

Meeting Program

**23rd Annual Meeting of the
Arkansas Chapter of the American
Fisheries Society**

**Clarion Hotel & Conference Center
Bentonville, AR**

February 3-6, 2009



BENTONVILLE
CONVENTION & VISITORS BUREAU

Meeting Program

Tuesday, February 3

Registration: 12pm – 1pm (Atrium)

Workshop (1 – 5pm; Ballrooms 2 & 3)

“Fisheries Professionals and the Media: You Are More Than Just a Pretty Face”

-presented by Jim Petersen (USGS)

Wednesday, February 4

Breakfast: On your own

Registration: 10am-1pm (Atrium)

Presentation loading: 10am – 12:30pm (Board Room)

Lunch: On your own

Free time: 8am – 1pm

Introductory Session (1pm-3pm; Ballrooms 2 & 3)

1:00 Welcome (Billy Justus, Darrell Bowman)

1:30 Plenary I – Jerry McKinnis

2:00 Plenary II – Don Jackson

BREAK : 2:30 (drinks and cookies)

Session 1 (3:00pm – 4:40pm; Ballrooms 2 & 3)

Moderator: Chris Racey

3:00 Justus, Billy G., James C. Petersen, Suzanne Femmer, Jerri Davis, and James Wallace
An analysis of algal, macroinvertebrate, and fish community indices for assessing low-level nutrient concentrations in wadeable Ozark streams

3:20 Hodges, Shawn
Channel catfish restoration in the Buffalo National River

3:40 Quinn, Jeffrey W.
Harvest of paddlefish in North America

4:00 Horton, Matt
Nuisance aquatic vegetation control on Lake Conway

4:20 Holt, Lee
Discovery and distribution of the Northern Snakehead (*Channa argus*)

in eastern Arkansas

Registration: 3:30pm – 5:00pm (Atrium)
Presentation loading: 5pm – 6pm (Board Room)
Poster set-up: 5pm – 6pm (Ballrooms 2 & 3)

STUDENT-PROFESSIONAL MIXER/SOCIAL (6:00pm – 9pm)

-Offsite at Fastlane (Food & Drinks provided)

* Shuttles depart from Clarion front parking lot at 5:30pm!

Thursday, February 5

Breakfast (buffet provided at hotel): 7 – 8:00am

Registration: 7:30am – 8am (Atrium)

Presentation loading: 7:30am – 8am (Board Room)

Poster set-up: 7:30am – 8am (Ballrooms 2 & 3)

Session 2 (8:00am – 10:00am; Ballrooms 2 & 3)

Moderator: Ted Wallace

- 8:00 Grippio, Richard S.
 Hypoxia and anoxia in the Gulf of Mexico: An Overview
- 8:20 Kottmyer, Mark D., Brian K. Wagner, and Christopher A. Taylor
 Status and distribution of the Gapped Ringed Crayfish, *Orconectes
neglectus chaenodactylus*, in Arkansas
- 8:40 Adelsberger, Christine (G), J. Wesley Neal, and Steve E. Lochmann
 Larval collection and observed movements of telemetered bigmouth
 sleeper *Gobiomorus dormitor* in Puerto Rico
- 9:00 Kluender, Edward R. (G), Lindsey Lewis, and S. Reid Adams
 Movements and habitat use of a leviathan, *Atractosteus spatula*: Initial
 progress and plans
- 9:20 Lochmann, Steve E. and Jeffrey R. Horne
 The effects of stocking hatchery reared largemouth bass on the 2007 year
 class of wild largemouth bass in backwaters of the Arkansas River
- 9:40 Will, Lael (G), and Steve E. Lochmann
 Spatial and temporal variability of fish assemblages on gravel bars in the
 Arkansas River

BREAK & Poster display: 10 – 10:20am (drinks and cookies)

Session 3 (10:20am – 12:00pm; Ballrooms 2 & 3)

Moderator: Ben Batten

- 10:20 Barkley, Sam W., and Sam D. Henry

3-Year Sportfish Survey of the Spring River

- 10:40 Timmons, Brett A. (G) and Steve E. Lochmann
Changes in sport fish characteristics and biomass of aquatic vegetation before and after biological control of vegetation in southern Arkansas
- 11:00 Fisher, Calvin (U), Steve E. Lochmann, M. Wine, and S. Shoults
Propagation and rearing methods for yellowcheek darter *Etheostoma moorei*
- 11:20 Risely, Jeremy T., and Diana L. Andrews
Preliminary results of the Lake Monticello creel survey and mail survey
- 11:40 Cato, Christopher B. (G), Ryan Allen, and Ronald L. Johnson
Genetic structure of largemouth bass (*Micropterus salmoides*) in several Arkansas lakes as determined by microsatellite analysis following the stocking of Florida bass (*Micropterus floridanus*)

LUNCH (Grand Atrium): 12 – 1:20pm

Session 4 (1:20pm – 2:40pm; Ballrooms 2 & 3)

Moderator: Billy Justus

- 1:20 Fox, J. Tyler (G), Ginny Adams, and Karen Steelman
Contaminant concentration analysis of cave streams utilized by grotto sculpin (*Cottus carolinae*) in Perry County, Missouri
- 1:40 Johnson, Clint R. (U), Julie L. Day, and Ginny Adams
Population ecology, growth, and reproduction of grotto sculpin (*Cottus carolinae*), an imperiled cave fish endemic to Perry County, Missouri
- 2:00 Day, Julie (G), and Ginny Adams
Ecology and conservation of grotto sculpin (*Cottus carolinae*), an imperiled troglomorphic fish from Perry County, Missouri caves
- 2:20 Fontaine, Bradley V. (G), Michael A. Eggleton, and Clifford P. Hutt
Assessment of catch and exploitation of largemouth bass *Micropterus salmoides* in the lower Arkansas River
- 2:40 Eggleton, Michael A., Bradley V. Fontaine, and Benjamin G. Batten
Characterization of dike field fish communities prior to proposed notching in the lower Arkansas River

