

Abstracts for oral presentations
and posters presented at the
Southern Division of the
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Spring 2007 Meeting

Memphis, Tennessee

Abstracts for all oral presentations
(Contributed Papers; Imperiled Species
Symposium; Stream Mitigation Symposium)
are pooled and listed by abstract submission number.

Poster abstracts are listed separately
following the oral paper abstracts.

Review of TVA's Reservoir Releases Improvements (RRI) Program, Modernization of Douglas Dam turbines, and snail darter monitoring, 1997-2005

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As a federal agency, TVA is not required to obtain FERC licenses to operate its dams, nor has it been forced to mitigate dam operations. However, during the 1980's TVA realized operations at some of their dams negatively impacted aquatic life downstream. Beginning in 1991, the agency's self-imposed Reservoir Releases Improvements (RRI) program developed methods to provide minimum flows and aerate discharges below 16 dams. The 5-year, \$50 million program improved 300 miles of river habitat. Following RRI, TVA began replacing certain older hydro turbines with more efficient, higher volume turbines. Because federally threatened snail darters (*Percina tanasi*) inhabit the French Broad River below Douglas Dam, TVA initiated a nine year study (1997-2005) to monitor effects of modernized Douglas turbines. The study found no adverse effects of the new turbines on snail darters in the lower third of Douglas tailwater. Fluctuations in snail darter abundance during the study period were related to April discharges from Douglas Dam and a four-year drought. Ironically, routine operation of Douglas Dam is thought to favor snail darter survival, although late spring floods can diminish year class strength.

Abstract Number: 100929

Contributed Oral Presentation

Stocking rate and passage of time influence the success of introduction and introgression of Florida alleles in Louisiana largemouth bass

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Since 1982, the Louisiana Department of Wildlife and Fisheries (LDWF) has stocked Florida-strain largemouth bass (LMB; *Micropterus salmoides floridanus*) in Louisiana to enhance recreational opportunities. Since 1988, we conducted analyses using allozyme electrophoresis at two loci to determine the genetic identity of 9,286 LMB. We analyzed the proportion of Florida-strain, hybrid, and northern-strain (*Micropterus salmoides salmoides*) LMB statewide and in individual water bodies. Further, we examined differences in weight-at-length among the genetic identities. In 1988, the state-wide proportions of LMB were 85.8% (8.6 SE) pure northern strain, 2.91% (3.75 SE) pure Florida strain, and 11.25% (6.15 SE) hybrid. By 2005, only 68.6% (14.99 SE) of sampled LMB were pure northern strain, 4.47% (6.17 SE) were pure Florida strain LMB, and 26.9% (12.95 SE) were hybrid LMB. Overall, the probability of sampling a Florida-allele bass increased 9%, 0.0065 SE ($t = 14.04$, $p < 0.01$) each year between 1988 and 2005. Successful stocking and resulting introgression varied by water body ($F = 40.53$, $p < 0.01$). Stocking rates, time since initial stocking, and a combination of stocking rates and time since initial stocking best explained the data. The LDWF stocking program appears to be successful in introducing Florida alleles in Louisiana.

Abstract Number: 100930

Contributed Oral Presentation

Expansion of a Northern Snakehead Population in the Potomac River

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A northern snakehead (*Channa argus*) population was documented in the Potomac River system in 2004. Boat electrofishing mean catch rate increased from 0.2 fish/hr in 2004 to 6.9 fish/hr in 2006 ($r^2=0.99$, $P=0.07$). Reported angler catches during 2006 (33) exceeded the combined total of the two previous years. Mean total length and weight in 2006 were 446 mm ($SD=141$) and 1271 g ($SD=1027$). The length weight relationship was: $\text{Log}W = -5.16 + 3.05(\text{log}TL)$. Dominant habitat uses were shallow waters (< 1 m) with submersed and/or emergent vegetation. Natural reproduction was suspected during 2004 and 2005 based on the collection of age 0 fish both years and identification of nine year-classes in 2005 but confirmed in 2006 when a nest was located. Trends in female GSI and otolith daily ring counts of age 0 fish suggested protracted and/or repeat spawning from May to September. Females were fecund carrying an average of 40,786 eggs. Collection patterns suggested snakeheads originated from Dogue Creek. Fifteen forage species were identified with banded killifish the dominant food item. Bluegill, pumpkinseed and white perch were also commonly consumed. A telemetry study was initiated in April, 2006 when twenty fish were implanted with transmitters. Though still underway, results indicate a high degree of site fidelity, discrete home ranges, and movement in response to changes in flow regime. Although the population appears to be growing, range has not increased greatly. Recent increases in angler catch at the northern and southern terminus of the existing distribution suggest range expansion is probably imminent.

Approximate Sample Sizes Required to Estimate Length Distributions

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Sample sizes required to estimate fish length were determined by bootstrapping from reference length distributions. Depending on population characteristics and species-specific maximum lengths, 1-cm length-frequency histograms required 375-1,200 fish to estimate within 10% with 80% confidence, 2.5 cm histograms required 150-425, Proportional Stock Density 75-140, and mean length 75-160 fish. In general, smaller species, smaller populations, populations with higher mortality, and simpler length statistics required fewer samples. Indices that require low sample sizes may be suitable for monitoring population status, and when large changes in length are evident, additional sampling effort may be allocated to more precisely define length status with more informative estimators.

Current Status and Review of Freshwater Fish Aging Procedures Used by State and Provincial Fisheries Agencies with Recommendations for Future Directions

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In 2006, the Fisheries Management Section of the American Fisheries Society formed the ad hoc Assessment of Fish Aging Techniques Committee to assess the current status of aging freshwater fish in North America. For seven species groups that included black bass *Micropterus* spp, crappie/sunfish *Pomoxis* spp/*Lepomis* spp, catfish (*Ictaluridae*), morinids, percids, salmonids, and esocids, a survey of USA and Canadian fisheries agencies (N = 51 agencies responding) revealed that scales, otoliths, and spines were the most common structures used to age fish. Latitudinal clines existed for some of the structures that were examined, with scales typically used more in northern latitudes than otoliths. Many agencies conducted some validation of age estimates techniques and most assessed precision at least for some of the age samples collected. Providing personnel with training to age fish was common. Scales were the most common structure used to age esocids, black bass, crappie/sunfish, and moronids, but only 27% of all respondents felt that scales accurately aged fish to the maximum age. Alternatively, most agencies felt that otoliths provided accurate estimates. From a review of published papers, otoliths were more accurate when compared to other aging structures and showed higher precision. Most agencies conducted back-calculation of lengths from annuli that provided additional information on growth, even though back-calculation procedures contain complex and inconsistent interpretation and computation issues. Interestingly, many studies are being conducted where known-age fish were chemically or physically marked, stocked, then recaptured after a number of years which can furnish data for age validation. Recommendations include the development of a known-age reference data base to allow sharing of information, publication of validation studies, and careful considerations for conducting back-calculation of lengths from presumed annuli.

Summer flow as a determining factor in American shad *Alosa sapidissima* survival

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Virginia has been conducting an American shad restoration program in the James River using broodstock from the Pamunky River since 1995. Pamunky River shad brood stock catch rates peaked in 2002 at an annual average of 11 per drift gill net set and were as low as 1.7 per drift gill net set in 1997. Declining catch rates since 2002 prompted a review of stream flow influences on year class strength and subsequent return to the river as spawning adults. Extensive age class data from returning adults were available from collection years 2000 through 2005. Year class CPUE indices were calculated from brood stock annual age class distributions. In the eleven years of the restoration, the strongest year classes were from 1996 and 1997 and the weakest from 2001. Correlations of adult year classes CPUE to monthly flows for that spawning year were evaluated for the period April through August. Significant correlations were observed for ages four through six CPUE and the average July flow for that year class. Also significant were the sums of the average June-August flows and corresponding year class strength. In both cases, correlations were nonlinear with the best year classes produced during wet summers. Optimum flows were in the area of 25% exceedence. Year class strength does not appear to be related to flows in April or May but rather rearing conditions in the summer months before migration to the ocean. Reproductive success during the drought years of 2001 and 2002 is expected to be low based upon the analysis. Flows during 2003 were above average and that year class should be near that observed in 1996 and 1997. What is unusual is the dependence upon years with above normal flow. Many

Virginia riverine species have optimum year class strengths when flows are near the median or average values. High summer flows could have several influences on juvenile survival: improved water quality, increased input of inorganic/organic matter for food production, and/or increased longitudinal freshwater habitat due to downstream movement of saltwater wedge.

Abstract Number: 100935

Contributed Oral Presentation

An evaluation of estimators of mussel abundance in a large lowland river in the Southeast US

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Accurate population estimates are crucial for the development and facilitation of effective freshwater mussel conservation strategies. Mark-recapture designs are commonly used to estimate population parameters, but design-specific assumptions must be met to obtain reliable estimates. We evaluated the efficacy of various sampling designs and estimators for estimating the abundance of three mussel species in the Altamaha River in Georgia. We found count based indices were substantially biased by incomplete detection and temporary emigration into the substrate. Temporary emigration also affected estimates from traditional mark recapture designs. Pollock's robust design, which allows for relaxation for certain assumptions, was found to be the best estimator. Our results emphasize the importance for estimating detection and emigration of mussels rather than relying solely on raw count data or traditional capture recapture methods. We also believe that this design is well suited for freshwater mussels not specific to the Altamaha River, and encourage implementation of the design in other systems.

