the summer and fall of 2011 in the Mississippi Sound. A total of 27 Atlantic sharpnose sharks, *Rhizoprionodon terraenovae*, were caught ranging in size of 51.5 to 94.2 cm and used to determine bite force involuntarily. Using a *TENs Unit Muscle Stimulator* set to deliver 100±5 V at a current of 20 µA, bite force was measured at the utmost anterior and posterior positions with a bite force gauge. The <70 cm size class had an average anterior force of 5.16 lbs (n=15) and a posterior bite force of 6.7 lbs (n=8). Sharpnose in the 70-90 cm size class had an average anterior bite force of 8.453 lbs (n=10) and posterior of 14.733 lbs (n=8). Sharpnose greater than 90 cm had an anterior bite force of 7.85 lbs (n=2) and posterior of 11.75 lbs (n=2). Voluntary bite force for sharpnose <70 cm was 2.405 lbs

(n=2, anterior) and 7.3 lbs (n=1, posterior), and 70-90 cm had a force of 5.6 lbs (n=2, anterior) and 10.3 lbs (n=1, posterior), respectively. These kinds of studies may provide information that could potentially be useful for addressing the problem of shark bycatch, as an end-point in stress studies and may be valuable for making better informed management decisions.

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## **Relative Abundance, Distribution, and Recovery Efforts for Southern Walleye in Alabama**

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<sup>1</sup>Alabama Division of Wildlife and Freshwater Fisheries, Fish Biodiversity Lab, Auburn University, AL, 36849

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The southern walleye (*Sander* sp. cf. *S. vitreus*) is a genetically unique fish endemic to the Mobile River Basin in Alabama and Mississippi. In Alabama, southern walleye have been collected in the Alabama, Coosa, Cahaba, Tallapoosa, Black Warrior, Tombigbee, Mobile, and Tensaw river systems. In 2005, the Alabama Division of Wildlife and Freshwater Fisheries began collecting southern walleye to determine its current status. Initial sampling efforts were directed in the Coosa River system then expanded to historical collection sites. We expended over 235 hours of electrofishing, 857 hours of gillnetting, and 1,615 net/nights with trap and hoop nets searching for southern walleye. Catch-per-effort for southern walleye was 0.17 fish/hr and <0.01 fish/hr for electrofishing and gill nets, respectively. No walleye were collected in trap or hoop nets. A total of 58 specimens were collected with 46 genetically identified as southern walleye. All southern walleye were collected from the Coosa River Basin. The remaining specimens were identified as either northern x southern walleye hybrids, northern walleye, or saugeye. These results indicate the decline in abundance and distribution of the southern walleye and need for recovery efforts.

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## **Interactions between Non-Native Yellow Perch and Native Fishes in Two Southeastern US Reservoirs**

Roberts, Craig M.\*, Dennis R. DeVries, and Russell A. Wright

Auburn University-Department of Fisheries and Allied Aquacultures, 203 Swingle Hall, Auburn University, AL 36849

Yellow perch, *Perca flavescens*, has been introduced into Southeastern US drainages outside their native range. Individuals were first discovered in Lake Martin on the Tallapoosa River in 1998 and the next reservoir downstream, Yates Lake, in 2004. Both populations are now well established. We sought to determine the effects of yellow perch on resident fishes in these two lakes. During both 2010 and 2011 we sampled larval, juvenile, and adult yellow perch and native fishes with a variety of sampling gears, conducted age-and-growth analysis using otoliths, and quantified diets of larval, juvenile, and adult fishes. Yellow perch were more abundant and had faster growth rates in Yates Lake than in Lake Martin. As larvae, temporal overlap between yellow perch and other fishes was limited in Yates Lake, while yellow perch, crappie, and gizzard shad co-occurred during April 2011 in Lake Martin. Among juveniles, diets of yellow perch and *Micropterus* spp. overlapped little during late spring, indicating limited

potential for competition. Juvenile yellow perch occurred in *Micropterus* spp. diets in both lakes in the spring, suggesting a potential benefit to these piscivores. While occasional native fishes were found in adult yellow perch diets, consumption was extremely limited, (only found in 7% of diets we analyzed). Adult perch were not consumed by *Micropterus* spp. or striped bass. We suggest that the benthic nature of yellow perch combined with a need for cooler water limited their interaction with native fishes in these southern systems. Their impact appears minimal due to their generalist diet, early spawning season, temperature requirements, and gape limitations. Given the abundant adult population in Yates Lake, combined with yellow perch juveniles providing prey for some resident piscivores, it appears that yellow perch introduction has generated a fishery with minimal negative effects on native fishes.

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## CANCELLED

### **Angler Action Program**

Roberts, Rick

The Snook and Gamefish Foundation, 5224 W SR 46 #102, Sanford, FL 32771

The Angler Action program meets a need for greater collaboration between the recreational fishing community and fisheries management agencies to improve recreational fisheries data collection and management. The Angler Action program facilitates communication between recreational fishermen and researchers in an ongoing program:

- Researchers clarify data needs
- Fishermen assist by providing data
- Both contribute to developing collection tools and research questions
- Tools for data collection are continuously improved, anticipating both sets of needs
- All have better and more frequent access to summary data from their efforts
- This collaboration opens a door for education and another means for resource management agencies to build credibility with the fishing community

Angler Action Partners make a commitment to participate in one or more of the following areas: data collection, tool and database development, analysis and applications, outreach and education. The Angler Action program is a service project of Snook & Gamefish Foundation. Over the years, SGF has developed partnerships within fishing communities and fisheries management agencies that are likely to succeed in delivering on emerging data acquisition and cultural change strategies.

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## **Implementing the National Fish Habitat Action Plan in the Southern Division in 2011**

Robinson, Scott

Southeast Aquatic Resources Partnership, 2123 U.S. Highway 278 SE, Social Circle, GA 30025

The Southeast Aquatic Resources Partnership (SARP) is working with numerous partners to implement the National Fish Habitat Action Plan in the Southern Division AFS geography. This presentation will be an overview of progress and challenges in 2011 and a forward look to plans for 2012. Regional habitat assessment projects and techniques regarding riparian land use, connectivity, flow alteration, and other habitat components will be discussed. Prioritization of habitat conservation projects and funding mechanisms and opportunities will also be included.

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## **Seasonal Gonad Development and Evidence for Reduced Spawning Activity of Spotted Gar in a Large River Floodplain Disconnected from the Main Stem River**

Rombach, Emily E.\*, Allyse M. Ferrara, and Quenton C. Fontenot

Bayosphere Research Laboratory, Department of Biological Sciences. NichollsStateUniversity, P.O. Box 2021, Thibodaux, LA70310

The Barataria Estuary (UBE) is the southernmost western floodplain of the Mississippi River, and has been cut off from the Mississippi River by flood-protection levees. The nearby Atchafalaya River Basin (ARB) is a large bottomland hardwood swamp that receives an annual flood pulse. Spotted gar, *Lepisosteus oculatus*, are a common species in both floodplains, but the altered hydrology of the UBE may reduce the reproductive output of the local spotted gar population. The purpose of this study is to identify seasonal gonad development trends in spotted gar and to identify evidence of reduced spawning within the UBE. Up to 20 male and 17 female spotted gar were collected monthly from February through November 2011 from the UBE with monofilament gill nets. For females, a 10% egg count by gonad weight was used to estimate fecundity and the diameter (mm) of 30 eggs per ovary were measured. Based on a lack of spent ovaries, preliminary macroscopic ovarian observations suggest that female spotted gar spawned few eggs in the UBE. A sample of spotted gar (n=9) were collected from the ARB in November 2011 for comparison. In November 2011, mean gonadosomatic index (GSI) of female spotted gar (n=8) in the UBE ( $11.2 \pm 1.6$ ) was greater than mean GSI of female spotted gar (n=4) in the ARB ( $2.4 \pm 1.5$ ). Mean November 2011 spotted gar egg diameter ( $2.39 \pm 0.0095$ ) in the UBE was greater than egg diameters in the ARB ( $1.66 \pm 0.019$ ). It appears that spotted gar in the UBE maintain a large portion of their eggs throughout the year, and although the reason is not known UBE spotted gar may have a reduced reproductive output.

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## **Analysis of Fin Rays for Aging Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)**

Rosati, Drew and Ivy E. Baremore

NOAA, National Marine Fisheries Service, SEFSC, 3500 Delwood Beach Road, Panama City Beach, FL 32408

The leading pectoral fin ray, or fin spine, is the typical aging structure of *Acipenser* species. Fin spine removal has proven to be non-deleterious in juvenile sturgeons; however, National Marine Fisheries Service advises against this removal in mature fish due to evidence of abnormal regrowth and possible increases in mortality. This study analyzed the use of the secondary marginal fin ray as a less invasive method for age estimation in the Gulf of Mexico sturgeon *Acipenser oxyrinchus desotoi*. The removal method was based on three criteria: 1) ease of removal for field application; 2) invasiveness of the removal; and 3) clarity and consistency of the banding patterns. Fin rays and fin spines from 134 individuals (46.0 – 189.0 cm FL) were collected from live Gulf sturgeon in four rivers and one estuary over two years (2010-2011). Thin sections were viewed under reflected light with a dissecting microscope, and preliminary band counts ranged from one to 20. Two Gulf sturgeon were recaptured one year after they were injected with oxytetracycline for age validation. Sections of the second marginal fin ray showed a distinct opaque band at the time of first capture, which fluoresced under UV light, followed by one complete band pair. This confirmed our assumption of one band pair formation per year. In addition, band counts from the secondary fin ray were plotted in comparison to band counts from previous studies using the fin spine to assess agreement between structures. Future work will focus on verifying band counts using the extensive tag and recapture records available for this species.

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## **Correcting for Length Bias of Common Warmwater Sport Fish Sampled with Standardized Experimental Gill Nets**

Ryswyk, R.<sup>1</sup> and Dan Shoup<sup>2</sup>

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Size selectivity of gill nets is widely discussed in the literature but to date no one has examined the selectivity of the standard gill net design suggested by Bonar et al. (2009 Standard Methods for Sampling North American Freshwater Fishes). Size selectivity can affect a number of metrics of concern to fisheries managers including length frequencies and size indices. To examine the size selectivity of the standard gill nets, we sampled white crappie, white bass, hybrid striped bass, saugeye, walleye, and channel catfish in eight Oklahoma reservoirs and used the SELECT method to model five log-linear selectivity curves (normal, normal location, log normal, gamma, and bimodal). The bimodal model was best fit for all species. The bimodal model was used to adjust length frequencies. Length distributions from adjusted and unadjusted data were visually compared using quantile-quantile (Q-Q) plots that displayed 0.01, 0.05, 0.10, 0.25, 0.50, 0.75, 0.95, 0.99 percentiles. While some differences between adjusted and unadjusted catch data existed, the mesh sizes specified in the new standard gill net design appears to minimize the length bias for most species that has traditionally been suggested for gill nets. When the standard net is used in other systems similar to the ones we sampled, our bimodal selectivity curve could be used to adjust length frequencies and PSDs to better represent the fish that encountered the net.

## **A War of Attrition: Conservation of Shoal Bass in Alabama and Georgia**

Sammons, Steven M.

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Shoal bass (*Micropterus cataractae*) are endemic to the Apalachicola drainage in Alabama, Florida, and Georgia. Shoal bass are habitat specialists, occupying shallow, rocky riffles and shoals in medium- to large-sized streams and rivers and are intolerant of reservoir conditions. Although a significant sport fishery occurs for this fish in the Flint River, GA, abundance of shoal bass in the Chattahoochee River has declined significantly over the last 50 years. In particular, shoal bass populations have been virtually eliminated in the mainstream channel of the Chattahoochee River along the Georgia-Alabama state line, due to numerous impoundments that have flooded shoal habitat necessary to the survival of this species. Since the 1950s, most of the remaining shoal bass populations in this area were restricted to shoal habitat areas in major tributaries to the Chattahoochee River. Consequently, this species has been assigned a status of "Special Concern" by the Endangered Species Committee of the American Fisheries Society. Recent surveys of the Alabama tributary streams have revealed that shoal bass have been virtually eliminated from these areas over the last 30 years. Reasons for the decline of this fish are unknown, but likely causes include changed land-use, increased human population in the watersheds of these streams, and possible invasion of the non-native Alabama bass *M. henshalli*. Shoal bass in the Flint River have been observed to make migrations during the spawning season to large shoal complexes; some of these movements have been documented in excess of 160 km. Spawning migrations have also been observed in tributary streams of both the Flint and Chattahoochee River. These shoal complexes are characterized by bedrock and unattached boulder substrates, associated with higher flows. Large numbers of age-0 shoal bass are observed in these habitats during the summer, indicating that these areas constitute important spawning and nursery habitat for these fish. Increased sedimentation and decreased water flows resulting from land-use changes likely impact these areas to a greater degree than other habitats, which may have contributed to the decline of shoal bass in the Alabama streams. Also, the overall effect of dams in the Chattahoochee River has been to reduce a continuous population of shoal bass into a series of isolated populations of limited genetic diversity and low effective population size, with an increased likelihood of extinction.