BREAK & Poster display: 3:00 – 3:20pm (drinks and cookies)

Session 5 (3:20pm – 5:00pm; Ballrooms 2 & 3)

Moderator: Dan Magoulick

- 3:20 Ryles, Jade (**G**), Charles Gagen, and John Jackson
Assessing the cumulative impact of road crossings on fish communities in a Ouachita Mountain stream
- 3:40 Entrekin, Sally A., Jennifer L. Tank, Emma J. Rosi-Marshall, Timothy J. Hoellein, and Gary A. Lamberti
Changes in macroinvertebrate production and resource consumption following an experimental wood addition to 3 headwater streams
- 4:00 Carmean, Nicholas J. (**G**), and John.R. Jackson
Spatial and temporal implications of day versus night electrofishing in a large floodplain river ecosystem
- 4:20 Inebnit, Tommy E. (**G**), Reid Adams, and Lindsey Lewis
Relationship between hydrology and reproductive success of alligator gar, *Atractosteus spatula*, in the Fourche LaFave River, Arkansas
- 4:40 Eggleton, Michael A., John R. Jackson, and Benjamin J. Lubinski
Comparison of fish-environment relationships in a large river-floodplain ecosystem using multiple sampling gears

BANQUET SOCIAL (6:00pm – 9pm)

-Onsite at Boston's

-Mardi Gras theme crawfish boil (Food & Drinks provided)

Friday, February 6

Breakfast (buffet provided at hotel): 7 – 8:00am

8:20 **Business Meeting (Ballrooms 2 & 3)**

Meeting Adjourned

***(U) = Undergraduate student paper**

(G) = Graduate student paper

Meeting Abstracts

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Status and Distribution of the Gapped Ringed Crayfish, *Orconectes neglectus chaenodactylus*, in Arkansas

Brian K. Wagner¹, Christopher A. Taylor², and Mark D. Kottmyer³

¹Arkansas Game and Fish Commission, Benton Field Office, Benton, AR

²Illinois Natural History Survey, Center for Biodiversity and Ecological Entomology, Champaign, IL

³The Nature Conservancy, Fayetteville, AR

Orconectes neglectus chaenodactylus, the gapped ringed crayfish, is an uncommon and poorly-known stream-dwelling crayfish that is endemic to the central White River basin of Arkansas and Missouri. This study surveyed a semi-random selection of stream sites in the Arkansas portion of this range in order to characterize the crayfish communities and evaluate the status of *O. n. chaenodactylus* in Arkansas. Collections of a total of 1,811 individual crayfish specimens were made at 82 sites, including 497 *O. n. chaenodactylus* from 21 sites. *O. punctimanus* was the crayfish species most commonly associated with *O. n. chaenodactylus*, occurring at 71% of sites occupied by *O. n. chaenodactylus*. *O. n. chaenodactylus* was found in streams not significantly different from the median characteristics of streams sampled in the study. It is our opinion that *O. n. chaenodactylus* is of moderate concern due to its limited distribution in Arkansas, and should be considered uncommon.

**Larval collection and observed movements of telemetered bigmouth sleeper
Gobiomorus dormitor in Puerto Rico**

Christine Adelsberger¹, J. Wesley Neal², and Steve Lochmann¹

¹S.E. Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

²Mississippi State University, Dept. of Wildlife and Fisheries, Mississippi State, MS

In general, there is little published information about tropical freshwater larval fishes. However, there is a growing interest in conserving and enhancing native freshwater fisheries in tropical regions worldwide. Effective management and culture for stock enhancement requires a thorough understanding of life history. In Puerto Rico, the bigmouth sleeper *Gobiomorus dormitor* is found in rivers and reservoirs, targeted by anglers, and is a candidate for culture and management. The life history requirements of bigmouth sleeper are uncertain, so conditions for culture are unknown. This study examined spawning location and migration using larval sampling and radio telemetry. Larval sampling was conducted during the presumed spawning season in 2007 for 24-hour periods in two river mouths. In summer 2008, larvae were sampled for 12-hour periods in one river at four locations (river mouth, 3 km, 6 km, and 9 km upstream). Radio tagged bigmouth sleepers were released in January 2008, and monitored from February to November. Bigmouth sleeper larvae were caught at the surface and bottom in drift nets and light traps. Bigmouth sleeper larvae appeared only in river mouth samples, and no fish larvae were caught upstream of the river mouth. Observed movement of adult bigmouth sleeper suggested that some fish migrated to the river mouth, and at least one left the river system, returning several months later. It is unclear whether these movements were directly related to spawning activity, but it was apparent that larval bigmouth sleeper likely spend some period in high salinity water to complete its life cycle.

**Discovery and Distribution of the Northern Snakehead (*Channa argus*)
in Eastern Arkansas**

Lee Holt

Arkansas Game and Fish Commission, Brinkley Regional Office, Brinkley, AR

The presence of a single, wild northern snakehead *Channa argus* was confirmed in Eastern Arkansas on April 14, 2008. In the weeks following this discovery, additional sampling within the Piney Creek drainage, using a variety of gear types, yielded 133 additional specimens. Several different year classes and the presence of NSH fry indicated that there is an established population of northern snakeheads in Eastern Arkansas (Lee and Monroe Counties). Extensive sampling efforts in adjacent drainages indicated that NSH are currently confined to Piney Creek and its tributaries. The northern snakehead population confinement to the Piney Creek drainage justifies an eradication effort. The eradication effort is currently being planned and is scheduled to begin in spring of 2009.