Abstract Number: 100941

Contributed Oral Presentation

An evaluation of the influence of streamflows and species traits on meta-demographic parameters of stream-dwelling fishes

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Fishery biologists are increasingly recognizing the importance of considering the dynamic nature of streams when developing streamflow policies. Such approaches require information on how flow regimes influence species-specific demographic rates, which can be cost-prohibitive to collect. A more cost effective alternative could be the use of species traits to predict how species are likely to respond to changes in flow. To appraise the efficacy of this approach, we evaluated relative support for hypothesized relationships between species traits and the persistence, colonization, and recruitment of stream fishes in relation to seasonal stream flow conditions. We used 4 years of seasonal fish collection data from 23 streams in the lower Flint River Basin, Georgia. Using multi-state, multi-season occupancy models we modeled the meta-demographic rates of 42 species in relation to flow conditions and as a function of a several species-specific traits, including morphological, reproductive, and life-history characteristics. Modeling results suggested that meta-demographic rates were influenced by streamflows, particularly during short-term, low-flow periods. The results also suggested that small-bodied species with generalized life-history and reproductive characteristics were more resilient to flow variability than were large-bodied species with specialized reproductive and life-history characteristics. The results of this study will be applied to a regional study investigating how stream-dwelling fishes are likely to respond to changes in the flow regime.

Abstract Number: 100942

Contributed Oral Presentation

Incorporation of hydrologic variation and mortality as stochastic factors influencing the growth of flathead catfish populations: implications for ecology and management

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We modeled hydrologic variation and mortality as stochastic factors influencing the population growth of native and introduced flathead catfish populations from the Coosa (Alabama, USA) and Ocmulgee (Georgia, USA) rivers, respectively. Size classified matrix models were constructed for both populations, and student residuals from catch-curve regressions were used as indices of year-class strength. A multiple regression model indicated that recruitment of flathead catfish in the Coosa River was positively related to mean spring discharge and November low flow. For the Ocmulgee River population, a multiple regression model indicated that year-class strength was negatively related to mean March discharge and positively related to June low flow. Incorporation of variable hydrology as a stochastic factor resulted in a slowly declining population in the Coosa River. This stochastic population response indicated that the current flow regime in the regulated reach would have a

negative, long-term impact on population growth in the system. In contrast, incorporation of hydrologic variation resulted in a slowly growing population in the Ocmulgee River. By modeling a reduction in mortality of flathead catfish (> 804 mm TL) with the highest reproductive values, population growth increased over a 50-year period in the Coosa River. Simulation of increased mortality of harvestable sized flathead catfish in the Ocmulgee River resulted in a substantial decline in population size. We encourage managers to use this approach for managing native and introduced flathead catfish populations in regulated and unregulated river systems.

Abstract Number: 100946

Contributed Oral Presentation

Variability in size at hatch and percent hatch of sunshine bass larvae due to different male striped bass

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We wanted to examine the amount of variability in size at hatch and percent hatch of sunshine bass due to paternal influence. Eggs from a female white bass were separated into four equal aliquots. Each aliquot was fertilized by sperm from a different male striped bass. Fertilized eggs were placed individually in 10-ml vials and incubated at 18 °C. Eggs were examined every 6 h until the first eggs hatched, and every 3 h thereafter. Approximately 50 yolk-sac larvae were removed from the vials at hatching and photographed. At 4 d post hatch, the remaining yolk-sac larvae were photographed and enumerated. Standard lengths of larvae were estimated from the photographs. This experiment was repeated in two subsequent weeks. There were significant differences in size at hatch among males during the first and third weeks ($P=0.014$ and $P=0.020$, respectively). Choice of male only explained 2%-4% of the variability in size at hatch, while egg stage duration explained 29%-63% of the variability in size at hatch. There were also significant differences in size at 4 d post hatch among males during the first and third weeks ($P=0.034$ and $P=0.002$, respectively). During the first week, the male with the shortest larvae at hatch was also the male with the shortest larvae at 4 d post hatch. During the third week, the male with the longest larvae at hatch was also the male with the longest larvae at 4 d post hatch.

Abstract Number: 100953

Contributed Oral Presentation

The Influence of Ecological Uncertainty on Evaluations of the Effect of Water Use on Stream Fishes

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River regulation and water use are among the foremost problems faced by natural resource managers in the Southeast. Identifying and quantifying the effects of river regulation and water development on aquatic communities is crucial for evaluating potential conservation strategies. The development of effective strategies, however, is complicated by the complexity and uncertainty associated with the response of ecological systems. To evaluate the influence of this ecological uncertainty, I developed empirical models relating changes in flow regime to changes in fish distribution in the Lower Flint River Basin, GA. I then used these models to examine changes in species-specific distribution patterns under 4 simulated water use scenarios. The simulations predicted a decrease in the distribution of 15 fish species relative to the no water use scenario, regardless of the biological dynamics simulated. The estimates of the effects of water use, however, were influenced by the assumptions about how other factors affect fish population dynamics. While it is clear that seasonal streamflows affect fish populations, remaining uncertainty about biological system dynamics make it difficult to predict with certainty the biological effects of water management decisions. I believe that an adaptive approach to managing flows could be incorporated into decision making to resolve the uncertainties about the dynamics of fish populations and improve water resource decision-making.

Abstract Number: 100955

Contributed Oral Presentation

Microhabitat use of the threatened snail darter (*Percina tanasi*) in the French Broad and Hiwassee rivers.

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When discovered in 1975, the snail darter was known only from the Little Tennessee River. The population was extirpated with the completion of Tellico Dam in 1980. Recovery efforts, prior to impoundment of the Little Tennessee River, were responsible for the current populations of snail darters found in the French Broad and Hiwassee rivers. Key to the conservation of remaining populations of snail darters is the estimation of habitat and its use. From June to September 2006, snail darter microhabitat was determined by snorkeling randomly selected 50-m long transects in the French Broad and Hiwassee rivers. Microhabitat use was measured where snail darters were sighted. Fish were characterized as adult (> 45 mm TL) or juvenile (< 45 mm TL). Available

depth, bottom velocity, and water column velocity were measured systematically along transects at 5-m intervals. Predominant substrate class, macrophyte, and silt coverage were visually estimated within a 0.25 m² area. Availability of most microhabitat variables differed significantly between rivers. Adult and juvenile snail darters in the French Broad River used microhabitats in greater proportion than availability. Adult and juvenile snail darters also used different velocities and substrate. Availability in the Hiwassee River was different than microhabitat use by adult snail darters. Juvenile snail darters used macrophyte and silt coverage in greater proportion than availability. Adult darters used different depth than juveniles.

Abstract Number: 100976

Contributed Oral Presentation

Dispersal of tournament displaced black bass and potential release site accumulation in Lake Martin, Alabama.

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Anglers fishing in black bass tournaments often displace fish great distances from their site of capture. Accumulation of black bass, which may have negative effects on populations and the fishery, can occur when many tournaments displace large numbers of black bass to a single tournament processing site. Largemouth bass *Micropterus salmoides* and spotted bass *M. punctulatus* were implanted with radio transmitters to observe the effect of tournament displacement on movement and measure the rate of dispersal from a popular tournament release site in Lake Martin (16,188 ha), Alabama. Displaced fish dispersed from the release site over time, however behavior was altered for up to 9 months after release and some fish remained in the vicinity (< 2 km) of the release site for up to 6 months. Dispersal rates were used to model the increase in biomass of black bass that occurred within 2 km of the release site during the spring and fall tournament seasons. Black bass tournaments probably contributed as much as 6-9 kg/ha of additional transplanted black bass biomass near the release site during typical tournament seasons which could have negative effects on growth, survival, and reproduction. Near the release site (< 10 km), relative weights black bass were less and spotted bass growth was lower compared to the rest of the reservoir.

Abstract Number: 100977

Contributed Oral Presentation

Assessment of the Catfish Fishery in Lake Wilson, Alabama

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A popular recreational and commercial catfish fishery for blue catfish *Ictalurus furcatus* and channel catfish *I. punctatus* exists on Lake Wilson, Alabama, a 6,400 ha impoundment of the Tennessee River. Currently, no bag or length limits are used to manage the fishery and catfish tournaments have increased in popularity on this reservoir as large trophy fish are relatively common. From April through October 2006, a roving creel survey was conducted to evaluate the angling effort, catch, harvest, and other characteristics of the catfish fishery. In addition, 2,200 catfish were tagged with Carlin Dangler tags and exploitation estimated from angler returns that provided a reward. We interviewed 1102 anglers, of which, 50% sought catfish. Local residents from three counties surrounding Lake Wilson comprised 30% of the catfish anglers, while 45% of the anglers were from out-of-state (primarily Tennessee). About 73,000 h of effort were directed at catfish during this time period and anglers harvested 87,000 fish (14 fish/ha) and 49,015 kg (8 kg/ha), and harvest was high compared to other USA reservoirs. Catch-per-effort for harvest averaged 1.17 fish/ h and catfish anglers released only 20% of fish caught. Among catfish anglers, 72 % would be in favor of protecting larger trophy size blue catfish. The majority of blue catfish and channel catfish harvested were between 280 and 575 mm. Estimates of exploitation from tag returns ranged from 7 to 23% for blue catfish and 1 to 3% for channel catfish at varying levels of angler non-reporting. Five commercial fisherman returned 30% of blue catfish and channel catfish tag returns (N=108).