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## **The Recreational For-Hire Sector in the U.S. Gulf of Mexico: Structural and Economic Observations from the Third Decadal Survey**

Savolainen, Michelle A.\*, Rex H. Caffey, and Richard F. Kazmierczak, Jr.

Center for Natural Resource Economics & Policy, Department of Agricultural Economics, Louisiana State University Agricultural Center, and Louisiana Sea Grant College Program, 179 Woodin Hall, Louisiana State University, Baton Rouge, LA 70803-5603

Cross-sectional surveys of the recreational for-hire (RFH) industry in the U.S. Gulf of Mexico were sponsored by NOAA Fisheries and jointly conducted by Texas A&M and the University of Florida for 1987 and 1997. The third decadal survey, conducted by Louisiana State University in 2010, collected effort, economic, and policy data for the calendar year 2009. Questionnaires were distributed to 2,305 captains in Texas, Louisiana, Mississippi, Alabama, and West Florida with an effective response rate of 33% (n=689) via postal (75%) and internet (25%) participation. Consistent with earlier studies, owner-operators comprised the majority (76%) of respondents, with 94.3% operating uninspected

passenger vessels (OUPV), a management unit NOAA refers to as “charter boats”. The remaining 5.7% operated U.S. Coast Guard inspected vessels, or “head boats”, down from 9% and 7% observed in the 1987 and 1997 surveys, respectively. Potential explanations for this apparent decrease include permit moratoria and regulatory reductions of reef species, competition from the expanding charter boat sector, and sampling differences among decadal surveys. While previous survey efforts were limited to the offshore, federal fleet, the advent of state-based licensing frames allowed for improved characterization of the RFH industry. “Guide boats” are a subcategory of uninspected, inshore/coastal charter vessels that represent a sizable, yet previously under-emphasized, management unit. These operations accounted for 70.5% of Gulf vessels in 2009 and more than 49.9% of the region’s estimated \$221.3 million in dockside revenue. Structural and economic profiles for these subsectors are provided with longitudinal comparisons to earlier Gulf-wide surveys.

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### **Diet Ecology of Non-native Northern Snakehead (*Channa argus*) Compared to Three Co-Occurring Predators in the Lower Potomac River**

Saylor, Ryan K.\*<sup>1</sup>, Nicolas W.R. Lapointe<sup>2</sup>, and Paul L. Angermeier<sup>3</sup>

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A reproducing population of northern snakehead (*Channa argus*) was discovered in the lower Potomac River in 2004. Its continued dispersal throughout this system has been well documented since its original discovery; however, little is known about the diet ecology of this species and its interactions with co-occurring predators. Here, we quantify northern snakehead diet in comparison to the diets of naturalized largemouth bass (*Micropterus salmoides*), and native American eel (*Anguilla rostrata*) and yellow perch (*Perca flavescens*) collected from tidal freshwaters bordering Virginia and Maryland near Fort Belvoir, Virginia. We found that northern snakehead is piscivorous, with >97% of the gut contents identified as fishes. Co-occurring predators included in this study were found in northern snakehead stomachs, but represented only a minor component of their overall diet. Dietary overlap was biologically significant only between northern snakehead and largemouth bass. Sharing abundant prey (mainly fundulids and centrarchids) may limit the potential for competition between snakehead and bass; however, estimates of prey abundance are needed to better elucidate this interaction. Aquatic invertebrates were >10 times more common in native predator diets, reducing dietary overlap with northern snakehead. Ontogenic shifts in adult northern snakehead diet were also detected but were likely an artifact of optimal foraging on prey rather than true selectivity. Northern snakehead may be occupying a novel niche based on a piscivorous diet, therefore limiting competition with co-occurring predators. Further research into interactions between largemouth bass and northern snakehead is needed to better inform management decisions regarding northern snakehead in North America.

## **Managing a Paddlefish Population on the Coattails of a Single Year Class**

Schooley, J.D.

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What would it take for population of large-bodied, slow-to-mature fish to suddenly explode in numbers and reach carrying capacity in a 46,500 surface-acre reservoir? Years of physiological, ecological, and demographic evidence on the American paddlefish *Polyodon spathula* in Grand Lake O' the Cherokees, Oklahoma supports this unlikely scenario as a result of an extreme recruitment event in 1999. An overwhelming majority (75%) of adult specimens aged during the period 2004-2011 via dentary bone annuli were spawned in 1999. Abundance estimates pre-1999 typically totaled 25,000 adults, yet later estimates revealed a major population explosion (to near 200,000 adults). Hydrological analyses reveal not only unique variables that may have contributed to spawning success in 1999, but also major similarities in hydrology between 1999 and other years having unimpressive recruitment success. Long-term acoustic telemetry efforts provide additional perspective on the spawning movements of adult female paddlefish. The Grand Lake population supports a national fishery and most management efforts revolve around a state-run roe-donation program which has grown in popularity and resulted in increased annual harvest. Oklahoma Department of Wildlife Conservation finds itself in a paradoxical scenario where sales of caviar from a declining population funds conservation research in addition to supplementing the general budget. As intense regional study of paddlefish has only recently begun (<10 years), the cyclic potential of Grand Lake population abundance is not fully understood. Therefore, careful examination and proactive regulation are ongoing while attempting to effectively utilize this currently abundant species.

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## **Angler Exploitation of Black and White Crappie at Lake Conway, Arkansas**

Schroeder, Matthew D., Matthew L. Horton, and Thomas R. Bly

Arkansas Game and Fish Commission, Fisheries Division, District 10, Mayflower Field Office, 213 A Hwy 89 South, Mayflower, Arkansas 72106

Angler catch, exploitation, temporal and spatial capture patterns were determined for crappie (*Pomoxis* spp.) in Lake Conway, Arkansas. Fish were tagged during the spring and fall of 2010. Total annual mortality estimated by catch curve from trap net data was 75%. Adjusted annual angler exploitation was 68% with an adjusted catch of 72%. However there was a 30% difference between the exploitation estimates from the spring (53%) and fall (83%) tagging events. Anglers caught the majority of crappie from the months of October to April (94%). The spring tagging cohort over-summered to be caught in the following fall. However, none of the fall tagging cohort that over-summered have been caught to date. Crappie tagged during the spring were released in two locations, and capture locations for these fish were evenly distributed around the lake. However, the fall tagging occurred in two creek arms of Lake Conway, Gold Creek and Caney Creek. Ninety-four percent and 83% of the crappie that were tagged in Gold Creek and Caney Creek, were caught in those locations, respectively. The different spatial capture patterns obtained from the spring and fall tagging cohorts can be explained primarily by the seasonal behavior patterns. Crappie migrate up the main tributaries of Lake Conway each fall following shad. This behavior had a direct impact on the results of this study. We conclude that seasonal behavioral patterns need to be accounted for when conducting exploitation studies.

## **The Effects of Salinity on Growth, Metabolic Rate and Ion Regulation of Juvenile Alligator Gar (*Atractosteus spatula*)**

Schwarz, Daniel E.\* and Peter J. Allen

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Alligator gar (*Atractosteus spatula*) are euryhaline fish that once occurred from Veracruz, Mexico to Illinois and Ohio, USA, but have declined in recent decades. Because alligator gar are found in the Gulf of Mexico and surrounding estuaries, they must acquire the ionic and osmotic regulatory capabilities to survive in saline water. Exactly how and when alligator gar are able to survive in saline water is not well understood. To investigate this, two different age groups (60 and 330 days after hatch [DAH]) of alligator gar were exposed to 4 different salinities (0, 8, 16, and 24 ppt) for a 30 day period. Specific growth rate (SGR), gill and tissue Na<sup>+</sup>, K<sup>+</sup>-ATPase activities, plasma osmolality, blood hematocrit, drinking rates, and corresponding metabolic rates were measured and compared between salinities. The results showed that the 60 DAH alligator gar did not differ in SGR's, gill and tissue Na<sup>+</sup>, K<sup>+</sup>-ATPase activities and corresponding metabolic rates between salinities. The 330 DAH alligator gar had greater SGR's in 0 ppt than in 16 and 24 ppt, showed increases in Na<sup>+</sup>, K<sup>+</sup>-ATPase activities in the pyloric caeca, middle and posterior intestine with increased salinity and had greater metabolic rates in 8 ppt than in 0 ppt. Both age groups showed that an increase in salinity increases plasma osmolality and drinking rates and decreases the blood hematocrit. The 60 DAH alligator gar survived for 57 days in 24 ppt whereas the 330 DAH only survived for 30 days in 16 and 24 ppt. Therefore, juvenile alligator gar have the physiological capabilities to survive in estuarine environments, although for extended periods of time gar must remain in salinities ≤ 16 ppt. The surprising increase in salinity tolerance in the younger alligator gar (60 DAH) may be associated with an evolutionary adaptation for temporary downstream movements into saline habitats.

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## **Annual Variation in Largemouth Bass Spawning Behavior in Small Florida Lakes**

Shaw, Stephanie L.\* and Micheal S. Allen

Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, University of Florida, 7922 NW 71<sup>st</sup> St., Gainesville, FL 32653

The objectives of this study were to evaluate variation in the proportion of largemouth bass *Micropterus salmoides floridanus* that spawn annually. We used snorkel surveys to monitor largemouth bass spawning in four study lakes in north central Florida in 2010 and 2011. The study lakes, located on private land southeast of Hawthorne, Florida, ranged in size from 2.7 – 16.6 ha. Mark-recapture population estimates were used to estimate adult largemouth bass abundance at each lake. Snorkel surveys were conducted twice weekly to estimate the total number of successfully spawned nests over the duration of the spawning season. The data collected for each nest included depth of the nest (m); developmental stage of the brood (i.e., egg, yolk-sac fry, swim-up fry); egg score (scale of 1 - 5); approximate size of the male and female, if present; dominant substrate type at the nest site; and nearby cover (i.e., woody debris, rock, or vegetation). Broods were followed on successive survey days until brood success or failure was determined. A brood was deemed successful by the presence of swim-up fry guarded by a male bass. The estimated total number of nests and the number of successful nests varied among lakes and years. Spawning behavior was relatively consistent in one lake with similar numbers of total nests and successful broods in both years. Some degree of skip spawning was noted in three of four

lakes in both years, with only 2 to 50% of adult largemouth bass spawning on a given lake/year. Skip spawning reduces the total number of nests possible for a bass population and may make each nest more valuable to recruitment. Very high levels of skip spawning have the potential to result in low recruit abundance or year-class failure.

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### **A Multi-Species Occupancy Approach to Assessing the Status of Stream Fishes in the Elk River, Tennessee, Following Operational Changes at Tims Ford Dam**

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Since the construction of the Tims Ford Dam (TFD) hydroelectric facility in 1970, the Elk River in Tennessee has experienced substantial changes in downstream thermal and hydrological conditions. These changes have presumably inhibited the ability of many stream fish species to persist in affected reaches, including the federally endangered boulder darter (*Etheostoma wapiti*). Beginning in 2007, the Tennessee Valley Authority ceased hydropower generation at TFD during critical boulder darter spawning and rearing periods (April – October), under the assumption that the improved conditions would (1) enhance survival and recruitment for existing populations, and (2) provide additional habitat for potential recolonization in areas that were previously unsuitable for warmwater fishes. Using data collected at seven fixed sites from 2005-2010, we developed multi-species occupancy models to estimate the influence of site-, habitat-, and species-level factors on the current status and distribution of 61 Elk River stream fishes, including *E. wapiti*. We also sought to estimate changes in species occurrence following the implementation of modified dam operations. Modeling results indicated that the probability of occurrence varied considerably among species and was influenced by site-, habitat-, and species-level characteristics. Modeling results also indicated that Elk River fish species were, on average, 1.4 times more likely to occur across all study locations following the initiation of modified dam operations, regardless of habitat type. Our study suggests that the operation of TFD strongly influences the structure and composition of Elk River stream fish assemblages. Results from this study will contribute to ongoing management and conservation activities in the Elk River Basin, including the development of a decision support tool that will be used to identify optimal operational strategies for TFD.

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### **Pond Management Approaches and Effects on Trophic-Dynamics**

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Mississippi has an abundance of ponds and small impoundments which provide a number of opportunities for anglers. Several enhancement strategies are used to improve fish production in ponds, including fertilizing and supplemental feeding. These strategies may ignore the potential ecological impacts that may unexpectedly arise such as prolific plant growth and potentially detrimental algal blooms. In

addition, although these strategies are regularly applied they may overlook associated economic costs, such as algae and nuisance plant control. This ongoing study consists of two phases; first, a mesocosm experiment to investigate fertilizer application rates (mg P/L) in relation to potential fish growth, and second, a pond experiment consisting of four treatments to simulate commonly used pond management strategies. Ponds will be surveyed to assess treatment effects on density and species diversity of phytoplankton, macrophytes, zooplankton, and macroinvertebrates. The costs associated with each pond management strategy will be documented in order to relate the economical costs to the potential benefits for fish production and overall impact on the aquatic community. This research will be used to refine current pond management recommendations to maximize results while minimizing costs to landowners and ecosystems.