The effects of stocking hatchery reared largemouth bass on the 2007 year class of wild largemouth bass in backwaters of the Arkansas River

Jeffrey R. Horne and Steve E. Lochmann

Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

The effects of stocking largemouth bass have been studied in detail for reservoirs, but little research has been conducted on rivers. In fall 2007, Jolly-Seber mark-recapture studies were conducted to estimate abundance of wild age-0 largemouth bass in 10 backwaters of the Arkansas River. Hatchery-reared largemouth bass were stocked at 60 fish/ha into five backwaters after the Jolly-Seber study. In fall 2008, Jolly-Seber mark-recapture studies were conducted to estimate abundance of wild age-1 largemouth bass. At stocking, there were no differences in weight ($T=-0.32$, $df=8$, $P=0.76$), length ($T=0.46$, $df=8$, $P=0.66$), or condition ($T=-0.62$, $df=8$, $P=0.56$) of wild age-0 and hatchery-reared largemouth bass. Daily instantaneous mortality rates for wild largemouth bass in stocked backwaters ranged 0.0006 to 0.0066 with an average (SD) of 0.0048 (0.0036). Mortality rates in unstocked backwaters ranged from 0.0004 to 0.0100 with an average of 0.0051 (0.0048). No significant difference was found between daily instantaneous mortality rates from stocked and unstocked backwaters ($T=-0.08$, $df=7$, $P=0.94$). There was no significant difference in relative weight ($T=0.62$, $df=7$, $P=0.55$) or growth ($T=0.06$, $df=7$, $P=0.95$) between wild age-1 largemouth bass from stocked and unstocked backwaters. In this case, stocking hatchery-reared largemouth bass did not appear to affect the wild year class.

Spatial and temporal variability of fish assemblages on gravel bars in the Arkansas River

Lael Will and Steve E. Lochmann

Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

We examined temporal and spatial variability of fish assemblages on 18 gravel bars in the Arkansas River. The influence that specific environmental variables, such as water quality and substrate composition, have on fish assemblage structure was also examined. Gravel bars were stratified by depth and distance from an upstream lock and dam. Fish assemblages on each gravel bar were sampled six times. Each sample consisted of duplicate trawls using a 3-m Herzog Armadillo trawl. Water quality parameters were measured in conjunction with fish sampling. Substrate samples were collected on each gravel bar using a standard Ponar dredge. The fish assemblages on gravel bars in the Arkansas River are primarily dominated by juvenile Ictalurids, Cyprinids, and Centrarcids. Of those, juvenile blue catfish, channel catfish and silver chub were the most abundant. Fish species richness was significantly different between shallow and deep gravel bars ($P < 0.0001$) and among the seasons ($P < 0.0001$). Catch per unit effort (CPUE) for the three most abundant species was analyzed for differences among depths, distance strata, and seasons. There were differences in CPUE among depths ($P = 0.03$) and seasons ($P < 0.0001$) for blue catfish. There were differences in CPUE among depths ($P = 0.01$, $P < 0.0001$), distances ($P = 0.04$, $P < 0.0001$), and seasons ($P < 0.0001$, $P < 0.0001$) for channel catfish and silver chub. The spatial and temporal variability in fish assemblage structure suggests that shallow gravel bars during the summer and fall seasons may be important habitat for some fish species.

3-Year Sportfish Survey of the Spring River

Sam W. Barkley and Sam D. Henry

Arkansas Game and Fish Commission, Jonesboro Regional Office, Jonesboro, AR

An intensive, electrofishing sampling effort was conducted over 60 km. of northeast Arkansas' Spring River from 2004 through 2007 to assess the quality of the river's sportfish assemblage. Over 4,000 sportfish were collected during the study using single-pass, day-time electrofishing techniques. Thirteen species of sportfish were taken with size-structure, population density, length-at-age, relative weight and stomach content data being collected for 5 warm water fish species commonly sought by area anglers. Smallmouth bass exhibited very rapid growth and were found to be the most abundant sportfish taken. The Spring River also contains a world-class shadow bass fishery and has good numbers of largemouth bass, spotted bass, walleye and channel catfish. The study results suggest that the current fishing regulations are effective in producing a high quality smallmouth bass fishery and that the other sportfish may be an underutilized resource.

Propagation and rearing methods for yellowcheek darter *Etheostoma moorei*

Calvin Fisher¹, Steve E. Lochmann¹, M. Wine², and S. Shoults³

¹Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

²U.S. Fish and Wildlife Service, Conway, AR

³Greers Ferry National Fish Hatchery, Heber Springs, AR

Yellowcheek darter *Etheostoma moorei* is found only in the shallow, high gradient riffles of the tributaries of the Little Red River in Arkansas. Over the last twenty years *E. moorei* has undergone a massive decrease in population. *E. moorei* was listed as a candidate species for addition to the Federal Endangered Species List in 2001. Our goal was to develop a successful propagation method, and once propagation had occurred to develop an effective feeding schedule to culture *E. moorei* larvae. Adults were captured from the wild using kick seining or snorkeling methods. Two females and one male were stocked into 57-L recirculating aquaria and fed a diet of blackworms 2-3 times per day. They were monitored continuously to observe spawning activity and to determine when spawning had occurred. When spawning was observed, the eggs were photographed at scheduled intervals until hatching occurred. Larvae were passively collected from the adult aquaria using the surface overflow as they swam up. Larvae were transferred to the 1.5-L black round rubber rearing tubs. The larvae were photographed every two days. Larvae were initially fed a mixture of saltwater rotifers (*Brachionus plicatilis*) at a rate of 10/mL, *Nannochloropsis* algae paste, and artificial plankton. Once they reached a large enough size, they were fed a mixture of rotifers (10/mL) and microcyst *Artemia* nauplii (2/mL). Three larvae survived long enough to develop pigmentation and a benthic behavior.