Abstract Number: 100983

Contributed Oral Presentation

Physiology, Survival and Dispersal of Tournament-Caught Largemouth Bass

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J. Percy Priest Reservoir, located east of Nashville, Tennessee, hosts over 400 fishing tournaments per year. Most tournament pressure is focused on largemouth bass, *Micropterus salmoides*. During the traditional weigh-in procedure, tournament-caught bass are transferred to the weighing station in plastic bags and weighed in a dry bag. Shimano, Canada, Ltd. and researchers at Queens University (Ontario, Canada) have developed the "Water Weigh-In System" to reduce physiological stress on tournament-caught fish. Using this system, fish are held in water prior to the weighing event and they are weighed in a basin of water; thus, air exposure is minimized. The objectives of our study are to (1) compare plasma lactate, osmolality, and cortisol levels of

largemouth bass caught in tournaments and subjected to either the Water Weigh-In System or traditional weigh-in procedures, (2) determine whether there is a relationship between blood chemistry of tournament-caught fish and delayed mortality, and (3) describe dispersal of largemouth bass after release from tournament weigh-in sites. From March 2006 to December 2006, radio tags have been externally attached to 57 largemouth bass and 194 blood samples have been collected at 14 tournaments in order to assess stress, dispersal, and mortality. Depending on the month and tournament procedure, delayed mortality ranged from 0% to above 90%. The maximum distance traveled after tournament release was approximately 7 km. Blood plasma assays are currently being conducted.

Abstract Number: 100984

Contributed Oral Presentation

An evaluation of the influence of fish life-history characteristics and flow regime on the recruitment of young-of-year fishes in regulated rivers in the Southeast.

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Modifications to the discharge and temperature (hydrothermal) regime in regulated rivers can negatively affect native stream fish communities. Spawning success of some species can be substantially decreased as a result of hydrothermal alterations. We hypothesize that life history characteristics determine the extent to which hydrothermal alteration affects fish reproductive success and recruitment. We evaluated the relative support for models representing hypothesized influences of streamflow and fish life history characteristics on recruitment of young-of-year fishes using existing datasets from two regulated rivers; the Tallapoosa River, AL and the Flint River, GA. Hierarchical linear models indicated relatively strong support for models relating recruitment to flow variability during critical spawning and rearing time periods and less support for the effects of minimum flows. There also was evidence that species with protracted spawning periods and generalized spawning requirements were less influenced the variation in the hydrothermal regime. Using these models, we plan to construct decision models that predict how native fishes are affected by river regulation according to their specific life-history traits.

Abstract Number: 100985

Stream and River Mitigation Programs Symposium

The Federal Energy Regulatory Commission's Integrated Licensing Process(ILP): A state biologist's perspective on what you can expect

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The Federal Energy Regulatory Commission (FERC) implemented the Integrated Licensing Process (ILP) on July 23, 2003 as an alternative to the Traditional and Applicant Prepared Licensing Processes. Goals of the ILP included reducing the time and cost of licensing, providing a predictable and efficient process that continue to ensure appropriate resource protections, and development of a coordinated stakeholder process. The ILP is being used by Appalachian Power Company to license the Smith Mountain Pump Storage Project near Roanoke, Virginia. We are currently at the end of the first year of studies and nearing the end of the Pre-Application Activities. While the ILP appears to be living up to its goals, it is a very fast paced intense process that will stretch the resources of most state fish and wildlife agencies. I explain both the positive and negative aspects of the ILP from the state agency perspective and offer recommendations on how to best prepare for and survive the ILP.

Abstract Number: 100986

Contributed Oral Presentation

Fluctuations in zebra mussel densities and associated limnological conditions in Lake Dardanelle, Arkansas

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ABSTRACT: - Zebra mussels (*Dreissena polymorpha*) were discovered in Lake Dardanelle, Arkansas in 1992. This study characterizes long-term trends in their density along with corresponding trends in water quality. Adult zebra mussels were collected annually at 16 sites by snorkeling at a depth of 1 m. Veligers, juvenile settlers, and water quality data were collected at four sites. Vegetation coverage was visually estimated at three sites. Changes in zebra mussel density were correlated with summer water temperatures. In years following summers with temperatures ≥ 29 °C for over 10 weeks, mean adult densities decreased 99.9%, whereas density increased 13-fold in years when summers temperatures were ≤ 29 °C for less than two weeks. No veligers were collected at temperatures below 2.9°C or above 31.9°C. Adult zebra mussel densities were positively correlated with Secchi disk depth ($r = 0.37$), and negatively correlated with turbidity ($r = 0.26$). From 1997 to 2001, mean percent macrophyte coverage was positively correlated with mean zebra mussel density ($r = 0.90$). However, from 2002 onward, vegetation was not correlated with mean zebra mussel

population density and it steadily increased. In conclusion, zebra mussels have the potential to greatly alter water clarity in southern reservoirs, and their densities are strongly and negatively affected by prolonged periods of high temperature.

Abstract Number: 100987

Contributed Oral Presentation

Impacts of Hurricanes on the Littoral Fish Community at Lake Okeechobee, Florida

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Habitat diversity and complexity influence fish community structure and population dynamics. Aquatic macrophyte abundance affects fish community interactions (e.g., predator-prey dynamics) and influences species diversity and population production rates. Thus, large scale changes to macrophyte abundance and distributions may result in lake-wide changes in fish community structure. Lake Okeechobee, Florida, was impacted by three large hurricanes during 2004-2005 that resulted in lake-wide changes to littoral habitats (i.e., > 95% lake-wide loss of aquatic vegetation). We sampled the littoral fish community during the summers of 2003 and 2004 (i.e., pre-hurricane) and again in summer 2006 (i.e., post-hurricane). We found decreased species diversity, species richness, total biomass, and centrarchid biomass after hurricanes relative to pre-hurricane conditions. Loss of complex vegetated littoral habitats also resulted in increased biomass of open water species (i.e., shad, *Dorosoma* spp. and silversides *Labidesthes sicculus*). Our results illustrated rapid responses of the littoral fish community to a large-scale natural disturbance, which has implications for management actions to facilitate the rehabilitation of Lake Okeechobee's littoral fish community.

Abstract Number: 100993

Contributed Oral Presentation

Creating a *Morone* hybrid fishery in a high flow-through reservoir in Oklahoma, year two: Comparison of two *Morone* hybrids.

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The hybrid striped bass is a popular sport fish among Oklahoma anglers. However, due to the high flow-through rates of many Oklahoma reservoirs, hybrid striped bass fisheries are difficult to establish given the propensity of the hybrids to emigrate from these reservoirs. In an attempt to establish a hybrid fishery in a high flow-through reservoir, Kaw Lake was stocked at 5 fish per acre with 80,000 common cross hybrids (male *Morone chrysops* x female *Morone saxatilis*) as well as 80,000 reciprocal cross hybrids (male *Morone saxatilis* x female *Morone chrysops*). The objective of this study is to determine if either the common cross or the reciprocal cross of hybrid striped bass survive and remain in a high flow-through reservoir in Oklahoma, and if either cross can create a viable sport fishery. Following initial stocking in June 2005, hybrids were again stocked in June 2006. Results from post-stocking weekly seine samples, spring 2006 gill-net samples, and fall 2006 gill-net samples will be discussed. Evaluation of over-winter survival of the 2005 stocking, and analysis of both age classes of hybrids will be presented.

Abstract Number: 100994

Contributed Oral Presentation

Status and Population Characteristics of Shoal Bass in Alabama

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The shoal bass *Micropterus cataractae* is native to the Chattahoochee-Flint-Appalachicola River drainages in the southeastern USA and in Alabama, shoal bass are only found in a few localized streams that pass over the fall line in east-central Alabama. Shoal bass have been considered exclusively shoal habitat specialists. We surveyed four streams that totaled 50 km in length and only 6 km of suitable shoal bass habitat were found. Shoal bass were common at only one site and within this stream, were infrequently collected in other portions even though suitable habitat existed. On the three other streams that historically contained shoal bass, these fish were extremely rare. A mark-recapture study found a density and biomass of 50 fish/ha and 14 kg/ha of shoal bass (≥ 150 mm TL) residing in the only known substantial population. Radio-telemetry of 24 shoal bass showed movement within the shoal complex and occasional migrations to deep slack water habitats during drought with little migration to an adjacent shoal. Shoal bass were strongly associated with large rocky boulder substrate, low current velocity (< 0.10 m/s), and moderate depth (0.30 m - 0.50 m). Recently, Alabama Division of Wildlife and Freshwater Fish banned harvest of shoal bass in Alabama. The decline of shoal bass in Alabama may be due to impoundment of the Chattahoochee River and loss of adult fish for recolonization, competition, potential invasion and possible hybridization with spotted bass *M. punctulatus*, and habitat fragmentation and deterioration.