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### **Movement of Telemetry Tagged Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*) in the Bonnet Carre' Floodway**

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The Bonnet Carre' Spillway is one of several structures included in the Mississippi River and Tributaries Project (MR&T) and is an integral part of the comprehensive plan for flood risk management in the Lower Mississippi Valley. The Spillway redirects excess flows from the Mississippi River into a floodway that empties into Lake Pontchartrain to reduce river stages at New Orleans. In response to the historic flooding along the Mississippi River in 2011, the Spillway was opened for 42 days beginning 9 May 2011. Following the opening, we used acoustic telemetry to monitor movement of entrained shovelnose sturgeon (*Scaphirhynchus platyrhynchus*) within the floodway. Twelve VEMCO VR2Ws (remote receivers) were deployed in the floodway from the Bonnet Carre' Spillway downstream to Lake Pontchartrain to establish an automated acoustic telemetry array. Eighteen shovelnose sturgeon ranging in size from 501-830 mm FL were captured from upper Barbours Canal, Y-Canal, and the Bonnet Carre' stilling basin and equipped with coded acoustic telemetry tags (VEMCO V9, 289 day battery life) during the period 20-27 June 2011. Tagged fish were then redistributed within the system near select telemetry buoys. To date, we have accumulated > 120,000 total detections and no mortalities have been reported. Initially, all individuals moved extensively near their original release point. However, movement of telemetry tagged fish began to decrease by early August as water levels within the floodway decreased, in part creating isolated pools and remnant channels, and as water temperatures continued to increase. During this period of reduced activity, salinity where the floodway enters Lake Pontchartrain was  $\geq 2$  ppt. Data are still being accumulated and analyzed, but at this time, there have been no detections to support movement of telemetry tagged individuals from the Bonnet Carre' floodway into Lake Pontchartrain.

## **Frequency of Strong Year Classes: Implications on Fishery Dynamics for Three Life History Strategies of Fishes**

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Many studies have examined variation in year-class strength and associated density-dependent growth of fishes. Few studies, however, have considered the effects of these factors on fishery quality. We examined how the frequency of strong year classes affects fish harvest and size structure for three species with varying life histories. We modeled both random and systematic occurrence of strong year classes for white bass *Morone chrysops* (short-lived), largemouth bass *Micropterus salmoides* (intermediate longevity), and blue catfish *Ictalurus furcatus* (long-lived). For white bass and largemouth bass, intermediate frequencies of strong year classes incrementally reduced harvest but improved proportional size distribution (PSD) under current fishing regulations. Greatest improvements in PSD, with minimal effects on harvest (relative to annual strong year-classes) occurred when strong year classes were produced every three years for white bass and every five years for largemouth bass. In contrast, strong year classes of blue catfish every six years maximized harvest and resulted in a fivefold increase in PSD, compared to strong year classes every one or two years. Greater annual consistency in fish harvest and PSD for intermediate- and long-lived fishes were achieved when strong year classes occurred systematically rather than at random. Our results suggest that intermediate frequencies of strong year-class production, relative to species life history, serve to balance harvest and size-structure characteristics. The use of fish stocking or water-level manipulations to produce strong year classes systematically can also improve consistency of annual harvest and size structure of longer-lived fishes.

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## **Development of a Genetic Monitoring Program for Stock Enhancement of Mississippi Spotted Seatrout**

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Spotted Seatrout, *Cynoscion nebulosus* is one of the most popular gamefish along the Mississippi Gulf Coast. Supplementation of native wild populations has been occurring since 2004 through stock enhancement implemented collaboratively between the Mississippi Department of Marine Resources and the University of Southern Mississippi Gulf Coast Research Laboratory. This work focuses on the development of a genetic monitoring program for spotted seatrout stock enhancement in Mississippi. Objectives of the program include development of molecular tools suitable for genetic identification of released spotted seatrout from their wild conspecifics, assessment of population structure and definition of management units, and monitoring of genetic diversity and effective population size of spotted seatrout populations. High throughput multiplex assays were optimized for twelve heterologous microsatellite markers. The broodstock used to produce spotted seatrout juveniles released in Mississippi bays and estuaries in 2009, 2010 and 2011 were characterized at the 12 microsatellites and simulation analyses are in progress to determine the power of the microsatellite panels for identification of released fish from wild seatrout through likelihood based parentage assignment. Samples were taken during 2010 and 2011 from the four major bay systems in Mississippi and from reference populations in Louisiana and West Florida (50 specimens per population). All samples were assayed at the three panels of microsatellite markers.

The data obtained will serve as a baseline for monitoring genetic variation in Mississippi spotted seatrout populations. Analysis of population structure is in progress and includes assessment of the magnitude and significance of genetic divergence among bay systems, and tests for an isolation-by-distance model of population structure in the region.

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### **Life Histories of Asian Carp in a Lower Mississippi River Backwater**

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Bighead carp (*Hypophthalmichthys nobilis*) and silver carp (*Hypophthalmichthys molitrix*) in the Mississippi River enter floodplain habitats when hydrologic connections occur, reside for varying periods of time, and return to the river when connections re-occur. During the period 2005-2010, we studied carp in Forest Home Chute, a backwater near Vicksburg, MS. Pectoral fin rays were sectioned and annual rings were counted to describe demographic patterns. Both species exhibited rapid growth and silver carp were larger at all given ages than previously studied populations in the Middle Mississippi River and in Asia. Bighead carp however, were less abundant than silver carp (1 bighead: 3.5 silver), were 11-17% larger than silver carp at Ages 2-5, and lived longer (12 years max vs 5 years max). Size at age was more variable, however, for bighead carp ( $R^2 = 0.23$ ,  $p = 0.0013$ , d.f. = 42) than silver carp ( $R^2 = 0.61$ ,  $p < 0.0001$ , d.f. = 150), percentage of fish younger than Age 2 was low (4.8%) compared with that of silver carp (29.1 %), and bighead carp Age 5 and older were not collected after prolonged (> 1 year) isolation from the river. Our data suggest that during inundation, backwaters are invaded by multiple age classes of both species, but that bighead carp, especially older individuals are less likely to persist during isolation.

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### **Fishes of the Fayetteville Shale and Factors Related to Assemblage Structure**

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Aquatic ecosystems are continually experiencing novel anthropogenic stresses. With the growing human population, new practices for natural resource acquisition have become necessary to supply increasing demand. However, many of these practices may be detrimental to aquatic ecosystems. Nontraditional shale gas extraction has begun on a large-scale in the Fayetteville Shale region of central Arkansas. This practice entails a suite of activities such as large scale construction, stream water withdrawal and improper disposal of hydraulic fracturing (hydrofracking) fluids that typically occurs in close proximity to or on small headwater streams. The Fayetteville Shale is a geologic basin that crosses several ecoregions, and both the White and Arkansas River drainages. Though intensive surveys have been conducted on the main stems of many of the larger streams and rivers in this area, a thorough survey of small headwater streams (> 3<sup>rd</sup> order) is currently lacking. We conducted a two-year survey of 21 sites located throughout the Fayetteville Shale to determine both fish assemblages and factors that may influence assemblage structure. We sampled fishes quantitatively from multiple riffle pool units per stream, using a backpack electrofisher and multiple pass depletion. We analyzed assemblage structure for each year using

Nonmetric Multidimensional Scaling (NMS), which has been shown to be an effective ordination technique for community data. In both years, NMS resolved a three axis solution. The strongest NMS axis in both years correlated positively to catchment area ( $\tau = 0.69$ ,  $\tau = -0.57$ ). In 2010, Axis 3 correlated to stream gradient ( $\tau = 0.60$ ), while in 2011 Axis 2 correlated with stream gradient ( $\tau = -0.32$ ). The remaining axis in both years appears to be driven by drainage basin endemics (White River and Arkansas River). Stream size, stream gradient and drainage basin all appear to be related to assemblage structure in the Fayetteville Shale region.

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### **Life History of the Redfin Darter (*Etheostoma whipplei*) in Central Arkansas**

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Little is currently known about aspects of life history and ecology of Redfin Darter, *Etheostoma whipplei*. Nearly the entire range of *E. whipplei* is potentially subject to nontraditional natural gas extraction (hydrofracking), a practice related to disturbances such as stream water withdrawal and increased siltation. Due to this potential range-wide threat we find it imperative to improve our knowledge base of *E. whipplei*. We conducted a reproductive life history survey of a population in Cypress Creek, Arkansas from June 2010 to May 2011. Gonadosomatic index (GSI) peaked in February and March at an average of 2.1 for males and March and April at an average of 12.4 for females. Reproductive season, based on presence of mature oocytes, lasts from mid-January to mid-May. Clutch size ranged from 45 – 346 oocytes for females ranging from 42 – 69 mm. Mature oocytes ranged from 0.62 – 1.81 mm in diameter. We conducted snorkeling surveys from February through April to observe spawning activities. Spawning peaked in April and occurs in runs 10 – 25 cm in depth. Males held loose territories roughly 0.5 m<sup>2</sup>. Female darters selected small to medium sized cobble substrate with crevices sheltered from current for spawning activities. Spawning occurred as both fish wedged themselves into the crevice. Asynchronous gamete release may occur as females often vibrated before males. *E. whipplei* is broadly similar to many members of its subgenus in most characteristics of its life history outside of its spawning behavior. Peak spawning occurs primarily before and during strong spring rains. Increased siltation from run-off from natural gas related construction activities at this time has the potential to result in embedded spawning substrate, impaired spawning success and/or low survival and recruitment of larvae.

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### **The Cast Net – The Overlooked Sampling Gear**

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Sampling of fish and decapod communities in estuarine marshes is an important aspect of assessing the health of fisheries and monitoring anthropogenic impact on these sensitive and productive environments. Technically, sampling in these areas is difficult because of the 1) variety of habitats that comprise the landscape, 2) nature and quality of the substrate, and 3) variations in depth. The choice of sampling gear is dependent on many factors, including the habitat and target species. Shallow water, soft substrate, and submersed aquatic vegetation may preclude the use of a trawl, gill net, or seine, and fishes and decapods may be too large/small or mobile for certain gear types to be effective. The cast net may be a sufficient

alternative to the throw trap or drop sampler. We suggest a method for standardizing the cast net with respect to the area covered by each operator deploying the net. Analysis of these data suggests that individuals are consistent but that variation exists among operators ( $F= 32.283$ ,  $p < 0.0001$ , and repeatability,  $r = 0.76$ ). When compared one-to-one with the throw trap, the cast net was quicker, easier to deploy, and collected a greater biomass ( $p < 0.001$ ) and number of species per deployment ( $p < 0.005$ ). Statistically, there was no difference between the two gear types with respect to total number of animals captured per deployment ( $p > 0.1$ ). The cast net is a reasonable gear choice in shallow estuarine marshes.

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## **The Louisiana/Mississippi Tarpon Project --Update**

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Tarpon (*Megalops atlanticus*) are an important economic resource in the Gulf of Mexico (GOM), supporting a multi-million dollar sport-fishing industry from the Florida Keys to the lower Texas coast. The species is migratory within the GOM and is believed to spawn in the Yucatan Channel, Mexico and off the southwest coast of Florida in the spring and summer. Large numbers of tarpon migrate southward along the east and west coasts of Florida in the spring, followed by a reverse migration during June. It is not known if these fish over-winter in the northern GOM. We are collaborating with sport divers and fishers in Louisiana and Mississippi to document the natural history of *M. atlanticus* in north-central GOM waters. One product of this collaboration is a video which documents large numbers of adult *M. atlanticus* around offshore petroleum platforms in the northern GOM during January 1999. Louisiana State Spearfishing Records confirm that nine of the 10 largest tarpon were captured during the months of February and March. Small and large (sub adult) juveniles have been documented in coastal and near-coastal waters of both States. In July 2011, we examined a 56.8 kg spawning capable female tarpon caught from GOM waters, 30 km south of Venice, La. The collection of all life stages of *M. atlanticus* on the coasts of Louisiana and Mississippi suggests that tarpon are capable of completing their life cycle in these waters.

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## **Contribution of 178-mm Channel Catfish (*Ictalurus punctatus*) Stocked in Two Medium-Size Reservoirs in Oklahoma**

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Many stocking programs rear fry to advanced sizes to improve fisheries. In Oklahoma, channel catfish (*Ictalurus punctatus*) are reared to 178-mm before stocking in medium-sized reservoirs to increase the proportion of catchable-size fish. To evaluate the contribution of stocked fish to the current population, we marked, stocked, and monitored the contribution of channel catfish in two reservoirs for one year.