Preliminary Results of the Lake Monticello Creel Survey and Mail Survey

Jeremy T. Risley and Diana L. Andrews

Arkansas Game and Fish Commission, Monticello Regional Office, Monticello, AR

Lake Monticello is a 607-hectare reservoir located in Drew County in Southeast Arkansas. The reservoir is popular among both largemouth bass and crappie anglers. It receives a large amount of angler pressure during the spring and winter months. From March 2008 to February 2009, an access point creel survey will be conducted at the two accesses on the lake. The objectives of the study are to determine angler pressure, harvest and satisfaction at Lake Monticello. Interviews are conducted in 4 or 5 hour shifts during 16 randomly selected days per month. During the interview, largemouth bass anglers were asked to participate in a mail survey. If the angler agreed, a mail survey was sent asking a series of question about why and when they fish Lake Monticello, along with questions about their feeling on harvesting fish and different regulations. Finally, we allow the anglers to give comments on how to improve their experience at Lake Monticello. At this point, the spring, summer and fall creel surveys have been conducted. During the 144 creel survey days, 691 anglers have been interviewed. Of the 691 anglers interviewed, 258 have signed up for the mail survey and 75% of them have returned the mail survey. Once the information is compiled, it will be combined with the population characteristics study conducted in 2006-2007 to get a better understanding of the fisheries in Lake Monticello.

**Assessment of catch and exploitation of largemouth bass
Micropterus salmoides in the lower Arkansas River**

Bradley V. Fontaine¹, Michael A. Eggleton¹, and Clifford P. Hutt²

¹Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

²Mississippi State University, Dept. of Wildlife and Fisheries, Mississippi State, MS

Historically, limited information has been available for largemouth bass *Micropterus salmoides* populations in the Arkansas River downstream of Lake Dardanelle. The objectives of this research were to characterize angler effort, catch, and harvest on Arkansas River Pool 4. In September 2007, 845 largemouth bass 330-mm total length and greater were collected, tagged, and released for a tag-rewards study designed to assess largemouth bass exploitation in Arkansas River Pool 4. Concurrently, bus route access-point creel surveys were conducted to generate effort, catch, and harvest statistics, and assess angler satisfaction. After one year (October 2007-September 2008), 624 angler surveys were completed and anglers returned 28.9% of the tags. Following adjustment for angler non-response, tagging-associated mortality, and tag loss, adjusted catch rates of largemouth bass were 70.3% and adjusted exploitation of largemouth bass was 13.8%. Compared to national averages, largemouth bass exploitation was low in Arkansas River Pool 4, as the fishery appeared to be largely catch and release. Conversely, largemouth bass catch rates were greater than national averages. Levels of mortality associated with routine handling of bass by both recreational and tournament anglers are not currently known. However, mortality could be significant under certain conditions at such high catch rates.

Characterization of dike field fish communities prior to proposed notching in the lower Arkansas River

Michael A. Eggleton¹, Bradley V. Fontaine¹, and Benjamin G. Batten²

¹Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

²Arkansas Department of Environmental Quality, Little Rock, AR

In 2007, dike field fish communities were characterized in selected areas of the lower Arkansas River. The goal of this research was to characterize dike field fish communities prior to notching efforts proposed in conjunction with the Arkansas River Navigation Study. Fish communities were sampled using boat-mounted electrofishing and mini-fyke nets, with sampling conducted in February-March and October. Electrofishing sampling in 25 dike fields (179 separate timed runs with 14.6 h of pedal downtime) yielded 49 fish species from 14 families. Catches were dominated by longear sunfish *Lepomis megalotis* (39%), bluegill *L. macrochirus* (15%), clupeids *Dorosoma cepedianum* and *D. petenense* (14%), black basses *Micropterus* spp. (6%), catfishes *Ictalurus* spp. and *Pylodictis olivaris* (5%), and cyprinids (5%). Fyke net sampling (51 net-nights in the same 25 dike fields) collected 27 species from 10 families. Fyke net catches were highly uneven as three species (bluegill, longear sunfish, and blacktail shiner *Cyprinella venusta*) comprised greater than 90% of the catch. Multivariate direct gradient analyses used on electrofishing data suggested that temporal variation related to water chemistry and temperature played a greater role in fish community structure in Arkansas River dike fields than spatial factors such as river mile, pool, or dike location within pools. Interpretations of fyke net results are more limited because data collection was restricted to February-March only. However, in the absence of temporal variables, local factors (e.g., total depth) and spatial factors (e.g., upstream distance from dam and river mile) were most important in the structuring of littoral-zone dike field fish communities. A possible confounding factor influencing all fish community results was the abnormal hydrologic conditions that existed in the lower Arkansas River during summer 2007. Once re-initiated, future research will better characterize seasonal variation in fish communities with both sampling gears and be expanded to additional areas of the lower Arkansas River. Additionally, a better baseline will be developed against which to assess fish community responses to dike notching.