Abstract Number: 100995

Contributed Oral Presentation

Evaluating Property Owner Willingness to Implement Shoreline Habitat Improvement Techniques

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Lake-front residential development is frequently accompanied by the purposeful removal of natural shoreline features (e.g., woody debris, standing timber, aquatic vegetation), often resulting in reduced habitat quality and diversity for fish and other aquatic organisms. Thus, it is important that shoreline property owners be made aware that these impacts are likely and are familiarized with enhancement techniques that can improve shoreline habitat. To address this objective, we mailed 9,394 copies of an informational brochure to shoreline property owners surrounding Lake Norman in central North Carolina. The brochure contained information about the importance of shoreline habitat and outlined multiple habitat enhancement techniques. We evaluated the effectiveness of the brochure by requesting that a survey be completed and returned by mail. We received a total of 386 responses which were compiled and used to characterize property owner activities and likelihood of voluntarily improving shoreline habitat. Sixty-nine percent of respondents stated a voluntary inclination to incorporate one or more of the techniques presented in the brochure. Of the techniques presented, shoreline plantings were generally preferred over maintenance of buffers, while preferences for enhancing habitat under piers and maintenance of natural shoreline were less evident. We learned that fishing opportunities played a minor role in the decision to purchase waterfront property on Lake Norman, whereas aesthetic and boating opportunities were more important factors. Future outreach should discuss application of enhancement techniques relative to property use to maximize chances of voluntary implementation.

Abstract Number: 101001

Contributed Oral Presentation

Trawling in the Gulf of Mexico: a study of the effects on red snapper and the associated community

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Effects of shrimp trawling on life history parameters and production potential were evaluated for juvenile red snapper *Lutjanus campechanus* in the northern Gulf of Mexico (GOM). In addition, the effects of trawling on the associated fish and invertebrate communities and their habitats were investigated. Quarterly trawl surveys were conducted over a two-year period on sand and shell-rubble habitats in conjunction with concomitant remotely operated vehicle (ROV) transects used to quantify habitat characteristics. Similar habitats both within a *de facto* non-trawl area, and outside of the area where commercial shrimp trawling occurred, were used to evaluate the impacts of trawls. Red snapper collected over sand and shell-rubble areas exposed to trawling exhibited slower daily growth rates in the fall, experienced higher mortality rates, had lower G:Z ratios, and had truncated size distributions when compared to similar habitats in the non-trawl area. In addition, lower numbers of both age 0.5+ (180-364 d) and age 2 and above (730+ d) red snapper were collected in trawled areas. Results of the habitat characteristics and their influence on the biotic community showed that structural characteristics were important for structuring shell-rubble communities and were influenced by the presence of trawling. The highest total number of fish and invertebrates were collected over the non-trawled sand habitat and both evenness and diversity were highest over non-trawled shell-rubble habitat. Length-frequency distributions indicated a truncated size distribution of the most influential fish species characterizing the communities over trawled habitats when compared to similar non-trawled habitats. This study demonstrated the negative effects of commercial shrimp trawling on red snapper demographics as well as the biological community and the associated habitat over the continental shelf of the northern GOM. We suggest juvenile red snapper production and the associated ecosystem may benefit from shrimp non-trawl areas on the northern GOM shelf.

Abstract Number: 101008

Contributed Oral Presentation

Movement of rainbow trout in the catch and release areas of Arkansas tailwaters

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Catch-and-release (CR) areas were developed in the mid 1990's on the tailwater systems of the White and Norfolk Rivers, Arkansas, with the goal of improving survival and residence time of rainbow trout *Oncorhynchus mykiss* in areas normally under put-and-take management. In a paired study design, rainbow trout were implanted with radio-transmitters from within and below four CR areas to investigate the assumptions that, 1) trout stay within CR areas and 2) trout maintain home-ranges within CR areas. 124 fish with 15+ weekly locations were tracked from July 2005 to October 2006. Home-ranges were determined based on total linear distance and kernel density estimates. Most fish did not move outside of the area where they were tagged (70% in CR areas, 54% in non-CR areas). The most downstream area, with higher water temperatures, had the

greatest proportion of fish moving outside the CR area. There were no significant differences in movement patterns between fish tagged in and out of CR areas. Summer movements in all but the farthest downstream area were limited (0-10 meters). In fall and spring several fish made upstream migrations covering distances ranging from 6-40 kilometers. The length of most CR areas in the White River and Norfolk River appears to be sufficient to encompass movement and home ranges of most rainbow trout. However, downstream CR areas with high water temperatures may not provide suitable habitat for rainbow trout to remain resident. Knowledge of movement patterns and home ranges will allow managers to more effectively establish the size and location of special regulation areas.

Abstract Number: 101015

Contributed Oral Presentation

Impact of increased sediment input and water turbidity on angler use and economic benefit on Norfolk tailwater, Arkansas

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We used a survey-based approach introduced by Loomis (2006) to quantify how angler use and associated economic benefits would change in response to increased sedimentation and turbidity on the Norfolk Tailwater, Arkansas. This study was prompted by angler complaints of "extremely muddy water" following the clearing of approximately 40 hectares of land overlooking Norfolk Dam for a residential development. In addition to evaluating actual impacts to angler use and benefit that had occurred since March 2006, we evaluated potential impacts by asking anglers how their visitation would change if 1) turbid water conditions following rain events were to continue in the future and 2) increased sedimentation negatively impacted trout growth rates resulting in a decrease in the average size of trout caught. Results from the 253 interviews completed to date indicate that the increased sediment input has had a substantial impact on angler use and economic benefits. Fourteen percent of the anglers interviewed indicated that since March 2006 they had fished the Norfolk Tailwater less because of increased turbidity. The average decrease in visitation was 0.4 trips/angler, which equates to an overall decrease of 1,345 trips and \$374,166 in angler expenditures. When asked if their visitation to the Norfolk Tailwater would change if the average length of trout caught decreased, 36% indicated that it would. The expected decrease in visitation under this scenario was 1.9 trips/angler. This reduction in angler use could result in a potential loss of 6,387 angling trips and \$1,776,800 in angler expenditures on the Norfolk Tailwater.

Abstract Number: 101016

Contributed Oral Presentation

The parasite, *Anguillicola crassus*, in yellow-phase American eels on the Shenandoah River, West Virginia

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The recent spread of the swim bladder nematode parasite, *Anguillicola crassus*, in American eels (*Anguilla rostrata*) along the Atlantic coast has caused concern among biologists and fishery managers. This study documented the presence of *A. crassus* in yellow-phase American eels on the Shenandoah River, West Virginia. One hundred eels were collected at Millville Dam during October 2006. Swim bladders were removed and examined for the presence of the adult nematode parasite. The number of adult parasites in each eel was recorded, and prevalence (percent of infected eels), intensity (number of nematodes per infected host), and mean intensity (average number of nematodes per infected host in a sample of hosts) was calculated. Furthermore, the relationship between length and age to parasite infestation rate will be measured. This is the first study to confirm the presence of *A. crassus* in the upper freshwater portion of the Potomac River watershed.

Abstract Number: 101017

Contributed Oral Presentation

Does freshwater influence the feeding ecology of estuarine-dependent sharks?

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Climate change is predicted to have significant effects on rainfall, perhaps leading to changes in freshwater flows, and altering salinity gradients in estuarine habitats. Juveniles of two estuarine-dependent elasmobranch species, the bull (*Carcharhinus leucas*) and bonnethead shark (*Sphyrna tiburo*) are suspected of having altered their habitat use in the Charlotte Harbor-Pine Island Sound Estuary, Florida, as a consequence of anthropogenic induced salinity changes. Salinity variations in this system, specifically the Caloosahatchee River, follow a seasonal pattern, resulting from water management practices. These practices transform the river from a low freshwater, well-mixed state (5ppt - 30+ppt) during the winter months to a high freshwater poorly-mixed state (0ppt - 18ppt) during the summer months. Conversely, the Myakka River is not subjected to water management practices and maintains a constant well-mixed state. Consequently, if increased freshwater flows

reduce the salinity in portions of this estuary, high salinity-dependent elasmobranchs (i.e., bonnetheads) will be forced into sub-optimal habitats, potentially reducing their survivability, whereas freshwater tolerant elasmobranchs (i.e., bulls) may benefit. This system provides an excellent opportunity to assess the significance of water management practices on feeding ecology, habitat utilization, and population ecology of these species. Food web structure and function, is a critical first step in understanding these relationships and will be assessed through chemical tracer techniques and stomach content analysis. Stable N and C isotopes, of multiple tissues in the elasmobranchs and their prey species, will be analyzed for purposes of contrasting the two elasmobranchs and understanding carbon and nutrient flows within these food webs.