Channel catfish fingerlings (~115 mm TL) were immersed in a 700 mg/ L oxytetracycline solution for six hours, reared in earthen ponds for 30 d, assessed for mark verification, and stocked at 178-mm TL size in September 2010. Fish were sampled from each reservoir monthly from May-August 2011 using baited hoop-nets at 16 randomly selected sites. All fish were measured, weighed, and lapilli otoliths were removed from two hundred randomly collected fish measuring less than 325 mm for mark assessment. Lake Lone Chimney had higher catch rates of fish ( $C/f = 56$ ) but lower contribution of stocked fish ( $C = 26\%$ ) than Lake Greenleaf ( $C/f = 21$ ;  $C = 98\%$ ). Follow-up research regarding the factors related to these contribution differences between reservoirs would aid fisheries managers when deciding which reservoirs to stock.

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### **Estuarine Residence and Movements of Tripletail (*Lobotes surinamensis*) within the Ogeechee River-Ossabaw Sound Estuary, Georgia**

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Tripletail *Lobotes surinamensis* support a popular recreational fishery along the coast of Georgia; however, no studies have been conducted regarding tripletail residency and movements within Georgia estuaries. The objective of our study was to describe the estuarine movements and residency of tripletail in the Ogeechee River-Ossabaw Sound Estuary in Georgia. In summer of 2010 and 2011, adult tripletail ( $n=27$ ; 421-710 mm TL) were captured using traditional angling methods and surgically implanted with ultrasonic transmitters. Tagged tripletail were detected within the estuary via a stationary array of acoustic receivers, which monitored the estuary continuously from June 2010 through December 2011. Manual tracking was conducted using a portable hydrophone and homing. Tripletail were detected in the estuary from April through November at sustained water temperatures above 21°C; outside of this time, tripletail were absent from the stationary array. Movements were highly correlated with tidal stage; 100% of the tagged fish moved upstream with flood tides and returned to the Sound with the ebbing tide on a daily basis. During these movements, we observed tripletail as far upstream as rkm 18. Our study provides the first information on the spatial and temporal habitat utilization of tripletail. Our results suggest tripletail exhibit a high degree of residency in Georgia estuaries and utilize a large portion of the estuary during their daily movements.

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### **Estimating Habitat Utilization from Incomplete Movement Data**

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Increasing interest in the spatially explicit management of fisheries resources requires the development of spatially explicit modeling tools and innovative approaches to data analysis to improve our understanding of the effect of local management onto extended populations. Passive acoustic telemetry is an important method to monitor the spatial behavior and habitat use of smaller fish species, but interpretation of such data has been restricted to residence behavior of mostly residential species. Interpreting the recordings of tagged highly mobile fish continues to be difficult due to limited numbers of receivers and large uncertainty in the true location of fish. In this study I combine resource selection analysis with a mechanistic movement model to explain patterns of space use demonstrated by tagged common snook

(*Centropomus undecimalis*). The unobserved movement between successive relocations is represented as a stochastic drift-diffusion process driven by habitat preferences and an unobservable stochastic state variable. The error associated with observed telemetry locations is derived from the range of acoustic receivers. A case study from Sarasota Bay demonstrates the applicability of the model to individual-based telemetry data obtained in a complex environment. Despite large uncertainty in the movement process, the movement model adds considerable information to the habitat utilization distribution obtained from telemetry data alone, and facilitates the assessment of habitat for fisheries management.

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## **Fine-scale Movements and Home Ranges of Red Snapper (*Lutjanus campechanus*) in the Northern Gulf of Mexico**

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Little is known about the fine-scale movement patterns of red snapper (*Lutjanus campechanus*) around artificial reefs. Such information could provide insight on habitat use and help answer persistent questions concerning the ecological function of these structures for red snapper. Thus, the present study examined fine-scale movements (~1 m accuracy) of red snapper (N = 17) around artificial reefs in the northern Gulf of Mexico with the VR2W Positioning System (VPS, Vemco Ltd, Nova Scotia). This system enabled the continuous monitoring (24-7, ~1 position min<sup>-1</sup>) of tagged fish over extended durations (44–375 d). These data allowed comparisons of movement patterns on various temporal scales (hourly, daily, and seasonal). Red snapper showed a consistent close association with artificial reefs (mean ± SD distance = 25 ± 28 m). Home ranges were significantly larger during the day (mean ± SE = 8,222 ± 478 m<sup>2</sup>) than the night (7,153 ± 503 m<sup>2</sup>) and during summer (8,375 ± 829 m<sup>2</sup>) and fall (10,543 ± 905 m<sup>2</sup>) than spring (4,681 ± 840 m<sup>2</sup>) and winter (1,294 ± 382 m<sup>2</sup>). Home range size was positively correlated with changes in water temperature, suggesting colder temperatures reduced red snapper movement. Red snapper showed a high degree of site fidelity to the studied artificial reefs on multiple temporal scales, and these habitats provided a “home base” from which fish expanded area use to the immediately surrounding unstructured habitat.

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# **CANCELLED**

## **Survival and Behavior of Shoal Bass after Capture and Transport in the Lower Flint River, Georgia**

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Until recently, little was known about the ecology and population status of shoal bass (*Micropterus cataractae*) a centrarchid endemic to the Apalachicola-Chattahoochee-Flint River Basin (ACF). Shoal bass are targeted along with other black bass species during large-scale fishing tournaments within the

ACF. Given the potential negative effects of fishing tournaments on black bass in general and the paucity of information on shoal bass, a pilot telemetry study was conducted from April 2010 – August 2010 to evaluate post-release and post-transport survival and behavioral response of spawning adult shoal bass in the Flint River, Georgia. During April, 27 adult shoal bass were captured at a known spawning site, transmitterd, and then either released at the original capture site (N=13) or transported (N=14) by truck 75 km downriver to a popular boat launch and weigh-in site for numerous black bass fishing tournaments on the Lower Flint River/Lake Seminole system. All 27 shoal bass survived surgical implantation of ultrasonic transmitters, and the 14 shoal bass in the transport treatment group survived the fishing tournament transport simulation. Post-release survival rate after 90 d was not different between transported fish and for fish released immediately. Stockpiling of shoal bass at release sites from tournaments occurs in the short-term. Transported fish remained near their release site significantly longer than fish released at the original capture site. Mean time to dispersal (> 1 km) for the transport group was 28 d compared to 12 d for the released group. Transported shoal bass initially moved an average of only 2.3 km compared to 7.1 km for the released group. However, mean total movement over the 90 d following release was 10.2 km for the transported group and 9.1 km for the released group. The high survival rates observed in this study suggest shoal bass physiologically cope with live-release; however, the re-distribution of adults after transport and release at weigh-in sites may be of concern to fisheries managers.

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### **Shoal Bass Tag Retention and Spawning Aggregation Abundance in the Lower Flint River, Georgia**

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Shoal bass (*Micropterus cataractae*) are a popular game fish endemic to the Apalachicola-Chattahoochee-Flint Basin of Alabama, Florida, and Georgia. Several concerns for the long-term conservation of the species have recently been identified, illustrating the need for quantitative population assessments. The objectives of our study were to 1) Quantify retention of internal anchor tags used in mark-recapture studies, and 2) Estimate the abundance of adult shoal bass in a major spawning aggregation. From February to May, 2011, adult shoal bass (n=144; 298 – 557 mm TL) were sampled using a boat electrofisher, tagged, and released. We used a double-tagging study to assess tag retention while concurrently using robust design to estimate spawning aggregation abundance. Over several months, 100 % of PIT tags and 63% of internal anchor tags were retained in adult shoal bass. Point estimates of adult shoal bass abundance in the aggregation area varied over the spawning season from 87 (95% C.I. 47 – 188) to 181 (95% C.I. 101 – 374). Results of our tag retention study suggest that researchers using internal anchor tags for mark-recapture studies of shoal bass need to account for tag loss beginning one week after tagging. Estimates of abundance and apparent survival in the spawning aggregation suggest that adult shoal bass moved into and out of the aggregation area in discrete pulses, illustrating the importance of large shoal complexes as spawning habitat for this species. We suggest that the abundance estimation methods and tag retention results provided in this study should be applied to future efforts to provide quantitative data as the basis for assessment of at-risk shoal bass populations throughout their native range.

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## **Early Life History of *Prognichthys occidentalis* and *Caranx crysos* Associated with *Sargassum* Habitat in the Northcentral Gulf of Mexico**

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Pelagic *Sargassum* and associated fronts provide an important combination of enhanced biological production and structural habitat in oceanic environments. Fronts are regions of convergence between two water masses and often provide enhanced prey densities for juvenile fishes. The present study examined the influence that this habitat has on the growth, feeding, and condition of larval and young juvenile blue runner *Caranx crysos* and bluntnose flyingfish *Prognichthys occidentalis*. Neuston tows were taken adjacent to fronts, and 1.6–3.2 km from each front in open water to serve as a reference. Sampling was conducted on each side of a front. Otolith increment analysis was performed, and analysis of covariance (ANCOVA) was used to determine the influence of habitat on growth rates. Stomach content analysis determined the influence of habitat on feeding success by means of ANCOVA. Diets were examined for each species and habitats using Morisita's and Schoener's Index. The influence of habitat on fish condition was determined by means of ANCOVA. Significant differences were found in the growth, feeding, and condition for these two species between habitats, although the directionality of the relationships was inconsistent. Variability in the results were likely caused by prey patchiness in the oceanic environment and suggests that *Sargassum* and associated fronts provide conditions for increased growth, feeding, and condition for many larval and young juvenile fishes.

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## **Estimating Grass Carp Consumption using Bioenergetics as a Tool for Verifying Biological Control of Submerged Vegetation**

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In the fall of 2008, a biological vegetation control project using grass carp was initiated in Felsenthal National Wildlife Refuge, in response to a decline in angler visits. To verify that grass carp controlled submerged vegetation, we estimated the biomass of aquatic vegetation, before and after vegetation control, in 2008 and 2010, respectively. We estimated annual production of hydrilla. We calculated grass carp consumption using two methods. We calculated consumption based on feed conversion (F/C) ratios from literature. Consumption to production ratios were used to estimate the proportion of hydrilla production that grass carp might have consumed. We calculated consumption using the Wisconsin Bioenergetics Model 3.0. We performed a sensitivity analysis on activity, egestion, and optimum temperature for consumption. We compared consumption estimates from the two methods. For both methods, individual consumption was calculated for maximum, median, and minimum observed growth. Mean (SD) vegetation biomass was 57.8 (157.2) and 138.1 (346.5) g/m<sup>2</sup> in 2008 and 2010, respectively. Hydrilla production ranged from zero to 2,276 g·m<sup>-2</sup>·year<sup>-1</sup>. The F/C ratio method indicated consumption was 284,726, 125,386, and 50,256 g veg·individual<sup>-1</sup>·year<sup>-1</sup>. Consumption to production ratios indicated grass carp could control 7390%, 1190%, and <1% of hydrilla production at maximum, median, and minimum observed growth and minimum, median, and maximum production, respectively. Using the bioenergetic model, consumption was 150,991, 148,651, and 151,913 g veg·individual<sup>-1</sup>·year<sup>-1</sup>. Adjusting

the activity coefficient  $\pm 25\%$  changed consumption  $\pm 20\%$ . Adjusting egestion  $\pm 25\%$  changed consumption by  $+30\%$  and  $-19\%$ , respectively. Adjusting the optimum temperature for consumption  $\pm 24\%$  changed consumption by  $+75\%$  and  $-38\%$ , respectively. Optimum temperature for consumption had the greatest effect on consumption. All the estimates of consumption from the bioenergetics model method fell between the maximum and median consumption estimates from the F/C ratios method. Both methods indicated observed growth could account for the observed decline in hydrilla biomass.

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### **An Evaluation of Anthropogenic and Non-anthropogenic Impacts on Smalltooth Sawfish (*Pristas pectinata*) Critical Habitat within the Charlotte Harbor Estuary**

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In 2003, the smalltooth sawfish, *Pristas pectinata*, was listed as endangered under the Endangered Species Act. In 2009, two areas in Florida were designated as critical habitat for the species. Critical habitat components, including mangroves and shallow euryhaline habitat, can be negatively affected from flow and/or water quality changes in upgradient watersheds, ultimately affecting sawfish population viability. The Charlotte Harbor Estuary [Critical Habitat Area – Unit I] is influenced partially by inputs from upstream watersheds, including the Peace River. The study analyzed biological and critical habitat requirements for the smalltooth sawfish, in relation to anthropogenic activities and natural events that can affect both water quality and quantity for the Peace River, other watersheds, and the Charlotte Harbor Estuary, to determine the likelihood that mining or other impacts are presently affecting critical habitat for the species. We conclude that despite historic water quality and quantity impacts to the Peace River and Charlotte Harbor Estuary from both human and non-human induced conditions, upstream mining may be no more critical than agriculture, urbanization or water management to the sustainability of smalltooth sawfish within the estuary.