Comparison of fish-environment relationships in a large river-floodplain ecosystem using multiple sampling gears

Michael A. Eggleton¹, John R. Jackson², and Benjamin J. Lubinski³

¹Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, Pine Bluff, AR

²Arkansas Tech University, Department of Biological Sciences, Russellville, AR

³Illinois Natural History Survey, Great Rivers Field Station, Brighton, IL

Modern-day floodplain rivers are subject to a variety of environmental impacts mostly related to economic development. These impacts are especially evident in floodplain habitats where the effects of altered hydrology and associated nutrient exchange, sedimentation, water withdrawal, and reduced connection between the river and floodplain are most exacerbated. Our objective was to examine relationships between floodplain lake fish assemblages and environmental variables in a large river-floodplain ecosystem. Additionally, a multiple-gear approach was used that included high-pulse and low-pulse boat-mounted electrofishing, mini-fyke nets, and experimental gill nets. Across all gear types, multivariate direct gradient analyses indicated that lake size and depth, and water clarity were the most important factors in the structuring of lake fish assemblages. Although fish assemblage structure was not strongly related to river-floodplain connectivity, fish species richness in individual lakes was positively correlated with a qualitative measure of flooding magnitude in those lakes. Procrustean analyses (H_0 : Assemblages are different) indicated that the multiple-gear approach was warranted as lake-specific fish assemblages depicted by the different gear types were different in all cases ($P = 0.109-0.576$), except between the two electrofishing configurations ($P < 0.001$). Our assessment of empirical fish-environment relationships in a large river-floodplain system identified environmental factors important in the structuring of riverine fish assemblages communities, and underscored the need for multiple-gear assessments.

Changes in macroinvertebrate production and resource consumption following an experimental wood addition to 3 headwater streams

Sally A. Entrekin¹, Jennifer L. Tank², Emma J. Rosi-Marshall³, Timothy J. Hoellein²,
and Gary A. Lamberti²

¹University of Central Arkansas, Conway, AR

²University of Notre Dame, Notre Dame, IN

³Loyola University Chicago, Chicago, IL

Significant reductions of large wood in streams have occurred globally from logging, agriculture, and urban development in surrounding watersheds. Wood in streams can increase organic matter retention and stabilize substrates, stimulating microbial and invertebrate production via auto- and allochthonous pathways that fuel higher trophic levels. We hypothesized that total macroinvertebrate production would increase following a replicated 100-m experimental stream restoration designed to increase organic matter retention and expose coarse substrate by adding 25 large logs to 3 streams. Macroinvertebrate biomass, production, and δC^{13} were measured one year before and two years after wood addition in control and treatment reaches. We observed localized increases in organic matter retention and gravel exposure associated with added logs, but no significant reach-scale increases. Macroinvertebrate production increased in one stream, did not change in a second stream, and declined in a third stream. Furthermore, localized changes in retention and substrate did increase overall consumption of allochthonous and autochthonous resources by the macroinvertebrate community in the most productive stream.

Spatial and temporal implications of day versus night electrofishing in a large floodplain river ecosystem

Nicholas J. Carmean and John R. Jackson

Fisheries and Wildlife Program, Arkansas Tech University, Russellville, AR

We compared species richness, catch per unit effort (CPUE), and species composition between day and night electrofishing in backwaters and dike fields of the Arkansas River, AR. Fish were sampled in the fall of 2007 in four different habitats: backwater shorelines (24 paired samples), dike tips (11 paired samples), dikes (10 paired samples), and interdike shorelines (23 paired samples). Richness was higher for night samples in all habitats and ranged from 34 to 37 species. During the day richness ranged from 26 to 34 species. Unique species were collected in all habitats both day (3 to 5 species) and night (7 to 10 species). Night electrofishing produced greater CPUE for largemouth bass (*Micropterus salmoides*), freshwater drum (*Aplodinotus grunniens*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), and river carpsucker (*Carpionodes carpio*) in some habitats. Gizzard shad (*Dorosoma cepedianum*) and white bass (*Morone chrysops*) CPUE was greater during day sampling in some habitats. Species composition in each habitat tended to change from day to night. For example, day sampling in tip zone habitat produced longear sunfish (*Lepomis megalotis*) (40%), bluegill (15%), flathead catfish (*Pylodictis olivaris*) (7%), and blue catfish (*Ictalurus furcatus*) (6%). Night collections included longear sunfish (50%), bluegill (17%), spotted bass (*Micropterus punctulatus*) (6%), and freshwater drum (5%). Additional sampling was conducted in the summer and fall of 2008. These data will be incorporated into a more complete analysis of day and night electrofishing.

**Relationship between hydrology and reproductive success of alligator gar,
Atractosteus spatula, in the Fourche LaFave River, Arkansas**

Tommy E. Inebnit¹, Reid Adams¹, and Lindsey Lewis²

¹University of Central Arkansas, Department of Biology, Conway, AR

²US Fish & Wildlife Service, Arkansas Field Office, Conway, AR

We studied spatial and temporal aspects of alligator gar (*Atractosteus spatula*) reproduction in the Fourche LaFave River system, a tributary of the Arkansas River. During spring and early summer of 2007 and 2008, we determined the timing and location of alligator gar spawning events from collections of larvae and two direct observations of spawning. Spawning occurred primarily in tributaries and generally corresponded with an increase in river stage due to flooding from the Arkansas River when water temperatures ranged from 22°C to 27°C. Reproductive success in 2007 was relatively high with five spawn events contributing to over 1000 observed alligator gar larvae/early juveniles (<70 mm) in June and over 100 juveniles (70 -1200 mm) observed in fall 2007 through early winter 2008. In 2007, river levels were below flood stage preceding the spawning season and then increased to a high magnitude, long duration flood event during and after reproduction, providing abundant spawning and nursery habitat. However, in 2008 a high magnitude, long duration flood event preceded the spawning season and river levels gradually decreased to below flood stage during and after reproduction. Spawning and recruitment success in 2008 was relatively low with only one spawn event (direct observation) and no larvae or juveniles observed. Our data suggest that timing of flood events and increase in water temperature not only cue spawning behavior in alligator gar but are also a determining factor in recruitment of young alligator gar in the Fourche LaFave River.