Abstract Number: 101019

Contributed Oral Presentation

The effects of contaminants on sperm quality and intersex condition of smallmouth bass (*Micropterus dolomieu*) in the Potomac River

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Intersex is a gonadal abnormality in which both testicular and ovarian tissues are present in an organism. This condition has been observed in several locations, one of which is the Potomac River. There are several chemical contaminants with endocrine disrupting properties that have been suggested as possible contributors to intersex. The purpose of this study is to analyze what contaminants are present, and to determine if these have any effect on sperm quality or intersex severity in smallmouth in the Potomac. Samples were collected by boat electrofishing in May 2006 from three sites in the South Branch of the Potomac River and one site in the Gauley River. The three South Branch sites are in areas with historically high intersex occurrence. The site on the Gauley serves as the control site. Gonads were collected from thirty-eight male fish. Samples were split, sent to USGS Lafayette Science Center for testing of sperm quality parameters, such as motility, viability, count and maturity, and maintained at USGS Leetown Science Center for histological analysis. Sperm morphology was analyzed and rank of severity of intersex was assigned for each sample. Data from a separate study involving passive samplers set out by the USGS and West Virginia DEP will provide contaminant information for our sampling sites. Data analysis is still being conducted for this study. Once completed, all data will be compiled and analyzed statistically to determine if there is any significant correlation between contaminants, intersex severity and quality of sperm.

Abstract Number: 101020

Contributed Oral Presentation

Smallmouth bass mortality, movement, and habitat use in response to seasonally discontinuous surface flow

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Toward the southwestern edge of the smallmouth bass (*Micropterus dolomieu*) range, the Boston Mountains Ecoregion of Arkansas contains streams which are prone to drying during the summer when rainfall is limited and evapotranspiration is high. Associated changes in habitat throughout the summer have the potential to negatively impact smallmouth. The objectives of this study were (1) characterize changes in the extent of available habitat (velocity, depth, temperature, and substrate) throughout the summer, (2) characterize smallmouth bass summer habitat use, and (3) estimate smallmouth mortality during this potentially critical time. Study streams included the East, Middle, and North Forks of the Illinois Bayou in the Ozark National Forest. Sixty radio-transmitters (20 per stream) were surgically implanted into smallmouth during May and fish were tracked until October. Habitat was measured three times from June-September. As summer progressed, most riffle and run habitat dried completely resulting in a series of disconnected, remnant pools. Generally, cumulative movements were limited (<300 m) yet mortality as a response appeared high (at least 20% of the transmitter-fish in one stream). Smallmouth, in all streams and months, were consistently found in an average depth of 0.85 m. In June, smallmouth were found in velocities near 0.01 m/s; however, by July they were confined to remnant pools where velocity was negligible and water temperature occasionally exceeded 30°C. Thus, seasonally discontinuous surface flow appears to have substantial negative impacts on smallmouth habitat which likely constitutes a major limiting factor in the Boston Mountain Ecoregion of the Interior Highlands.

Reproductive biology, life history, and population structure of a bowfin *Amia calva* population in southeastern Louisiana

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The bowfin *Amia calva* is an ancient fish that inhabits the bayous and backwaters of Louisiana, is the last extant species in its family Amiidae, and has many distinctive characteristics and behaviors including a bony gular plate, a long dorsal fin, sexual dimorphism, parental care of offspring, and a physostomus swim bladder which functions as a lung and allows it to tolerate hypoxic waters. Bowfins are fished recreationally and commercially in Louisiana for their meat and roe. The minimum commercial and recreational size limits are 559 mm and 406 mm total length, respectively. The purpose of this study was to define the life history characteristics of a bowfin population in southeastern Louisiana, specifically age, growth, fecundity, egg size, age of maturation, and spawning period. Bowfin (N=297) were sampled from September 2005 to September 2006, from the upper Barataria Estuary using gill nets, trot lines, and hook and line. Females were older and heavier than males. Mean fecundity was about 23,000 eggs, and mean egg diameter was 2.0 mm from December to April. Most bowfin are mature by age 2. Only a few (N=5) female bowfin spawned during this study. The commercial minimum size limit targets the largest and oldest female bowfin in the population. If spawning success is limited, this bowfin population may become overharvested. Life history traits described in this study can be incorporated into population models to adapt current management regulations. Effective management regulations can protect the population from overharvest if fishing pressure on the population increases.

Assessment of Multi-Phase Largemouth Bass Stockings in Two North Carolina Coastal Rivers Following Hurricane-Induced Fish Kills

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Widespread fish kills were observed in North Carolina's coastal rivers following the passage of Hurricane Isabel in September of 2003. An experimental, multi-phase largemouth bass stocking effort was launched in 2004 to determine whether localized population recovery could be achieved. Largemouth bass stockings included the release of 12,000 age-1 (127-200 mm) pellet-reared bass in February, 46,000 young-of-year (51 mm) bass in June, and 8,000 advanced fingerlings (102-127 mm) in September. All fish were injected with coded wire tags, held in numbered batches, and scattered within 28 separate 1-km shoreline reaches in the Roanoke and Chowan rivers. Recapture electrofishing was conducted during spring and fall months of 2004-2006. Results confirmed the findings of earlier pilot studies suggesting that stocking 51-mm bass into riverine habitats has no detectable effects. Similarly, the advanced fingerlings provided no significant contribution. Although we recovered 183 bass stocked at age 1, their presence diminished with each recapture event. Electrofishing catch ratios of stocked age-1 bass to wild bass >200 mm were initially high (0.77 in the Chowan River and 0.17 in the Roanoke River), declined to 0.09 and 0.05 in the spring of 2005, and were <0.01 in 2006. Bass stocked at age 1 were often recaptured several km from their original stocking site, and harvest by anglers was observed as the bass recruited to the fishery (356-mm size limit). However, supplemental stockings were ultimately not necessary as we observed three successive strong year classes of wild bass, and consistent increases in catch rates of wild adult bass.

Hydropower Licensing and Understanding the Integrated Licensing Process -- Ferc Perspective.

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The Federal Energy Regulatory Commission (FERC) has exclusive authority to license non-federal hydroelectric facilities on navigable waterways and federal lands. On July 23, 2003, FERC issued Order 2002, adopting the Integrated Licensing Process (ILP). The ILP, which is a defined process with established time frames, is intended to streamline the hydropower licensing process by providing a predictable, efficient and timely licensing process that continues to ensure adequate resource protections. The ILP integrates various stakeholder processes, including 401 water quality certification, ESA consultation, NEPA scoping, and tribal consultation. When FERC adopted the ILP, it committed to studying the effectiveness of the process in achieving reductions in processing time and cost. As part of the process, FERC engaged in discussions with federal and state agencies, Indian tribes, licensees, non-governmental organizations (NGOs), and members of the public involved in the initial seven relicensing cases using the ILP. The purpose of the effort was to document ideas, tools, and techniques that were being implemented (or could be implemented) by applicants, agencies, FERC staff, tribes, NGOs, and others to achieve the goals of the ILP. The stages of the process evaluated during the ILP effectiveness study were (a) ILP Preparation, (b) Pre-Application Document Development, (c) Scoping, and

(d) Study Plan Development. I briefly outline the ideas put forth that the Commission believes would best help future ILP participants without unduly extending the licensing process, expanding existing regulations, or compromising environmental protection. Ideas for implementing the ILP are expected to evolve over time.

Abstract Number: 101024

Contributed Oral Presentation

Evaluation of Biweekly versus Monthly Stocking of Rainbow Trout in the Arkansas Urban Fishing Program

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Declines in recreational fishing participation, under-representation of women and minorities among the angling population, and increasing urban flight have prompted many state management agencies to start urban fishing programs. Arkansas Game and Fish Commission (AGFC) currently stocks rainbow trout biweekly during the winter months as part of their Urban Fishing Program (UFP), and the transportation costs can be prohibitive because frequent stockings at many locations are required. We evaluated monthly stocking as an alternative to biweekly stocking in the UFP. We conducted a creel study from December 10, 2005 to March 31, 2006 on four ponds stocked with rainbow trout by AGFC. Two ponds received the AGFC standard biweekly stocking, and two ponds received monthly stocking at double the biweekly density. Bus-route type roving creel surveys at the study ponds were used to collect data on angler demographics, effort, catch, and attitudes. Urban pond anglers were predominantly African-American (68%). Effort, catch, and harvest of trout varied greatly between the four ponds with average catch rate (CPUE) ranging from 1.12 to 2.66 per pond. The majority (55%) of anglers had caught a trout when interviewed, and most (68%) anglers rated their overall trips as good or excellent. The mean CPUE for the two ponds stocked monthly was 1.89 trout/h, and was only 1.44 trout/h for the ponds stocked biweekly. These findings suggest that monthly stockings are capable of maintaining high angler satisfaction ratings.