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### **Influence of Multi-Scale Factors on Fish Structural Indices in Freshwater Impoundments: Implications for Successful Fisheries Management**

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Fisheries managers are tasked with providing quality fishing experiences to the public and producing harvestable fish populations. Fisheries biologists may manage waterbodies similarly, but the fish communities produced within these waterbodies can differ across locations. The disparity in fish condition among waterbodies creates uncertainty as to which management strategies produce desirable fish communities. This uncertainty can result in suboptimal use of resources. To further examine how waterbodies and fish communities differ and how to successfully manage these differences, we investigated the influence of multi-scale factors on fish condition. We sampled fish via electrofishing in

26 impoundments from 10 to 357 acres in size. Impoundments were located in 10 parks throughout Georgia, USA. For each impoundment, we used a combination of empirical sampling and geographic information systems to obtain measurements for multi-scale factors including mean depth, surface area, primary productivity, watershed area, land cover, and climate. To reflect the productivity of each impoundment, we calculated structural indices (e.g., relative weight, relative stock density, and proportional stock density) for largemouth bass (*Micropterus salmoides*). We then used information theory, with hierarchical linear regression to evaluate the relationship between impoundment characteristics and fish condition. We found largemouth bass condition was predicted by lake- (e.g., impoundment age, mean depth, benthic biomass) and watershed-level factors (land cover, precipitation, and watershed area). We also found these multi-scale factors can interact to affect sportfish biomass (e.g., climate can interact with lake depth to produce stressful summer stratification conditions). Management actions based on multi-scale factors may optimize fish condition and stock composition in freshwater reservoirs. Because many of the landscape-level parameters (e.g., land cover, geologic composition, and impoundment age) that influence these systems cannot be realistically manipulated, we present managers with activities that can be employed in an economical and practical manner to successfully manage freshwater fisheries.

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### **Summary of Previous and New Records of the Least Darter (*Etheostoma microperca*) in Arkansas**

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The Least Darter, *Etheostoma microperca*, has an extremely limited distribution in Arkansas and is designated as a species of greatest conservation need by the Arkansas Game and Fish Commission. It is restricted in the state to the Illinois River basin in Benton and Washington counties and was first documented in the state in 1938 in Wildcat Creek west of Springdale. Additional discoveries in 1960, 1973, 1981, and 1982 documented its general distribution in the state prior to this study. A 1997 study documented the persistence of the species in 2 of the historic streams. Field sampling in 2004-2005 and 2010-2011, provided more concentrated sampling efforts in the basin. Herein we report on the state of previously documented populations, document additional populations in the vicinity of previously reported ones, and document a population discovered in an additional sub-basin. These efforts update the status of this rare member of the state ichthyofauna and greatly improve the resolution of the distribution of this species within Arkansas.

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### **Putting the Pieces Together to Prioritize the Landscape: A Pilot Project in the Tennessee, Cumberland, and Ohio River Basins**

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In March of 2011, a cooperative effort between the Southeast Aquatic Resources Partnership and the Ohio River Basin Fish Habitat Partnership was begun to model the conditions of aquatic habitat in the Tennessee, Cumberland, and Ohio River Basins, and to prioritize areas most in need of restoration or protection, based on the levels of anthropogenic stress and natural habitat quality. The two Fish Habitat

Partnerships compiled state, regional and national datasets that represented fish communities, habitat threats, and natural aquatic habitat components. Using a modeling approach developed and ran by Downstream Strategies, LLC, models predicted fish distribution patterns, and helped to explain the relationship between the natural habitat qualities and anthropogenic threats that are driving fish responses at the regional scale. Stream reaches with high natural habitat qualities and low anthropogenic stress are targeted as protection opportunities. Areas with medium to high anthropogenic stress and low natural habitat quality are flagged as restoration opportunities. A decision support tool is being developed that can be utilized to predict the impact a protection or restoration project can have on the aquatic habitat. A total of seven different models representing various fish and mussel responses will be discussed.

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## **Quantifying Fish Detection Probabilities with Video Cameras in Dense Submersed Vegetation**

Wilson, Kyle L.\*<sup>1</sup>, David Crain<sup>1</sup>, Micheal S. Allen<sup>1</sup>, Nicholas Cole<sup>1</sup>, Zachary Slagle<sup>1</sup>, and Michael Netherland<sup>2</sup>

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In freshwater ecosystems, dense submersed vegetation provides important habitat for many fish populations but can pose significant sampling problems for fish population assessments due to habitat complexity. We validated a new sampling technique using underwater video cameras (UVC) to measure fish abundance, by evaluating the relationship between fish detection probabilities and habitat. We utilized UVC to obtain point counts on known densities of replica-fish below the canopy layer in dense hydrilla *Hydrilla verticillata* habitat on three 0.45 ha ponds. Our approach avoided uncertainty in animal behavior and point count abundance focusing solely on the relationship between habitat covariates and detection probability. Stem density, turbidity, available light and distance to fish were measure at each point count. We analyzed video recordings to quantify the detection probability in each pond obtaining average detection probabilities of 44% of fish at each point count that sampled ~0.90m<sup>2</sup>. Analysis found that distance to fish and plant stem density significantly influenced detection probability at each point count. We simulated habitat data and UVC point counts drawn from two fish populations to estimate detection probability and ultimately estimate fish abundance. Our results indicated that UVC can accurately and precisely estimate fish abundance in dense submersed vegetation. Current limitations with UVC are the total sampling area is often <1.0m<sup>2</sup> increasing the number of samples needed to make valid abundance estimates. We provide an innovative method for estimating heterogeneous detection probabilities for fish in dense submersed macrophytes, showing that underwater video cameras can be a reliable method of estimating fish abundance in such habitats.

## Larval Crappie Densities in Relation to Environmental Variables and Stock Abundance in Arkansas Reservoirs

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We evaluated relationships between larval crappie (*Pomoxis* spp.) densities, environmental characteristics, and stock abundance in six Arkansas reservoirs in 2010 and five reservoirs in 2011. Environmental variables included dissolved oxygen, pH, hardness, alkalinity, conductivity, turbidity, surface area, watershed area, watershed:reservoir area ratio, shoreline development index, mean depth, maximum depth, chlorophyll-a, and pre-spawn rainfall. Stock abundance was determined from fall trap netting in 2010. Peak larval densities ranged from 0.19 to 1.83 fish/m<sup>3</sup> in 2010 and 0.08 to 1.57 fish/m<sup>3</sup> in 2011 for crappie  $\leq 8$  mm TL. The relationship between environmental variables and peak larval density was modeled using a stepwise multiple linear regression. Peak larval densities were negatively related to the watershed:reservoir area ratio ( $r^2=0.81$ ,  $P=0.0144$ ,  $N=6$ ) in 2010 and shoreline development index ( $r^2=0.67$ ,  $P=0.0909$ ,  $N=5$ ) in 2011. Reservoirs with large watersheds relative to their size may have more variable water levels and lower retention time. Low post-winter retention time has been shown to be negatively related to crappie recruitment. Reservoirs with greater shoreline development index have more littoral area relative to their size which has been associated with predator abundance. Largemouth bass (*Micropterus salmoides*) PSD has been shown to be inversely related to crappie PSD and may regulate the abundance of potential spawners. The relationship between stock abundance and peak larval density was evaluated with the Beverton-Holt model ( $\log_e R = \log_e \alpha S / (1 + \beta S)$ ). Stock abundance (CPUE of crappie  $\geq$  age-2) in the fall was positively related to peak larval density the following spring ( $r^2=0.89$ ,  $P=0.0563$ ,  $N=4$ ). Crappie stock abundance could potentially be used as a guide to prioritize reservoirs for supplemental stockings; however, small sample size limits the interpretation of the model. Evaluation of age-1 crappie abundance from 2011 fall trap netting may help clarify the relationships between environmental variables and year-class strength.

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# POSTER PRESENTATIONS

*Sorted alphabetically by presenter; presenter is underlined; a \* indicates student presenter.*

## **Comparing Selectivity and Catch Rates of Gillnets and ‘Noodle’ Angling for Blue Catfish**

Adkins, Nathaniel D.\*<sup>1</sup>, Brian R. Murphy<sup>1</sup>, Steve L. McMullin<sup>1</sup>, and Vic DiCenzo<sup>2</sup>

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Blue catfish (*Ictalurus furcatus*) provide excellent angling opportunities for recreational anglers within Kerr Reservoir, located in southern Virginia and northern North Carolina. Many of these anglers utilize a unique fishing technique similar to juglines, locally known as noodling. We sought to determine if the sampling methods used by state biologists provide total length (TL) distributions that differ from the blue catfish harvested via noodling. We also compared catch rates between the two gear types. During June through October, we conducted experimental fishing sets using noodles constructed with three hook sizes (3/0, 5/0, and 8/0) to represent the actions of the anglers. We also carried out overnight gillnet sets once a month over the same period using 2-inch-bar and 3-inch-bar gillnets. Statistical analyses of the TL distributions for each of the techniques showed fish collected with 3/0 noodles were significantly smaller than those collected with 5/0 noodles and 8/0 noodles. There was no significant difference in the fish collected via 5/0 noodles versus 8/0 noodles. Fish sampled via 2-inch mesh were significantly smaller than those caught in 3-inch mesh. Nets using 2-inch mesh collected significantly smaller fish than all noodles, while 3-inch mesh collected fish significantly larger than noodles, suggesting that current sampling methods fail to adequately represent the TL distribution anglers harvest via noodling. CPUE averaged 0.156 fish/hook-hour for noodle fishing sets, but regulations allow for multiple noodles to be deployed simultaneously (up to 20 per person), allowing many fish to be harvested in a short period of time. Gillnet sampling was more efficient (CPUE=5.2 fish/net-hour) but may not be representative of angler catch rates. Managers could use noodle angling as a means of sampling to better represent angler harvest, both in size of fish collected and in catch rate.

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## **Managing the Flood Pulse for Optimal Fisheries Production in the Atchafalaya River Basin, Louisiana**

Alford, J. Brian and Mike R. Walker

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The Atchafalaya River Basin in south-central Louisiana (USA) comprises the largest contiguous river-floodplain swamp in North America and functions as a distributary for the Mississippi River to the Gulf of Mexico. We assessed the impact of the annual flood pulse on fisheries production at a basin-wide scale. We modeled flood duration (days/year Butte LaRose gage height > 3.6 m) and magnitude (mean daily gage height) against long term (1987-2009) fishery-independent and fishery-dependent data on largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* spp.), blue catfish (*Ictalurus furcatus*), buffalofish (*Ictiobus* spp.), gizzard shad (*Dorosoma cepedianum*) and crayfish (*Procambarus* spp.). When the Atchafalaya River at Butte LaRose is at flood stage ( $\geq 3.6$  m gage height) for approximately 121-157 days/year, then annual relative abundances of largemouth bass, crappie, blue catfish and

buffalofish are optimized during the fall (October-December). In contrast to the tenets of the flood pulse concept, gizzard shad abundance was optimized during low flow years, when flood duration is  $\leq 10$  days/year. Annual proportion of age-1 largemouth bass was associated positively with flow magnitude during the previous year, while proportions of age-2 largemouth bass and crappie were associated positively with flood magnitude two years prior to the fish sample. Results for commercial production metrics were ambiguous. Crayfish catches were associated positively with flood magnitude and duration, while gizzard shad landings peaked at a relatively small flood magnitude level and were not related to flood duration. Blue catfish and buffalofish annual landings were not influenced by the annual flood pulse. The annual flood pulse can be managed to optimize the availability of recreational (largemouth bass and crappie) and commercial fisheries resources (blue catfish and crayfish). We estimate that a minimum discharge of  $8,807 \text{ m}^3/\text{s}^{-1}$  is required at the river's source for approximately 4-5 months during the winter-spring months to optimize fisheries production.

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### **Applicability of a Handheld Chlorophyll-*a* Fluorometer in Oxbow Lakes**

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Oxbow lake environments in the lower Mississippi Alluvial Valley are subject to high phytoplankton production (herein estimated by chlorophyll-*a*) that have important effects on water quality and fish communities. Quantifying chlorophyll-*a* for monitoring or research efforts requires careful transport and labor-intensive analytical methods. Estimating chlorophyll-*a* with handheld meters measuring fluorescence can be a more efficient, less costly way to monitor. However, the ability of fluorometers to accurately predict chlorophyll-*a* requires creating system specific linear models. Background water characteristics, light conditions, quenching, and turbidity can decrease the accuracy of meter measurements. This research explored sample adjustments (e.g., dilutions, dark adaptation, adjusting for interference effects) and covariates (e.g., turbidity) as ways to improve fluorometer measurements. Sample adjustments were made onsite at the time of fluorescence measurements; turbidity was concurrently measured with a separate handheld meter. The relationship between fluorescence and chlorophyll-*a* was linear and statistically significant ( $P < 0.01$ ;  $r^2 = 0.55$ ). Adjustments made to the sample did not significantly improve this relationship ( $P > 0.05$ ). Adding turbidity to the fluorescence-chlorophyll-*a* relationship did improve the predictive ability of the model ( $r^2 = 0.68$ ). These results suggest that handheld fluorometers can be used in oxbow lakes to predict chlorophyll-*a* concentration, but that measurements are improved if they include a turbidity correction.