Ecology and conservation of grotto sculpin (*Cottus carolinae*), an imperiled troglomorphic fish from Perry County, Missouri Caves

Julie Day and Ginny Adams

Department of Biology, University of Central Arkansas, Conway, AR

Grotto sculpin are unique populations of banded sculpin (*Cottus carolinae*) endemic to cave systems underlying Perry County, Missouri. These troglomorphic fish are state-threatened and a federal endangered species candidate. Due to the unstable nature of the cave environment, grotto sculpin are highly susceptible to pollution via suspected agricultural and waste runoff. It is therefore imperative that we understand the ecology of this species in order to effectively conserve their populations. We combined a long-term mark-recapture study with a multilocus phylogeographic analysis to examine dispersal, recolonization, and genetic connectivity of grotto sculpin among cave, resurgence, and surface streams. Most fish moved less than 50m (67%) however, substantial movements of over 201m (14%) were observed. In resurgence streams we found a marked decline of adults in late winter (January-March) and a peak in abundance of young-of-year in May, corresponding to the presence of larval sculpin drifting from resurgence springs. This late winter decline in adults may indicate a subterranean migration of adult fish for reproduction. Seasonal abundances and recapture rates drop considerably in winter but increases during spring and summer, supporting movement out of the study area, or deeper into the caves, during winter. Sequence data from the mitochondrial control region and nuclear intron locus, α -enolase were collected and analyzed using parsimony and maximum likelihood techniques. We found a substantial degree of population genetic structure within Perry County, suggesting gene flow may be limited among certain sites. Marked genetic divergence and indications of population isolation were also observed. Our data demonstrate a dynamic demography with higher recolonization and dispersal potentials than published cottid literature indicates, however conservation of grotto sculpin populations should remain a priority in order to preserve maximum genetic diversity.

**Population ecology, growth, and reproduction of grotto sculpin (*Cottus carolinae*),
an imperiled cave fish endemic to Perry County, Missouri**

Clint R. Johnson, Julie L. Day, and Ginny Adams

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Troglomorphic species are considered one of the most threatened groups of organisms worldwide due to their limited range, specific habitat requirements, and limited biological information. Available data is usually limited to single season descriptive studies due to the logistically demanding cave environment. This project focused on long term seasonal length-frequency trends to determine critical life history characteristics including growth, longevity and timing of reproduction of the grotto sculpin, a unique fish threatened by pollution and invasive species. Grotto sculpin are unique populations of banded sculpin (*Cottus carolinae*) endemic to Perry County, Missouri and are believed to be in the process of adapting to the cave environment. Grotto sculpin were sampled in two caves and their corresponding resurgence sites every four to twelve weeks beginning in August 2005. Fish were measured (SL, TL, weight and eye length) and implanted with an elastomer tag for mark-recapture analysis. Growth rates, analyzed using FiSat, were found to be up to twice as high in surface populations compared to cave populations. Along with greater observed maximum lengths from fish found in caves, this growth data suggests that fish residing underground are longer lived than their above ground counterparts. Large numbers of young-of-year fish were observed at surface sites from spring through fall (May-October) before disappearing, presumably into nearby caves. We believe grotto sculpin are using these resurgence sites as nursery areas to allow young fish to grow quickly before entering into the caves, minimizing chances for cannibalism by larger sculpin after migration underground.

Contaminant Concentration Analysis of Cave Streams Utilized by Grotto Sculpin (*Cottus carolinae*) in Perry County, Missouri

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Recent studies have employed polar organic chemical integrative samplers (POCIS) and semipermeable membrane devices (SPMDs) to assess contaminant levels in aquatic ecosystems. The current study is among the first to use these sensitive, *in-situ* samplers to monitor water quality in subterranean streams. Sites chosen for this assessment are located in Perry County Missouri, and represent the only known habitat for the Grotto Sculpin, a rare hypogean fish allocated to the Banded Sculpin (*Cottus carolinae*) complex, and a species of high conservation concern. Of particular interest is the widespread use of sinkholes for disposal of various agricultural, industrial and domestic wastes. Intensive agriculture, petroleum products manufacturing and wood curing operations are also suspected sources of contaminants. Thin or unconsolidated soil layers underlying many Perry County sinkholes allow contaminant-laden rainwater to flow directly into caves without filtration and remediation. As a consequence, water quality can quickly and severely decline with rapid transmission of pollution from the surface into caves and conduits of the karst aquifer. In order to assess contaminant levels, perforated stainless steel canisters containing POCIS and SPMDs were deployed in five cave streams for a period of 30 days during May 2008 and again during June 2008. Upon collection, accumulated chemicals were extracted and purified in preparation for qualitative and quantitative analysis by gas chromatography (GC) – mass spectrometry, and GC – electron capture detection. Concentrations of target contaminants present in SPMD and POCIS extracts were used to calculate and compare time-weighted average ambient water concentrations in cave streams.