Abstract Number: 101025

Contributed Oral Presentation

Differences in CPUE and size structure of largemouth bass and bluegill using day and night electrofishing

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Many studies have shown that electrofishing during the night produces higher catch rates and larger individuals than daytime electrofishing; however, due to safety concerns, sampling during the day is preferred. We sampled two reservoirs in central Virginia to quantify differences in catch-per-unit-effort (CPUE) and mean size of largemouth bass and bluegill before and after sunset. Each reservoir was sampled bimonthly from April to October at eight sites. We found no significant differences in largemouth bass CPUE between day and night electrofishing. The mean length of largemouth bass did not differ among sampling times, however the variance did decrease throughout the seasons. Conversely, bluegill CPUE was greater at night than during the day; larger bluegill were more commonly found during nighttime electrofishing, resulting in an increase in the mean length and variance compared to day electrofishing. These results are important for biologists designing sampling programs for reservoir management.

Abstract Number: 101026

Contributed Oral Presentation

Perfluorinated compounds in Georgia waters: a preliminary analysis

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The Southeast is home to a range of ecologically diverse but threatened aquatic habitats; the Conasauga River in northwest Georgia, in particular, is home to 24 rare or endangered species. As population in the Southeast increases, land is transformed to urban and industrial areas, which inadvertently causes trace organic pollution in natural waterways. In particular, perfluorinated compounds (PFCs), highly recalcitrant compounds used in industrial applications as stain guards need to be assessed because they biomagnify in food webs and have unique toxicological properties but have never been measured in Georgia waters. To address this gap, we analyzed PFCs in water samples from small streams and ponds around Dalton, Georgia; from the Conasauga River near the wastewater land application site for Dalton; and in the Altamaha River. Levels of PFCs were very high in streams and ponds of the Dalton region (PFOA 50-300 ng/L and PFOS 15-120 ng/L) and the Conasauga River (PFOA 188-1,417 ng/L and PFOS 11-329 ng/L), in the same range as the highest ever measured in water at a non-spill location. PFC concentrations in the Altamaha River were much lower (PFOA ~3 ng/L and PFOS ~2.6 ng/L) but are higher than those measured in the mid Atlantic Ocean, suggesting the Altamaha River is a source of PFC contamination in estuaries. In light of these extreme PFC concentrations additional studies and an ecological risk assessment is warranted, particularly since PFCs are not considered in Georgia's fish

Abstract Number: 101028

Contributed Oral Presentation

Systematic error in tag-based survival estimates by time-trend models: examples from simulated and real data

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Given a time series of tag-recapture data and an interest in annual survival rates (S), one can fit models that parameterize survival as constant, time-specific, or period-specific. Additionally, recent advances in methodology and software allow fitting of models with annual environmental covariates, and researchers have recently described a covariate approach with dummy variables that can fit linear monotonic time trends (time-trend models). Time-trend models are (1) reasonable given a hypothesized increase or decrease in S across a time series, (2) simple, i.e., involve a low number of estimable parameters, (3) usable without complex datasets, and (4) potentially dangerous (as demonstrated from our analysis). Time-trend models are a part of the candidate set of models used in tag-based analyses of survival rates of Atlantic striped bass, and this paper will demonstrate examples of time-trend model underestimation of terminal year S from Atlantic striped bass stocks. Further, based on analyses of simulated data, we demonstrate that time-trend models underestimate S when the true model (i.e., generating model) represents a non-monotonic decrease in S . Clearly, underestimation of terminal-year S is critical, given management emphasis on terminal year estimates. If linear time-trend models are retained, then future analyses of striped bass tagging data should preferably include a non-monotonic trend model in the candidate set, or at least apply non-monotonic trend models as exploratory diagnostic measures. Also, simulation results indicated the importance of sample size to model selection, and further work is needed to address relationships among sample size, model selection, and model complexity.

Abstract Number: 101032

Stream and River Mitigation Programs Symposium

Evaluation of Fisheries Mitigation on the McClellan-Kerr Arkansas River Navigation System in Arkansas and Oklahoma

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The McClellan-Kerr Arkansas River Navigation System provides 455 miles of channel modifications for flood control, barge traffic, and hydropower on the White, Arkansas, and Verdigris rivers from the confluence of the Mississippi River to Catoosa, Oklahoma. It includes a series of 18 locks and dams with a minimum 9-foot deep navigation channel and widths ranging from 150 to 300 feet maintained through dredging and training structures. Navigation improvements are underway that will expand the channel depth to 12 feet by modifying or adding training structures and by dredging. Mitigation activities of aquatic and terrestrial impacts have been developed in coordination with the United States Fish and Wildlife Service, the Arkansas Game and Fish Commission, and the Oklahoma Department of Wildlife Conservation. Evaluation of fisheries mitigation is being conducted by researchers from Arkansas Tech University, University of Arkansas at Pine Bluff, University of Central Arkansas, Mississippi State University, Oklahoma State University, and the United States Geological Survey – Water Resources Division. Three primary categories of mitigation being evaluated are 1) deepening and/or reconnecting backwater entrances to the mainstem river for fish access to spawning and rearing locations, 2) notching dikes to reduce sedimentation, increase habitat diversity, and provide fish access to dike pools; and 3) relocation of dredged gravel to minimize loss of coarse substrates used by a variety of mussels and fish. Long-term sampling protocols and baseline data are the first priority for the project followed by monitoring population and community changes.

Abstract Number: 101039

Contributed Oral Presentation

Egg and larval characteristics and culture techniques for rearing yellowcheek darter *Etheostoma moorei*

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The yellowcheek darter *Etheostoma moorei* is endemic to four headwater tributaries of the Little Red River, Arkansas. Creation of Greers Ferry Reservoir in 1962 inundated much of the historical habitat, and the yellowcheek darter experienced a decline in population abundance. The U.S. Fish and Wildlife Service elevated yellowcheek darter to candidate status in 2001, and efforts to determine propagation methods were begun. We reared yellowcheek darters in recirculation systems with a partial water exchange at 21°C. Larvae and eggs were collected and photographed to determine morphometric characteristics. Egg diameters ranged in size from

1.73 to 2.73 mm with an average (SD) diameter of 2.34 (0.15; N=103). Larvae were fed copepods, saltwater rotifers *Brachionus plicatilis*, and artificial plankton. Post yolk sac larvae ranged from 4.46 to 5.69 mm TL, with an average (SD) total length of 5.29 (0.31) mm. The larvae survived for approximately 10 d and grew an average of 0.14 mm/d. The cause of egg and larvae mortality is not clear, although poor water quality may have been a contributing factor.

Abstract Number: 101042

Contributed Oral Presentation

Fate of Brook Trout Stocked into the Watauga River Below Wilbur Dam

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Brook trout *Salvelinus fontinalis* have been stocked below Wilbur Dam on the Watauga River since 2001, but they are rarely caught by anglers and have never been collected in annual monitoring samples. This study was designed to assess possible factors contributing to the poor performance of brook trout in this system. Brook trout stocked in July and October 2006 were sampled with barge-mounted electrofishing gear within seven days of stocking and at approximately monthly intervals thereafter. Preliminary catch-curve analysis revealed a minimal (< 0.01%) annual survival rate for the July cohort. A change-in-ratio population experiment conducted in April 2006 estimated the number of brown trout *Salmo trutta* at 33,048 (95% CI = 24,592 - 41,505). Seventy-one adult brown trout were sampled immediately after the October stocking, and seventeen brook trout were found in seven brown trout stomachs. An additional cohort of brook trout will be stocked in the winter of 2007. Future analyses will focus on comparative growth, dispersal, and diet of stocked brook trout, brown trout, and rainbow trout *Onchorynchus mykiss*, as well as on angler attitudes toward the brook trout stocking program.

Abstract Number: 101046

Contributed Oral Presentation

Integrating gear bias and selectivity into development of a standardized fish sampling protocol for Puerto Rico streams

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Few studies have been conducted on riverine fishes of Puerto Rico, making management difficult. Proper management requires both appropriate gear selection and sampling methods. We evaluated estimating stream fish populations by removal and mark-recapture methods using electrofishing in two Puerto Rico drainages that varied in rainfall and morphology. We conducted a bias assessment and found that none of the methods exhibited a systematic bias, but a three-pass removal method was more accurate than a two-pass removal or a Peterson mark-recapture. To understand how changes in capture probabilities are affected by season, site, habitat, and water quality, we used program MARK to determine the model that best estimated these populations. We used AIC model selection to identify the most parsimonious model for estimating capture probabilities and population sizes. We found among seasons (spring, summer, and fall), capture probabilities in the spring were statistically greater. Among 12 sites sampled, only one was statistically different in capture probability from the others. Among 18 instream habitat and water quality parameters, only stream width and velocity explained variation in capture probability. We conclude that a three-pass removal is the best method for estimating populations, and that these estimates are affected seasonally, occasionally by site, and by variation in stream width and velocity. These results may be used to define a standardized stream fish sampling protocol for research and biomonitoring in Puerto Rico.