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### **Recolonization of an Ephemeral Estuarine Pond by Nekton Species**

Bader, Maiadah\*

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I sampled nekton species in an ephemeral estuarine pond to assess re-colonization of the habitat by fishes, shrimp, and crabs after a flood occurred during Tropical Storm Lee (September 2011). The pond is associated with the University of New Orleans' Coastal Education and Research Facility, which is located

on Chef Menteur Pass. This pass is a narrow natural waterway, which connects Lake Pontchartrain and Lake Borne in southeastern Louisiana. The pond is 43 m X 39 m with all depths less than 1 m. It is located 18 m from a bayou that connects with Chef Menteur Pass. Prior to Tropical Storm Lee, the pond was dry. I wanted to test how soon nekton species re-colonized the habitat and which species occurred when. I deployed three sets of triplicate minnow traps to sample fishes throughout a two-month period starting from 16 September to 16 November 2011. Unbaited traps were sampled and returned to the pond every five days. I also measured salinity, temperature, dissolved oxygen, conductivity, and specific conductance to analyze fluctuations in abiotic conditions associated with weather changes and to examine the habitat conditions. All species collected were identified, weighed, and counted. The top five species collected were sailfin molly (*Poecilia latipinna*), spotted seatrout (*Cynoscion nebulosus*), Gulf killifish (*Fundulus grandis*), blue crab (*Callinectes sapidus*), and white shrimp (*Litopenaeus setiferus*). The first species to re-colonize the pond were *C. nebulosus*, *L. setiferus*, green sunfish (*Lepomis cyanellus*), sand seatrout (*Cynoscion arenarius*), bluegill (*Lepomis macrochirus*), and *C. sapidus*. Over the two months, salinity ranged from 12.4 to 16.5 psu although the nearby bayou had a lower salinity (8.5 psu). It is interesting that this ephemeral pond attracted both estuarine and freshwater species even though its salinity was higher than surrounding habitats.

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### **Exposure to and Effects of Cytochrome P450A1-inducing Contaminants in Unique Populations of Freshwater Atlantic Stingrays (*Dasyatis sabina*) Residing in Florida's St. Johns River**

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Florida's St. Johns River provides essential habitat for hundreds of wildlife species. Previous studies have demonstrated the presence of elevated concentrations of certain environmental contaminants in the northern portions of this river basin, such as polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Exposure to these compounds poses a significant risk to wildlife that resides in these regions, therefore, it is critical to examine pollutant exposure and effects in these populations. The objective of this study was to determine if PCBs and PAHs are affecting the health of unique freshwater populations of Atlantic stingrays (*Dasyatis sabina*) inhabiting this river system. To accomplish this goal, the levels of cytochrome P450 (Cyp1a1), a Phase I biotransformation enzyme involved in the metabolism of both PAHs and PCBs, were examined in stingray liver using the ethoxyresorufin-O-deethylase (EROD) assay. Levels of hepatic EROD activity were measured in ~70 stingrays from multiple sites in the St. Johns River including, 4 central Florida lakes (Lake George, Lake Monroe, Lake Jesup, Lake Harney) and portions of the Lower St. Johns River Basin. Overall, levels of EROD activity ranged from 0.0-14.8 pmolresorufin/min/mg protein. Values are compared among sites to determine if stingray health is being compromised by pollutant exposure.

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### **Evaluation of Habitat Utilization, Recruitment Bottlenecks and Movement of a Coastal Striped Bass Population**

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South Carolina Department of Natural Resources, Marine Resources Research Institute, Charleston, SC

The ultimate goal of our current striped bass research is to build a restoration model for coastal striped bass; here we report our ongoing evaluation of habitat utilization, recruitment bottlenecks and population dynamics in the Ashley River, SC. Our project utilizes cultured animals and molecular genetic tools to

minimize risk associated with re-establishing a coastal population of striped bass and address these challenging ecological questions, building upon preliminary research in this system that once sustained a natural striped bass population. Following the implementation of a full factorial stocking design and an expanded sampling area, a recruitment bottleneck appears to occur during the first summer for striped bass in coastal streams. We have documented through GIS-based evaluation substantial utilization of upstream reaches of coastal streams, specifically with older fish using the uppermost reaches of the system while the young of year fish were recaptured more often in the mid reaches. Even with the increased sample sizes this spring, we had no multiple recaptures of fish to evaluate within-system movement; however, our standardized random sampling throughout coastal SC allowed us to document low levels of striped bass movement between systems. Samples from 2010 and 2011 included the identification of non-stocked fish from the 2009YC and 2010YC within the Ashley River, suggesting evidence of natural reproduction within the system or recruitment into the system for the first time in several decades. Genetic-based restoration designs require a full understanding of the natural population genetic diversity, estimated survival of stocked animals and appropriate strategy for re-introducing animals back into the system. Therefore, through the continuation of our striped bass research within the Ashley River, we will be able to robustly determine the potential for establishment and sustainability of a population within this coastal system.

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### **Integrating Research and Extension for the Creation of a Baitfish Industry in Louisiana**

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A project involving research and extension objectives centered on the Gulf killifish (*Fundulus grandis*) also known as cocahoe minnow began in 2009. Upon its initiation 71 Louisiana bait shop and marina owners were sent a baitfish survey. Response rates were over 50% and indicated that over 50% of those bait sellers could not meet the demand for Gulf killifish, even with three or more suppliers. Based on these results, a need for year round baitfish production was identified as a potential alternative to the seasonally wild-caught supply. Research needs were focused in the areas of egg production, stocking density, sex ratios, collection cycles, temperature maintenance, optimal feeding and the economics involved such an operation. As research continues on optimal production strategies for the Gulf killifish, information is being disseminated to stakeholders and potential marine baitfish producers. In addition to holding informational workshops for interested parties and potential producers, fact sheets with much of our findings are available to the public via the LSU AgCenter website. We have worked with several co-operators outside of the university to cultivate these fish and examine the real world feasibility of growing Gulf killifish from eggs to market size. Finally, an economic analysis has been completed to compare production scenarios to identify the optimal economic scenario for baitfish production. This analysis involved interviewing existing marinas and bait shops to create a feasibility report for potential producers to consider when developing their business.

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## **To Remove the Hook or Not: Degradation Rates of Marine Fishing Hooks**

Coker, John W.\*<sup>1</sup>, Jesse J. Secord<sup>1</sup>, Robin L. Sherman<sup>1</sup>, and David W. Kerstetter<sup>2</sup>

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Ten commercial (sizes 16/0 and 18/0) and recreational (size range: 4-6/0) fish hook models, which were selected as representative of Florida marine fisheries. Hooks were then suspended into individual jars of various strength acid (pH 1.5, 2.5, and 7.8) to simulate gastric conditions and ambient seawater. At regular intervals from 3-82 days following first immersion, hooks were removed and weighed for comparisons. Changes in mass were significant between pH 1.5 and 7.8 treatments and pH 2.5 and 7.8 treatments, although overall mass changes were minimal. Hooks were also dried for later mechanical stress testing at a local fishing gear supplier and tested for metal composition at an independent facility, although those results are not yet available. While not a complete assessment, we feel that these results still provide useful information regarding the potential biological costs/benefits of leaving the hook in a fish upon release, especially as increasing numbers of fisheries are moving to slot-limit management regimes.

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## **Genetic Characterization of the Savannah and Pee Dee River Populations of Robust Redhorse (*Moxostoma robustum*) with Conservation Implications**

Darden, Tanya and Carolyn Tarpey

South Carolina Department of Natural Resources, Marine Resources Research Institute, Charleston, SC

Robust redhorse (*Moxostoma robustum*) is a deep dwelling Catostomid that lives in southeastern rivers of the United States. After being lost to science for about 100 years, robust redhorse was rediscovered in the 1980s by the Georgia DNR and is a federal species of special concern. Our goal was to genetically characterize *M. robustum* populations in two river systems, Savannah and Pee Dee rivers, based on genetic diversity and population structure using a suite of 10 microsatellites. Substantial levels of population structure were detected between rivers ( $R_{ST} = 0.308$ ), with high genetic diversity (0.81-0.87) and low inbreeding in both systems. Long-term estimates of effective population sizes were very high for both systems, but contemporary estimates were substantially lower with the Pee Dee River estimate concerning from a conservation standpoint. Their long life-span and overlapping generations result in a high potential for across year-class spawning and are likely contributing to the maintenance of high genetic diversity in light of their decreased effective population sizes. Although modeling results indicate a faster loss of allelic richness as compared to heterozygosity, results are congruent as the Savannah River population is forecast to maintain 90% of its genetic diversity for >200 years and the Pee Dee for ~65-120 years. These results support the current management of each river as evolutionary significant units, provide an important genetic baseline for future monitoring of *M. robustum* populations and build an excellent foundation tool for any future population restoration activities.

## **Population Recovery of American Shad in the Edisto River, SC: Using Genetics to Characterize Population Dynamics and Stocking Contribution**

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American shad are a diadromous species of fish that support an important commercial and recreational fishery within river systems along the eastern coast of the United States. The 2007 Atlantic States Marine Fisheries Council stock assessment of American shad indicated declines in both commercial landings and catch per unit effort over the last fifteen years within the Edisto River population and recovery efforts are being planned. The goal of our project is to determine if larval stocking will be a viable management tool for enhancing the Edisto River American shad population. Over five hundred genetic samples have been collected during the 2008-2011 sampling seasons. All samples have been genotyped at thirteen *Alosa*-specific microsatellite loci. Initial evaluation has indicated high confidence in the utilization of our suite of markers for parentage analysis and identifying individual fish. Additionally, an initial evaluation of our stocking program detected no difference in genetic composition among the broodstock and field collections. We have determined that no temporal genetic differentiation exists between sampling periods, and effective population size estimates for the Edisto River are low. Our first evaluation of stocking contribution indicated a 1.2% contribution to the 2010 year class prior to their out migration. We will continue monitoring the population genetics of American shad in the Edisto River over the next several years as well as determine stocking contributions for both the 2009, 2010, and 2011 year classes during their return spawning migrations. The project results will be critical in designing effective long term management efforts through our increased understanding of American shad spawning and juvenile survival in the Edisto River.

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## **Preliminary Results of Effects of Intercropping on Crayfish Communities in the Sand-Clay Hills Subsection of Mississippi: Pretreatment Data Collection and Analyses**

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In February 2008, Catchlight Energy LLC, (a Chevron|Weyerhaeuser joint venture) was formed to explore potential of intercropping switchgrass (*Panicum virgatum*) as a biofuel feedstock between rows of planted pine (*Pinus taeda*) on Weyerhaeuser-owned land. Potential large scale implementation of this strategy has created questions about the effects of intercropping on biota in headwater streams. Therefore, our objectives were to: 1) evaluate crayfish community structure within perennial and intermittent streams on intercropping research sites; 2) determine if species of concern were present in streams; 3) revisit historically sampled sites where *Procambarus lylei* (Shutispear Crayfish) was collected; 4) evaluate whether species of concern are reproducing; and 5) evaluate impact of intercropping on crayfish communities using a Before-After Control-Impact study design. During February 2011, stream reaches were electrofished for crayfish species prior to intercropping on research sites. Carapace measurements, sex, and stage of maturity were documented for all crayfish sampled. We collected 320 crayfish from 6 taxa across 8 streams. Two crayfish species of concern were identified: *P. lylei* and *Hobbseus yalobushensis* (Yalobusha Riverlet Crayfish). *Procambarus lylei* were collected in historic sites and in two non-documented sites in the Shutispear Creek drainage. Qualitative data from 1988 indicated reproduction of *P. lylei*, and recent collections of juveniles indicated ongoing reproduction.

Furthermore, *P. lylei* constituted a significant portion of the community where found. *Hobbseus yalobushensis* was collected in intermittent streams which had not previously been sampled in the Topashaw River drainage. Males and females were present in equal numbers for both species at all but one site. Preliminary results and literature indicate that intermittent streams provide important habitat for *H. yalobushensis*. Further study into the stream flow requirements and mechanisms by which flow influences populations would be helpful in managing this species. Although both species reproduced in the study sites, population viability analysis should be studied to determine population sustainability.

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### **The Effect of Structural Complexity, Prey Density, and ‘Predator-free’ Space on Prey Survivorship at Created Oyster Reef Mesocosms**

Decossas, Gary A.\*<sup>1</sup>, Austin T. Humphries<sup>1,2</sup>, Megan K. La Peyre<sup>3</sup>,

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Oyster reefs created by *Crassostrea virginica* form and provide a structurally complex habitat for many estuarine organisms. The structural complexity of oyster reefs may mediate interactions between predators and their prey, but the extent to which this is true and whether other factors override structural effects is unclear. Using a series of laboratory experiments with oyster reef mesocosms, we manipulated structural complexity as well as prey density and ‘predator-free space’ to examine the effects on prey (grass shrimp, *Palaemonetes pugio*) survivorship in the presence of a predator (red drum, *Sciaenops ocellatus*). When manipulating prey density, we scaled and increased the number of prey with increasing structural complexity. By increasing the interstitial space within the reef mesocosms, we were able to manipulate ‘predator-free space’. Our results showed that the presence of structure increased prey survivorship, and that increasing complexity of this structure further increased survivorship, but only to a point. This agrees with theory that a threshold of diminishing returns exists between structural complexity and prey survivorship. The results were consistent when scaling prey density to reef structural complexity or altering the amount of ‘predator-free space’ within our created reef mesocosms. The structure and complexity of our oyster reef mesocosms was more important in facilitating prey survivorship than perceived refugia or density-dependent prey effects.