Harvest of Paddlefish in North America

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Abstract.—Paddlefish *Polyodon spathula* have been intensively harvested in both sport and commercial fisheries. Recent harvests (2000-2006) were surveyed from state agencies and compared to historical harvests (1965-1975). Seven major sport fisheries had recent annual harvests greater than 1,000 fish, and most large sport fisheries appeared to have sustainable harvests due to intensive management. Recent commercial harvest was greater than sport harvest across the species' range. Most of the commercial harvest was from Arkansas, Kentucky, and Tennessee. Annual commercial harvest from the Ohio River increased from 6,000 kg to 196,000 kg from 1965-1975 to 2000-2006. Annual harvest remained substantial from the Arkansas River (37,000 kg), the lower Tennessee River (121,000 kg), and the Mississippi River (103,000 kg). Harvests of paddlefish (sport and commercial) compiled from the literature were highly variable and ranged between 0.01 to 5.06 fish/ha and 0.04 to 43.43 kg/ha (median = 0.12 fish/ha, 1.73 kg/ha). Stock depression has been associated with a first-year harvest as low as 1.46 kg/ha, and harvests > 5 kg/ha were usually associated with overfishing or opening a previously closed fishery. Case-histories from the Tennessee and Ohio River systems documented that paddlefish were susceptible to overharvest in lentic waters and river-reservoirs, but the threat posed by commercial harvest from large rivers will remain unresolved until more fisheries-independent data becomes available. Anthropogenic alterations to habitat, over-reliance on harvest data, and lack of fisheries-independent data limit our historical understanding of the degree of threat that harvest is to paddlefish populations.

Genetic structure of largemouth bass (*Micropterus salmoides*) in several Arkansas lakes as determined by microsatellite analysis following the stocking of Florida bass (*Micropterus floridanus*)

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The extent and effects of hybridization between the largemouth bass (*Micropterus salmoides*) and introduced Florida bass (*M. floridanus*) in southern lakes has been a great source of debate. Previous genetic studies investigating hybridization of these two species have often lacked sufficient resolving power to distinguish specific hybridization events. The goal of this study was to determine the incorporation of Florida bass alleles into several Arkansas lakes. To achieve this goal, a suite of seven microsatellite markers capable of distinguishing largemouth bass, Florida bass, and their hybrids were employed to categorize over 2000 individuals from 8 southern Arkansas lakes (Lakes Chicot, Columbia, DeGray, Erling, Millwood, Monticello, Ouachita and SWEPCO). These lakes had differing Florida bass stocking histories, ranging from no previous introductions to extensive and continued stocking. DNA extraction was performed on bass fin clips, microsatellite loci were amplified using PCR, and alleles were separated using capillary electrophoresis. The software *Structure* was used to analyze the distribution of microsatellite loci within individuals and populations, cataloging allele frequencies, and for admixture analyses. Largemouth bass allele frequencies ranged from 0.29 (Lake Monticello) to 0.99 (Brushy Creek of Lake DeGray) for the composite of the loci studied. Allele frequencies and cluster analysis are largely consistent with that predicted based upon stocking histories and protocols.

Assessing the cumulative impact of road crossings on fish communities in a Ouachita Mountain stream

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Little is known of the effect of road crossings on fish communities, the majority of work done to assess this issue has focused on anadromous coldwater species. This study is being conducted on Long Creek a tributary to the Little Missouri River in the Ouachita National Forest of Arkansas. Long Creek was chosen for this study because there are nine road crossings within approximately 7 km of stream. The objective of this study is to describe the impacts of multiple road crossings on fish communities and the capacity of fish to recolonize sites following depletion as might occur in intermittent streams during summer months. Fish were removed from six depletion zones five 100 m in length and one 180 m. Acrylic polymer was used to make subcutaneous marks on all fish captures for 100 m upstream and downstream of depletion zones. Variations in color of polymers serve as indicators of location of origin for recaptured fish. PIT (passive integrated transponder) tags were used to mark smallmouth bass (*Micropterus dolomieu*) and northern hog suckers (*Hypentelium nigricans*) for analysis of migration tendencies following successive recaptures. A total of 2883 fish were removed in the depletion zones of which 35.9% (1036) were central stonerollers (*Campostoma anomalum*) 22.5% (649) were orangebelly darters (*Etheostoma radiosum*) and 16.9% (489) were longear sunfish (*Lepomis megalotis*). The results presented here were gathered in the first of two summer field seasons and detail mostly community structure as monitoring for movement will be the focus of the second field season.

An Analysis of Algal, Macroinvertebrate, and Fish Community Indices for Assessing Low-level Nutrient Concentrations in Wadeable Ozark Streams

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Biological indices for algae, macroinvertebrate, and fish communities can be effective for monitoring streams with high nutrient concentrations, but little is known regarding the efficacy of each community for monitoring low-level nutrient concentrations. The U.S. Geological Survey National Water-Quality Assessment Program collected nutrient (nitrogen and phosphorus) and biological samples from 30 Ozark streams in 2006 and compared biological metric and index response to a nutrient index calculated from log-transformed and normalized total nitrogen and total phosphorus concentrations. Biological metrics that were the best candidates for the three indices were identified with a process that included a combination of non-parametric multivariate-, univariate-, and visual-selection procedures. After consideration of 78 algal metrics, and 58 metrics each for macroinvertebrates and fish, 4 metrics were selected for each of the three biological indices. The algal index had higher correlations to the nutrient index and to agriculture land uses (i.e. poultry and cattle production) than did macroinvertebrate and fish indices. Our data suggest that the algal community may be most appropriate for monitoring exposure to low-level nutrient concentrations, perhaps, because nutrient uptake is more direct for primary producers than for consumers.

**Movements and Habitat Use of a Leviathan, *Atractosteus spatula*:
Initial Progress and Plans**

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The Fourche LaFave River of west-central Arkansas accommodates a viable population of alligator gar, *Atractosteus spatula*. The relatively unimpacted status of the river allows recruitment by maintaining connectivity with critical spawning locations in the shallow floodplain tributaries. Thus the Fourche LaFave population is attractive as a model for the movements and habitat use of alligator gar in a contiguous system. On 5 December 2008, 15 adult alligator gar were captured with gill nets from a deep bend on the Fourche LaFave River and externally tagged with Advanced Telemetry Systems F2090B radio transmitters. They were also tagged with passive integrated transponder (PIT) tags and t-bar Floy tags. Blood samples and fin clips were taken for sexing and DNA analysis, respectively. Lengths (147.0 cm – 220.0 cm) and weights (25.0 kg – 81.0 kg) ranged widely. Fifteen additional fish will be added to the study population using similar methods. All 30 fish will be located periodically until the summer of 2010. Each location will add to a body of data describing movement patterns and habitat use and selection as they vary across season, day, and spawning events. Rate of movement to and from spawning locations will be calculated as well. We will attempt to analyze all data to detect differences between male and female fish. The majority of existing gar life history data are from lentic and estuarine populations; data describing riverine alligator gar are lacking. This study will produce needed data as well as providing direction for future studies and stewardship efforts in Arkansas and similar regions.