Abstract Number: 101047

Contributed Oral Presentation

The role of previous experience with piscivory and exposure to fish predators on survival of walleye *Sander vitreus* fingerlings

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Hatchery reared walleye *Sander vitreus* fingerlings given a prepared diet are thought to be inferior to wild populations that experience predation and prey capture. This study was conducted to determine if fish culturists could increase survival by exposing summer fingerlings to fish predators and/or providing experience with piscivory before being stocked for recreational angling. Walleye were given 10 days of experience in one of the following categories; zooplankton, predator, prey, and predator/prey prior to being stocked. An additional group was help in tanks and feed trained. Walleye fingerlings from each group were marked with a unique visible implant elastomer tag and fin clip. One fingerling from each group was placed in a 132 liter tank with gravel and submersed vegetation to allow the individual to take refuge from predation. A largemouth bass was added, and survival was recorded after 24 hrs. No significant difference among treatment groups was measured ($p =$

0.5553). Twelve 0.04-hectare ponds were prepared by placing 15 adult bluegill and 5 adult largemouth bass and a 6.5 m x 1 m cedar reef for cover. Survival of the predator/prey experienced group was significantly better than other groups through day 7 ($p = 0.0227$).

Abstract Number: 101050

Stream and River Mitigation Programs Symposium

Kentucky Department of Fish and Wildlife Resources In-Lieu-Fee Program

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The Kentucky Department of Fish and Wildlife Resources administers one of three In-Lieu-Fee Programs within the state. The service area covers 113 of Kentucky's 120 counties. KDFWR began developing their Program a little over five years ago, and has been doing stream projects for just over three years. Currently, 29 stream restoration/enhancement projects are in some phase of implementation, several of which are constructed or under construction. The Program has experienced a variety of growing pains as well as successes. Some of the problems include: accruing fees but not having approval to do projects early on; outside pressure to spend trust funds on items other than stream restoration; landowners backing out/conservation easement issues; excessive bureaucracy/red tape. One option that has proved to be invaluable is partnering with universities, NRCS, RC&D Councils and others to administer projects.

Abstract Number: 101055

Contributed Oral Presentation

Aggregate extraction impacts on Unionid mussel species richness and density

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Kentucky Reservoir on the Tennessee River supports a diverse freshwater mussel community including federally listed endangered species. Resource extraction operations have been conducted on the Tennessee River since at least the 1920's. The condition of abandoned dredge sites as aquatic habitat for benthic organisms, including freshwater mussels, is relatively unknown. Objectives of this study were to determine the condition of abandoned dredge sites as aquatic habitat for freshwater mussels, compare species richness and density between sites in relation to years post dredging, collect information relevant to future permitting consultations, and provide a greater understanding of the effects of resource extraction in a large regulated river. Six hundred 0.25 m² quadrat samples were collected and processed from the twelve study sites. Both mean density (54.51 mussels • m⁻²; SD = 58.335) and species richness (15 taxa; SD = 1) were significantly higher at reference sites than at the dredged sites ($P < 0.0001$). Correlation analysis indicated no significant relationship ($r = 0.2059$, $P > 0.10$) between mean mussel density and time (in years) since the last dredge event. The Wilcoxon's rank sum tests indicated significantly lower mussel abundance ($P < 0.05$) and richness ($P < 0.05$) at the dredge sites relative to the reference sites. Based on data obtained during this study, we will advocate additional protection of specific sites within the lower Tennessee River reach currently permitted for commercial dredging.

Abstract Number: 101056

Contributed Oral Presentation

An evaluation of the influence of trapping methods for detecting stream-dwelling fishes

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Monitoring the presence and distribution of at risk fishes can provide useful information on population status and trends. This generally requires that samples be collected at several sample sites to ensure detection of changes in fish distribution. Under these circumstances, monitoring can be expensive and time consuming, particularly when crews are required to expend significant effort to detect rare or difficult to sample species at each sample unit. A potentially cost-effective alternative could be to sample fishes using a passive gear such as fish traps. Thus, we evaluated the efficacy of fish traps for detecting the presence of small-bodied stream-dwelling fishes. We developed three different traps designs and evaluated the influence of trap style, presence of bait, and habitat on fish detection probabilities using occupancy models. Trap type, presence of bait, and fish species influenced fish detection. In general, bullheads (*Ameiurus sp.*) and bluehead chub (*Nocomis leptocephalus*) were most susceptible to capture; the use of bait increased detection. Results will contribute to sampling protocol development in Upper Coosa River system.

Abstract Number: 101058

Contributed Oral Presentation

Predicting Largemouth Bass Body Composition Using Bioelectrical Impedance Analysis
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The need to measure growth and condition is vital to fisheries management; however, a method to quickly and accurately evaluate body condition is lacking. Most present condition indices rely on morphological measures rather than internal assessments. Morphological methods may save time and money but accuracy and reliability must be sacrificed for the convenience of these nondestructive methods. There are several methods used to estimate body composition such as total body electrical conductivity (TOBEC) and proximate analysis, but they are not viable options for field studies or cost-efficient for large samples. Bioelectrical impedance analysis (BIA) is a nonlethal technique that can quickly, safely, inexpensively, and reliably measure the body composition of fish. We used BIA to analyze the body composition of largemouth bass from reservoirs in central Virginia and found strong correlations between BIA readings and proximate analysis ($r^2 \sim .70 - .80$). These results confirm that BIA can be a valuable assessment and monitoring tool for fisheries biologists in reservoir management.

Abstract Number: 101059

Contributed Oral Presentation

Costs of producing all-female largemouth bass for trophy bass fishing

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Trophy largemouth bass are typically females. In the following study, largemouth bass were produced intensively, fingerlings trained to a formulated diet and cultured to a range of sizes with the goal of determining the cost of production of manually selected females. Eleven-month old bass were sorted into five size categories and sexed. The accuracy of manual selection was determined for each size category. The costs of production (variable costs only) to obtain fry, fingerlings, and sexable-size fish was determined. An average of 14,769 eggs/kg female was obtained, resulting in 4,905 swimup fry/kg female at a cost of \$4.84/1000. Nursery ponds stocked at 148,515/ha yielded 0.97 g fingerlings with a 95.6% survival, at a cost of \$53.53/1000. Fingerlings were stocked into 3 mm mesh net cages, feed trained for 13 days and held an additional 21 days on a commercial diet. At harvest fish averaged 3.53 g with a 61.2 % survival costing \$253.03/1000. Fingerlings were stocked into ponds at 20,000 and 40,000/ha and cultured 270 days on a commercial diet. Average weights and survivals at harvest were 179 g and 159 g and 25.3% and 33.7% for the two respective stocking densities. It was possible to sex fish with 100% accuracy when they were 20 cm and larger. Thirty five percent of the total number of bass produced were identifiable females. The cost of production of these females was \$5.26/fish when the value of males and unsexable fish at \$6.61/kg was deducted from the total production costs.

Abstract Number: 101060

Contributed Oral Presentation

Determining consequences of sediment chemical extracts from the South Branch of the Potomac River on the reproductive capacity of Japanese medaka *Oryzias latipes*

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An intersex condition, often associated with exposure to exogenous estrogens, has been observed in smallmouth bass in the South Branch of the Potomac River, West Virginia. Intersex is believed to indicate that endocrine disrupting chemicals may be present in environmentally relevant quantities. These chemicals are usually hydrophobic and would tend to be found within the sediment of aquatic environments. However few studies have attempted to show the effects of exposure to EDC's on fish using sediment chemical extracts. We have developed a mass sediment extraction technique in order to determine the combined effects of the extracted chemicals on the reproductive performance of adult mating pairs of Japanese medaka (*Oryzias latipes*) for 14 days. Samples of sediments were sonicated and filtered three times. After solvent exchange with acetone, pairs were subjected to the extracts at the ratio of 10g of extracted sediment in 1L of water. Endpoints included the number of eggs produced daily, rate of fertilization, and hatchability. We expect that extracts will show estrogenic activity in that they will induce vitellogenin in male fish and have negative effects on reproductive performance. This study will lend insight into the investigation of endocrine disruption in the South Branch of the Potomac River.

Survival of fish embryos after electroshock: investigations with a model species

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Effects of electroshock on developing fish embryos are not well understood. If electroshocking reduces embryo survival to hatching, this could jeopardize isolated populations of threatened and endangered fishes. Fish embryos are not targets of electroshocking, but can be unintentionally exposed to electric fields, and potential negative impacts on survival are possible. Zebrafish *Danio rerio* was used as a surrogate species to investigate effects of electroshock on embryo survival to hatching. Embryos were exposed to 16 V/cm direct current (DC) at different developmental stages to define the most sensitive stage, and subsequently this stage was used in experiments to evaluate effects of voltage gradient, DC versus pulsed DC (PDC), and water conductivity. Embryos at developmental stages from 2 h post fertilization (pf) to 48 h pf were exposed to homogeneous DC for 20 s in water of 46 μ S/cm conductivity. Survival to hatching was reduced from 2-7 h pf. The embryonic stage most vulnerable to electroshock-induced mortality occurred at 4 h pf (20-30% epiboly), when mortality was 82.2% of control. Before 2 h and after 7 h, survival to hatching was similar between exposed and unexposed embryos. Ongoing investigations include exposure of embryos to DC and PDC; at various voltage gradients; and water conductivities. Future research includes experiments with embryos of selected threatened and endangered species to characterize their susceptibility to electric fields and to provide guidance for operators of electrofishing equipment to reduce harm to embryonic fish.