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### **Within Stream Population Dynamics of *Etheostoma flabellare***

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*Etheostoma flabellare* (subgenus *Catonotus*) is an abundant and wide-spread darter throughout Eastern North America. Previous movement studies have showed that movement within *E. flabellare* is minimal, with movements greater than 200 meters being rare. Phylogenetic studies using haplotype data suggest species subdivision within river drainages, but studies looking at small-scale isolation in darters inhabiting unfragmented streams and rivers are virtually non-existent. The current study uses microsatellite DNA to quantify population isolation and subdivision within a third order stream in the

Ozark Highlands of Missouri. Initial results with 5 microsatellite loci indicate a high degree of fragmentation within this species. These data will be explored in the context of the overall paradigm of movement within darters at large.

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### **Analysis of Nekton Intertidal Distribution within Micro-Tidal Saltmarshes Based on Inundation Models**

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Gulf of Mexico intertidal saltmarsh habitat provides extensive support for a diversity of nekton that feed, grow, reproduce and evade aquatic predators within this transitional ecotone. With each tidal event, nekton exchange energy between terrestrial and aquatic environments. Previous research in east coast meso-tidal habitats has identified nekton dispersal patterns along the marsh intertidal based on tidal depth and distance onto the marsh surface. The prolonged tidal period of micro-tidal systems, although smaller in comparative magnitude to that of meso-tidal systems, allows for the duration of the flooding period to be more influential in determining habitat use patterns of nekton. The purpose of this project is to provide a better understanding of how nekton use the marsh intertidal of a micro-tidal system by focusing on the role of micro-topography and tidal dynamics along marsh gradients. Nekton were captured from the marsh surface twice in August and twice in September 2011 with an array of bottomless lift nets during high tide at three sites within Crooked Bayou, Grand Bay NERR. These samples are currently being picked, sorted and identified. The dispersal of the nekton collected will be analyzed and patterns of distributions will be compared to distance from the marsh creek edge and inundation data. Water depth and referenced elevation points will be used in ArcGIS® to create inundation models for each site to compare frequency of inundation and depth at different capture points on the marsh surface. By facilitating our understanding of nekton habitat use on the marsh surface, enhanced management practices can be implemented in an effort to conserve this critical fisheries habitat, and further identify potential risks that may be created through anthropogenic impact or climatic change. These results may be important when considering salt marsh restoration in micro-tidal ecosystems in the northern Gulf of Mexico.

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### **Evaluating Marshland Habitat for Juvenile Blue Crabs using GIS Imagery of Micro-Scale Landscapes**

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Very high numbers of blue crab megalopae enter the Gulf of Mexico, but a “bottleneck” attributed to lack of juvenile habitat restricts the numbers of blue crabs that reach a harvestable size. Juvenile blue crabs actively seek out complex habitats, and use inundated interior salt marsh in addition to salt marsh edge. According to previous studies, as juvenile blue crabs are collected further into interior marsh, they are fewer in number and smaller in size than their near-shore counterparts. Previous studies have also found

that juvenile blue crabs use the interior marsh during times of inundation, but return to the edge when the water subsides. These three factors, duration of marsh inundation, distance from the edge, and utilization of habitat as a function of crab size, can be quantified and weighted as coefficients using available GIS tools and imagery to generate a marshland habitat suitability model. This model could be a valuable tool to predict the juvenile blue crab carrying capacity of micro-scale coastal wetlands when used in conjunction with other data such as juvenile developmental stage, predator density, prey density, and hydrology.

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### **Investigation of the Impacts of the Deepwater Horizon Oil Spill on Coastal Fish Populations in the Northeast Gulf of Mexico using Measurements of Cytochrome P450 1A1 Activity**

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The Deepwater Horizon Oil Spill (DHOS) occurred in the northeast Gulf of Mexico in April, 2010, resulting in extensive contamination of Gulf waters with oil-related pollutants, such as polycyclic aromatic hydrocarbons (PAHs). It is critical to trace the effects of these contaminants on marine wildlife populations residing in and near sites where the DHOS occurred as well as in coastal locations that were eventually impacted by the onshore transport of oil. The focus of this research was to examine if physiological effects of oil exposure have occurred and are occurring in near shore fish populations residing in oil-impacted locations on the northeast Gulf coast. To accomplish this goal, liver samples were obtained from multiple species of coastal teleosts and elasmobranchs collected from sites extending from FL to LA and analyzed for the activity of cytochrome P450 1A1 (Cyp1a1), a Phase I biotransformation enzyme that is involved in PAH metabolism and is induced in response to PAH exposure. Increased Cyp1a1 activity was observed in fish collected from AL waters after oil reached the state's coastline, suggesting that fish were experiencing physiological effects of PAH exposure. Additional samples are currently being analyzed to determine if similar effects were observed in other coastal locations that were impacted by oil and/or if such effects are still occurring in coastal fish populations.

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### **Composition of Bycatch in Commercial Traps in the Mississippi Blue Crab Fishery**

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Bycatch, the unintentional catch of animals in fishing gear, is a recognized problem in commercial fisheries, including the blue crab fishery. While commercial crab traps are very effective at collecting blue crabs, trap catch often includes a large number of bycatch species. Relatively little information exists on prevalence, species composition, and condition of bycatch in the Mississippi blue crab fishery. A study of the fishery was initiated in May 2007 to provide information on catch-per-unit-effort, fishing effort, biological characterization of the catch, and disposition of the commercial harvest. Twice a month, project personnel accompany three fishermen to collect data for each trap harvested. As a part of this

study, data on bycatch, including species, quantity, and condition are collected for each crab trap. Current data cover the period May 2007 to December 2011. Typically, the amount of bycatch follows a seasonal pattern, with more caught during warm months. Species diversity is highest in traps located in Jackson County and lowest in Hancock County. Overall, nearly 70 different bycatch species have been collected in commercial crab traps. While bycatch mortality does occur, the vast majority of species are released alive.

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## **Implementation of a Before-After Control Impact Study Design to Examine Impacts of Natural Gas Development on the Gulf Mountain Wildlife Management Area, Arkansas**

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The majority of aquatic ecosystems in the United States are imperiled due to anthropogenic effects. New among these is the process of nontraditional natural gas extraction. In the Fayetteville Shale of central Arkansas, nontraditional natural gas extraction has expanded extensively over the last eight years, with over three thousand gas wells currently in existence. Some potential disturbances associated with gas extraction are siltation from pad, road, and pipeline construction, along with improper disposal of production water. Siltation of streams can alter substrates vital for successful reproduction in fishes and macroinvertebrates. To examine impacts of natural gas extraction on headwater streams, we surveyed six headwater streams on Gulf Mountain Wildlife Management Area in north-central Arkansas beginning in 2009. Our study is unique due to the opportunity to obtain an extensive pre-disturbance fish community dataset. To date two well pads have been constructed and further production activities are expected. We sampled fishes quantitatively using backpack electrofishing and multiple pass depletion on multiple riffle-pool units per site. Over the course of the study, overall fish assemblage richness ranged from 2 to 22 species per site. Species richness was positively correlated with catchment area ( $r = 0.88$ ,  $p = 0.02$ ). Most sites were dominated by percids and cyprinids. Fish taxa sensitive to disturbances as defined by EPA standards are found on the Gulf Mountain Wildlife Management Area (e.g. Bigeye Shiner *Notropis boops*, Greenside Darter *Etheostoma blenniodes*, and Rainbow Darter *Etheostoma caeruleum*). In addition, two species present in our survey, Ozark Madtom *Noturus albater*, and Autumn Darter *Etheostoma autumnale*, are Ozark Highland endemics. Continued monitoring of these headwater streams will allow us a strong experimental approach to examine what effects the installation and operation of natural gas well pads has on the resident fish assemblages.

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## **The Diets of Larval and Juvenile Pallid and Shovelnose Sturgeon (*Scaphirhynchus* spp.) in the Lower Mississippi River**

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Although North American sturgeon have been the focus of extensive research in the last several decades, more research is essential to ensure their conservation. The free-flowing Lower Mississippi River (LMR) is occupied regularly by two sympatric sturgeon, pallid— (*Scaphirhynchus albus*) and shovelnose sturgeon (*Scaphirhynchus platyrhynchus*). Recent studies have documented the life history of adult sturgeon in the Mississippi River, but studies focusing on young-of-year (YOY) are limited because

young fish are difficult to collect and identifications are problematic. Spawning sites in the LMR are unknown and though extensive effort has been put forth to capture YOY sturgeon for scientific study, specimens are seldom collected and rarely in large numbers. This gap in knowledge is substantial since recruitment success is important for the recovery and survival of both species. This study takes an ecosystem approach in exploring microhabitat associations of YOY pallid and shovelnose sturgeon based on their diets. During systematic sampling (2001-2010) of the LMR (RKM 131.32-1361.18) 75 total specimens (pallid and shovelnose) were obtained using a 10' Missouri Trawl. Gut content was analyzed and identification of prey items was made to the highest possible taxonomic level. By examining microhabitat preference and behaviors of sturgeon prey items (mostly benthic macroinvertebrates), the microhabitat feeding associations of sturgeon can be predicted. Initial analyses indicate that both species are specific in the type of microhabitat in which they feed. The majority of prey items (71.8%) of both sturgeon species belong to a single subgroup of Chironomidae (*Harnischia* complex) that are predominantly found burrowing in sand substrates, typically shifting sediments of large river systems. Several other sturgeon prey items also are known to occupy this specific microhabitat. These data can be paired with collection data to assess habitat use, availability and threats, and to make recommendations for conservation.

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### **The Reproductive Biology of the Blurred Lantern Shark (*Etmopterus bigelowi*) from the Northern Gulf of Mexico: A Preliminary Assessment**

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Lantern sharks, or etmopterids, are comprised of more than 40 small, deep-water species that play an important role in the mesopelagic ecosystem, and occur circum-globally. In the Gulf of Mexico, little is known about etmopterids, in general, and virtually nothing is known about their reproductive biology, which is most likely due to the lack of sampling within the mesopelagic zone. The blurred lantern shark, *Etmopterus bigelowi*, is one of the largest lantern shark species and is relatively common in the northern Gulf of Mexico. Based on the limited reproductive information available, we know that etmopterid sharks are ovoviviparous and likely have an asynchronous reproductive cycle. During 2010 an increased sampling effort of deep-water bottom trawls were conducted in the northern Gulf of Mexico and a significant number of *E. bigelowi* were collected. The goal of this research is to provide a more accurate description of the reproductive biology of *E. bigelowi* in the region.

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## **Effects of Lake Fertilization on Recreational Hook and Line CPUE for Bluegill (*Lepomis macrochirus*): A Pilot Study**

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The Arkansas Game and Fish Commission (AGFC) has applied fertilizer to lakes for decades as a means to increase the fishery's productivity. Fisheries managers consistently receive complaints from anglers that application of fertilizer decreases angler catch-per-unit-effort (CPUE) for up to one month, primarily affecting bluegill, *Lepomis macrochirus*. We conducted a pilot study on Lake Overcupto determine if recreational angling CPUE for bluegill was negatively impacted by fertilizer application and if this issue merits additional study. Standardized hook and line sampling was conducted to accurately replicate recreational bluegill angling. A multivariate stratified random sample design was used. Meteorological, temporal, water quality and angling data were recorded throughout the lake on each sample day to establish relationships with CPUE. Analysis of standard mean differences indicated that the CPUE ( $P=.049$ ), water temperature ( $P=.017$ ), and pH ( $P<.001$ ) were significantly higher in the post-fertilization condition. Wind speed ( $P=.040$ ) was significantly higher in the pre-fertilizer condition. Turbidity was lower and chlorophyll-a was higher, although not statistically significant, during post-fertilization samples. An initial interrupted time series regression indicated that the general trend of increasing catch rate across the total sample was significant; however the effect on catch rate immediately after fertilizer application and the catch rate across the post-fertilization samples were not statistically significant. A second higher order regression using water temperature, chlorophyll-a, and wind speed as predictors with the trend data indicated that these variables did not significantly influence the catch rate; most likely because the trend data accounted for 72% of variance, due to small sample size. Results indicated that the catch rate increased across both the pre-and post-fertilizer conditions and that fertilization itself did not affect the trend.