Channel catfish restoration in the Buffalo National River

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In 1910, Seth E. Meek and H. Walton Clark surveyed the freshwater mussel fauna of the Buffalo River from Pruitt to its confluence with the White River. Since their survey, the completion of Bull Shoals (1951) and Norfolk (1943) dams has turned the Buffalo River confluence and adjacent White River habitats into a cold tailwater trout fishery. The full extent of this alteration has yet to be realized, but recent surveys of the fish and freshwater mussel fauna of the Buffalo River are beginning to show changes within the ecosystem. Fish surveys have shown a decline in large, warm water migrates in the Buffalo River, with the most notable being freshwater drum (*Aplodinotus grunniens*) and channel catfish (*Ictalurus punctatus*). After a three year freshwater mussel survey, the mussel species that require these fish as host are in decline within the Buffalo River. The National Park Service in cooperation with the Arkansas Game and Fish Commission are working to restore the channel catfish to replace the lost fishery and their historic role in the river ecosystem.

Nuisance Aquatic Vegetation Control on Lake Conway

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Various methods of vegetation control were used to control several species of nuisance aquatic vegetation on Lake Conway, a 6,700 acre man made reservoir, located in central Arkansas. The size, location, morphology, and hydrology of the lake contribute greatly to its acceptability to, and difficulty in treating nuisance aquatic vegetation. The management goals are to reduce the coverage of nuisance aquatic vegetation to tolerable levels, with emphasis on alligatorweed (*Alternanthera philoxeroides*) control. Five species of aquatic vegetation are identified for their invasive and problematic nature: alligatorweed, water pennywort (*Hydrocotyle ranunculoides*), waterlettuce (*Pistia stratiotes*), spatterdock (*Nuphar lutea subsp. advena*), and American lotus (*Nelumbo lutea*). An intergraded pest management approach is used by incorporating chemical and biological methods to control the aquatic plants. Alligatorweed flea beetles (*Agasicles hygrophila*) are used to assist with the control of alligatorweed. Different methods of chemical application were used including airboat, airplane, and boat application via tank and wand. Aerial photographs were taken to assist in determining and prioritizing spray locations and schedules. Several applications of herbicide are required to control alligatorweed, pennywort and waterlettuce. In 2008, eight treatments of herbicide via airboat were applied to alligatorweed in the same areas resulting in drastic reductions in vegetative mass. Application of herbicide via boat is important in the control of weeds in tight areas (i.e. piers and boathouses). Aerial application of the herbicide glyphosate to several hundred acres of spatterdock and American lotus proved to be effective after only one treatment. Understanding the nature of the water body and plant species, along with the incorporation of various control methods, and persistence in monitoring and treatment have all been crucial to the success of nuisance aquatic vegetation control on Lake Conway.

Hypoxia and Anoxia in the Gulf of Mexico: An Overview

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Hypoxia is a condition found naturally in all coastal areas subject to the discharge of nutrient-rich freshwater rivers containing inorganic nitrogen into nitrogen-limited seawater. This presentation will provide a general overview of the issue of occurrence of extensive hypoxic and anoxic waters in coastal areas of the northern Gulf of Mexico that are influenced by discharge from the Mississippi and Atchafalaya River watersheds. These watersheds are producing unnaturally elevated nutrient levels ostensibly arising from anthropogenic sources, including Arkansas. It has been suggested that such freshwater nutrient input has resulted in eutrophication of the shallow waters located down-current from the coastal discharges leading to organic matter deposition and hypoxic and even anoxic conditions in deeper waters in areas where stratification occurs. These oxygen-depleted conditions may be contributing to deleterious changes in the associated marine fisheries, including finfish, decapods and molluscs.

Changes in sport fish characteristics and biomass of aquatic vegetation before and after biological control of vegetation in southern Arkansas

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The Ouachita and Saline Rivers, creeks, sloughs, lakes, and swamps cross Felsenthal National Wildlife Refuge (FNWR), the world's largest green-tree reservoir. The Refuge has developed an aquatic vegetation problem that hinders angler access and has reduced public visits. The three most abundant aquatic vegetation species are American Lotus *Nelumbo lutea*, Hydrilla *Hydrilla verticillata*, and Coontail *Ceratophyllum demersum*. Aquatic vegetation reduces predator-prey encounter rates, so largemouth bass *Micropterus salmoides* condition and growth can decline. We sampled fish and vegetation from the FNWR. Largemouth bass and bluegill were sampled with a boat electrofisher. Twenty-meter transects and 1-m² quadrats were used to determine vegetation cover and biomass. The mean (SD) CPUE of largemouth bass was 11 (12) fish/hr and the mean CPUE of bluegill was 59 (75) fish/hr. The mean percent cover was 19 (35)% and the mean biomass was 93 (232) g/m². Twenty-five centimeter grass carp *Ctenopharyngodon idella* were stocked at a rate of about 5 fish/ha. The fish and vegetation assessments will be repeated in the future to determine changes in those communities due to biological control of vegetation.