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## **Effects of Deepwater Horizon Oil Spill Evaluated by Fixed Wavelength Fluorescence (FF) of Polycyclic Aromatic Hydrocarbons (PAH) Metabolites in Fish Bile of Coastal and Epipelagic Species**

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The Deepwater Horizon oil spill released large quantities of petroleum into the Gulf of Mexico. It is vital to determine the effects on Gulf wildlife from the oil-related pollutants, particularly the polycyclic aromatic hydrocarbons (PAHs), which are the most toxic components of oil. The goal of this study is to evaluate the effects of the oil spill on pelagic and coastal fish species in the Gulf of Mexico. The study examined fluorescent aromatic compounds (FACs), which are PAH metabolites, in fish bile via fixed wavelength fluorescence. Fluorescent values were measured for naphthalene, pyrene and benzo(a)pyrene; concentrations were also determined for each FAC with protein used to normalize values. The ratio between petrogenic (naphthalene) and pyrogenic (benzo(a)pyrene) FACs was assessed to analyze source of PAHs. At the present time the results show evidence for naphthalene-, pyrene- and benzo(a)pyrene- like

metabolites in bile for all locations, but no consistent trends have not yet been observed. This suggests that animals are taking up the PAHs and metabolizing them to FACs. The amount of FACs was highly variable among and between sites, which may be due to species' specific differences in the metabolism of PAHs. The majority of the samples currently analyzed are epipelagic species, which could account for the variability due to their mobility. Additional samples from pelagic and coastal sites are currently being analyzed. The results will be re-assessed to determine effects of oil spill on both coastal and epipelagic marine fishes.

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### **Resident Benthic Fish Populations of Artificial Reefs in the Mississippi Sound: Effects of Habitat Relief and Subregion**

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Cryptic benthic fishes are ecologically important residents of oyster reefs, and may contribute to the diets of sport fishes visiting reefs. Alternative artificial reef designs coincide with different physical conditions, including flow speed and sedimentation rate, which may also affect the suitability of reef habitats for benthic cryptic fishes. To address this question, we are examining resident benthic fish populations of two high profile and two low profile artificial reefs in the Mississippi Sound in an effort to document variations in community structure, densities and the condition of resident benthic fishes among the reefs. We employ small oyster habitat samplers made from modified minnow traps containing oyster shell. After a conditioning period, these samplers serve as habitat for cryptic fishes. Preliminary results comprise pilot collections from one low profile reef in July, and two collections from all four reefs in September and October of 2011. Dominant cryptic benthic fishes included the Oyster toad fish, *Opsanus beta*, the Naked goby, *Gobiosoma bosc*, and the Freckled blenny, *Hypsoblennius ionthas*. By far the Naked goby was the most abundant and frequently occurring species on both reef types, occasionally forming dense aggregations. Few benthic fishes were collected from the low profile reefs during either autumn collection; however, a decline in overall abundance was observed between September and October. A precipitous decline in the abundance of naked gobies was noted at one of the low profile reefs between July and September. This decline might reflect seasonal behavioral shifts or the impacts of Tropical Storm Lee which passed through the study area during September 2011. High profile reefs were not as bereft of cryptic fishes as low profile reefs during autumn. Continued sampling will be conducted in the spring and summer of 2012.

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### **Nursery Habitat Function of Small, Low-Order Tributaries: An Often Overlooked Feature of River-Floodplain Ecosystems**

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Floodplain environments have been shown to provide important spawning and nursery habitat (e.g, oxbow lakes, backwater, and seasonally inundated floodplain); however, little attention has been directed specifically to the function of low-order floodplain tributaries that are seemingly undervalued floodplain

habitat. Despite their visual resemblance to drainage ditches, lowland, floodplain tributaries provide permanent access to seasonally inundated habitat important for spawning. Similar to oxbow lakes, floodplain tributaries may provide low velocity habitat conducive to growth and development of floodplain resident fishes and migratory fishes prior to recruitment to the main channel. From 2007 to 2011 three first to second-order lowland tributaries of the Fourche LaFave River, AR (Caney Creek (CC), Lawson Creek (LC), and West Fork Mill Creek (WFM)) were sampled for richness and abundance of young-of-year (YOY) fish species (CC 2007, LC 2007 and 2008, and WFM 2007, 2008, and 2011). Each sampling event was comprised of 3-4 seine hauls per stream section (upper, middle, and lower) and 1-2 overnight mini-fyke net sets per section. Sampling was undertaken to monitor post spawn species richness and abundance and analyze trends across years of varying hydrologic conditions. Across all years, tributaries, and gear types, approximately 42 YOY species were collected. The young-of-year fish fauna among tributaries was very diverse containing ecologically important fishes (*Dorosoma petenense* and *D. cepedianum*), recreationally important fishes (*Lepomis macrochirus*, *L. gulosus* and *Micropterus salmoides*), and species of conservation concern (*Atractosteus spatula*, *Etheostoma fusiforme*, and *Erismyzon sucetta*). West Fork Mill Creek was the only tributary sampled in all three years; YOY assemblage composition at this site differed across years with different flooding regimes. Abundant YOY fishes corresponded to coupling of flooding with optimal spawning times of resident and migratory species. Preliminary analysis has shown these low-order tributaries are important fish nurseries containing diverse YOY fish assemblages, necessitating further investigation.

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### **Length Frequency Changes of Longspine Porgy (*Stenotomus caprinus*) from 1987 to 2011: Evidence of Shrimp Trawling Bycatch Impacts?**

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*Stenotomus caprinus* (longspine porgy) is one of the top five most abundant bycatch species caught in trawl fisheries in the northern Gulf of Mexico. Southeast Area Monitoring and Assessment Program (SEAMAP) surveys have collected data since 1987 on a variety of Gulf of Mexico species using groundfish trawl nets. Biological data include lengths, weights, and abundance of all species, including longspine porgies. Length frequency histograms were developed using the length and abundance data from the SEAMAP surveys and compared to shrimping effort (days fished). Although longspine porgies are a r-selected species which reproduce at a young age in mass quantities, length frequency histograms indicate a population decline. We intend to age longspine porgies via reading the sagittal otolith to obtain their life span, age classes, mortality, and abundance from 1987 to 2011 in order to determine if a correlation exists between the mortality of this species and shrimping effort. A better understanding of the age and growth of this species may provide information to more effectively evaluate their high rate of bycatch.

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## Comparisons of Biomonitoring Results from Davis Pond and Caernarvon Mississippi River Freshwater Diversions

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The purpose of the Caernarvon- and Davis Pond Diversion Structures is to divert Mississippi River water into the Breton Sound and Barataria Bay Estuary, respectively. To evaluate the potential impacts of the freshwater diversions on animals downstream, fish and other biota were analyzed for contaminants. Understanding compound movements through ecosystems is useful for quantifying and predicting potential biological effects. In each project, fish were collected pre- and postdiversion from the Mississippi River and three marsh locations at increasing distances downstream from structure outfalls. In Caernarvon studies, 20 fish species and oysters were sampled (1990 to 1994), where two prediversion and two postdiversion collections occurred. In Davis Pond studies, three fish species, bivalves, euglenoid, and nutria livers were assayed for contaminants levels in one pre- and one postdiversion sampling (2001 to 2009). Contaminant residues measured included organochlorine (OCs) pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), aliphatic hydrocarbons (AHs), and trace elements. Although results between biomonitoring projects were not directly comparable due to differences in study designs, trends in the whole body fish results were noted. Prediversion concentrations were generally higher at Caernarvon than at Davis Pond. Species-specific differences were sometimes noted per compound in Davis Pond among fish sampled at three trophic levels: herbivorous striped mullet (*Mugil cephalus*), omnivorous blue catfish (*Ictalurus furcatus*), and carnivorous largemouth bass (*Micropterus salmoides*). In each postdiversion study, results indicated that organic contaminants (i.e. OCs, PCBs, AHs, and DDT isomers) were increasing in marsh biota, particularly at sites closest to the river. Conversely, the marsh samples generally exhibited lower trace element concentrations than those found prediversion, apparently due to increased freshwater flows; some exceptions applied (i.e., mercury and selenium). Values were compared to those from various sources, including the National Contaminant Biomonitoring Program, in which the 85<sup>th</sup> percentile and above represents cause for concern.

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## The Effects of Statins, Cholesterol Lowering Pharmaceuticals on Larval Sheepshead Minnow and Zebrafish

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24 hour post hatch zebrafish (*Danio rerio*) and sheepshead minnow (*Cyprinodon variegatus*) larvae will be exposed to simvastatin and mevastatin at .01, .1, 1, and 10 mg/L concentrations for 24, 48 and 96 hours in comparison with an environmental concentration at 57ng/L, the maximum river concentration as

of 2006. Genes HMG CoA reductase, retinoid X receptor (rxr), peroxisome proliferators activated receptors (pparg), steroidogenic acute regulatory protein (star), 3-beta hydroxysteroid dehydrogenase (hsd3b, hsd 17b, hsd20b), and cytochrome P450 (cyp 17a, cyp11b, cyp19a1a) will be monitored. These genes all utilized the pathways of steroidogenesis and spermatogenesis. Plasma 11 KT (ketotestosterone) and cholesterol levels will be confirmed with appropriate bioassays (Velasco-Santamaria et al 2011). The antimicrobial, chloramphenicol, will also be applied to account for biotransformation of the statin by endosymbiotic microbes living within the organism. Comparing colony forming units from the samples will confirm the action of the antibiotic. Exposed adults will also be bred and their larvae assessed. Exposed larvae will be grown so that gonadal histology can be analyzed. Extracted RNA from all samples will then be subjected to real time qPCR and confirmed with 11KT and cholesterol bioassays. Confirmation of the statins action will lower cholesterol by down regulation of the genes HMG CoA reductase, hsd3b, hsd17b, hsd20b. If an endocrine disruptor, the genes in spermatogenesis (STAR, PPARy, cyp17a, cyp11b, and cyp19a1a) will be down regulated. The cholesterol and 11KT bioassay should also reflect those levels.

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### **Molecular Systematics and Population Subdivision within *Crystallaria asprella*: Recently Rediscovered Populations from Missouri**

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The genus *Crystallaria* contains two species of darters that are collectively distributed broadly but disjunctly across eastern North America. The recent rediscovery of multiple populations of *Crystallaria asprella* in several river systems in Missouri has warranted a range wide reappraisal of genetic diversity and subdivision within these species as these populations were unavailable at the time of the last published study. Evaluation of mitochondrial and nuclear data sets for these species suggest novel patterns of genetic divergence within *C. asprella*. These data will be compared to patterns of genetic subdivision within co-distributed species of darters in an effort to gain a more complete perspective on extrinsic factors promoting population subdivision.

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### **Testing the Effect of Live Oyster Presence and Structural Diversity on Nekton Abundance and Diversity**

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Biogenic reefs formed by the eastern oyster (*Crassostrea virginica*) provide structurally diverse habitat which supports high densities and diversity of nekton communities relative to other habitat types within estuarine systems. Past studies suggest that the presence of structure alone may be the most important factor in attracting nekton species to reef formations and that increased structural complexity is not a limiting factor for provision of nekton habitat. Few studies, if any, have directly examined the effect of

live oyster presence on nekton habitat use. We used a quantitative sampling technique to examine the effect of live oyster presence and structural complexity of experimental reef units on nekton abundance and diversity. Specifically, we created five reef complexity treatments by placing 5 L of substrate collected on-site in sample trays. Treatments consisted of 4 replicate trays each of no shell (control), loose shell, live single oysters, live oyster clusters only, and a combination of reef material comparable to adjacent natural reef, placed over reef and mud habitat in Sabine Lake, LA. Trays were sampled 3 weeks later. We found significantly higher nekton abundance and diversity for all treatments holding shell or oysters as compared to empty control treatments, but found no significant differences in abundance or diversity among experimental units that varied in live oyster presence and structural composition. The presence of reef material had the greatest effect on nekton support.

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### **Determining the Effect of Major Histocompatibility Genotype on Parasite Load of Common Snook (*Centropomus undecimalis*)**

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Parasites cause commercial losses for aquaculture and fisheries industries; can represent a threat to human health, and in wild fish, impact population structure by affecting reproductive fitness. Parasites rob the host of energy otherwise used for reproduction which may lead to fewer or smaller eggs produced, decreased egg quality, or lengthen the time between spawning events. The Major Histocompatibility (MH) genes are critical for recognition of self and non-self (pathogen derived) peptides, and therefore vital to an adaptive immune response to viral, parasite, and bacterial infections in wild and captive fish. This project will investigate the effect of MH genotype variability on parasite load of common snook, *Centropomus undecimalis*, and relate parasite infection to fecundity. The common snook is a popular gamefish in Florida, providing the state with millions of dollars each year in fishing revenue. To date 10 female snook have been examined for parasites, batch fecundity, and have been genotyped. Our hypothesis is that higher genetic variation of MH alleles will result in a lower parasite load and higher batch fecundity. To the best of the author's knowledge, this will be the first study to test the relationship of MH gene variability on fitness of bony fish. This research is significant for not only for fisheries management, but also for the progression of our understanding of the role of disease in wild populations of fish.

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