Initial telemetry findings on habitat use, home range, and dispersal of northern snakehead in the Potomac River catchment.

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Northern snakehead (NSH) (*Channa argus*), recently established a population in the Potomac River catchment. This large, piscivorous, air-breathing fish may pose substantial risk to native fishes. To understand habitat preferences, home range size, and dispersal ability of NSH in this novel environment, we implanted 49 fish (weighing 790-3489 g; mean = 2065 g) with radio transmitters in October 2006. Fish were captured and released in three tributary embayments in Virginia. We will locate each fish monthly through March 2007, and six times per month during April-November 2007. The geo-referenced locations of fish will be recorded, along with measures of water quality (temperature, turbidity, salinity, dissolved oxygen) and habitat (depth, cover, substrate). Identical measures will be taken at random locations paired with fish locations, enabling us to characterize habitat selection. In fall 2006, most fish were found in shallow (<1.5 m) offshore milfoil beds in the bays where they were released. Four fish were observed in the mainstem in similar habitat, and one moved several kilometers upstream. Five of the ten fish tagged in Little Hunting Creek, where milfoil is sparse, moved >1 km upstream. Eight fish in Dogue Creek were located every 1.5 hours for 12 hours on October 31st. Most fish stayed in milfoil beds, moving little during the day. More frequent and longer movements (up to 1 km) were observed after sundown, with several fish moving to shallow inshore areas. Initial results suggest a strong preference for cover, and a restricted home range with occasional long distance dispersal.

Captive propagation of the tangerine daters, *Percina aurantiaca*

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The Pigeon River suffered major water quality degradation from 1908 through the 1980's from paper mill effluent which resulted in the extirpation of many native fish species. Mill modifications have cleaned the effluent to the degree where some native species are recolonizing many areas of the river. In 2001, the Pigeon River Restoration Project was initiated to re-introduce native non-game species which have been unable to return of their own accord. In addition to relocation of selected suitable species into the river, captive production of the tangerine darter (*Percina aurantiaca*) has been attempted since current translocation methods have proven inefficient due to the small number found in the Pigeon River drainage tributaries. It is anticipated that, through hatchery propagation, sufficient numbers of tangerine darters can be acquired for re-introduction. However, this method to date has seen limited success with the *Percina* species. Attempts to produce tangerine darters in captivity have met with limited success. Using brood stock of sub-adult tangerine darters collected from the Pigeon River and associated tributaries similar, three attempts to hatch tangerine darters were conducted at the Conservation Fisheries Incorporated (CFI) facility in Knoxville, TN. In the first trial, no eggs were found; the second year produced eggs but relatively few larvae survived. The third attempt has produced

approximately 90 juveniles but growth-out has been erratic; future propagation efforts will target optimum grow-out densities as well as determining the nutrition requirements for larval and juvenile tangerine darters.

Abstract Number: 101073

Contributed Oral Presentation

Acoustic estimates of habitat-specific fish biomass and length distributions in a Louisiana estuary

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There has been an increasing emphasis on the integration of acoustic technology into traditional fisheries techniques to estimate fish biomass and size distribution in aquatic systems. To date there have been few studies specifically applying hydroacoustic technology in ultra-shallow (<2 m) coastal waters; most acoustic systems are limited by the constraints imposed on the propagation of sound in shallow waters. Seasonal estimates of acoustic fish biomass and length-distribution were obtained from monthly hydroacoustic surveys in Barataria Bay, Louisiana. Two BioSonics 420 kHz split-beam transducers were deployed on hard-bottom (oyster shell/reef) and adjacent soft-bottom (sand/mud) habitats at three stations along a salinity gradient. Acoustic equipment was deployed contemporaneously with both a gill net and a push trawl to estimate and compare fish size distribution, biomass, and to obtain information on community composition. Results indicated both greater mean acoustic fish biomass and fish size was associated with higher salinities and hard-bottom habitats. Moderate concordance was observed between acoustic length distributions and fish length distributions derived from net catches. The integration of acoustic techniques and advances in analysis pathways with traditional methods will further our understanding of the role of estuarine habitats on the distribution and abundance of fishes.

Abstract Number: 101076

Contributed Oral Presentation

Genetic relationships of black bass populations in Florida

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Recent molecular evaluations have suggested the largemouth bass and Florida bass should be reclassified as distinct species. Both are native to Florida, and co-occur in a natural intergrade zone in the northern part of the state. This study used molecular techniques to evaluate the genetic constitution of 48 black bass populations in order to identify and characterize the genetic structure that exists among populations in Florida. Protein electrophoresis measured nuclear genetic variation and mtDNA restriction fragment length polymorphism surveyed diversity in the mitochondrial genome. Largemouth bass allozyme alleles were detected in a number of populations that are well south of the recognized intergrade zone. Analyses of allozyme genotypes did not detect evidence of non-random mating or selection against hybrids in any populations. When the mitochondrial and nuclear results were integrated, however, largemouth bass mitochondrial haplotypes were observed much less frequently than largemouth bass allozyme alleles, results suggestive of assortative mating or poor survival of offspring produced by largemouth bass females. The results of analysis of molecular variance indicated that significant genetic differences exist between populations in five regions of the state. These results suggest that management and conservation of this valuable resource should consider not only differences among Florida bass and largemouth bass, but the significant genetic differences amongst population in different regions of the state.

Abstract Number: 101079

Contributed Oral Presentation

Predation and tag retention of young-of-the-year fishes marked with Visible Implant Elastomer Tags

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A fundamental assumption of mark recapture projects is the ratio of marked and unmarked individuals within the population does not change between sampling events. To meet this assumption several conditions must be met, including fish must retain marks between sample events and must not be more vulnerable to predation. We compared predation of young-of-the-year (YOY) largemouth bass *Micropterus salmoides*, channel catfish *Ictalurus punctatus*, and blacktail shiners *Cyprinella venusta* marked with visible implant elastomer (VIE) tags by adult largemouth bass, flathead catfish *Pylodictis olivaris*, and white bass *Morone chrysops*. We also evaluated tag retention for each of the YOY fishes over a one-month period. We found no significant increase in predation related to marking among prey or predator species. Mark retention varied by species and mark location. Young-of-the-year largemouth bass showed variable tag retention with 20% retention in dorsal-head area, 15% along mandible, and 90% in opercula. Channel catfish had 45% mark retention in dorsal-head, 20%

along mandible, and 95% above anal fin. Blacktail shiners had 100% mark retention above and below caudal peduncle and above the anal fin. Visible implant elastomer tags can be used to create identifiable batch or individual marks without sacrificing marked individuals and without significantly increasing their risk of predation. Use of VIE tags, however, appears to be limited by the variability in tag retention among species and mark location.

Abstract Number: 101082

Contributed Oral Presentation

Factors influencing Post-Stocking Survival of Hybrid Striped Bass

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Survival of hybrid striped bass following stocking into small impoundments can be low and is often attributed to changes in water chemistry and/or temperature. We examined the effects of hardness, temperature, and acclimation rate on post-stocking survival of hybrid striped bass under controlled laboratory conditions. In the first laboratory study, hybrid striped bass (mean TL = 139.2 mm, SE = 0.8) were stocked from high hardness (365 mg/L CaCO₃) water into four experimental conditions: 1) low hardness only, 2) low hardness with 5 C temperature increase, 3) 5 C temperature increase only, and 4) no change in hardness or temperature. In the second laboratory study, hybrid striped bass (mean TL = 86.9 mm, SE = 1.4) were stocked from high hardness (350 mg/L CaCO₃) water into three experimental conditions: 1) low hardness with 30 minutes acclimation, 2) low hardness with 60 minutes acclimation, and 3) no change in hardness and no acclimation. For both laboratory studies, low hardness water had a mean hardness of 52 mg/L CaCO₃ (SE = 2.5 mg/L CaCO₃), and fish were observed for 1 week after stocking. There were no significant differences between any of the treatments in either study, and mortality was low for all treatments. These results suggest that acclimation, hardness, and temperature are not the primary factors leading to poor survival of hybrid striped bass. We suggest additional research on handling stress as the primary factor in hybrid striped bass stocking mortality.

Abstract Number: 101084

Contributed Oral Presentation

Florida Bass Conservation Center: Science-based Bass Stocking Programs

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The Florida Fish and Wildlife Conservation Commission's Florida Bass Conservation Center and Richloam Fish Hatchery recently received a \$15 million renovation to increase production capabilities. The hatchery's new production goals include more than 1.5 million fingerlings (<35-mm TL) and up to one million advanced-sized (~100-mm TL) largemouth bass. We will follow guidelines of our agency's new fish genetics policy to insure genetic conservation of wild populations. This will include protecting the genetic integrity of Florida bass *Micropterus salmoides floridanus* by genetically testing brood fish, and avoiding translocations of genes from bass populations in one Genetic Management Unit (GMU) into another as a result of state stocking programs. Cultured fish will be screened for listed pathogens (e.g., LMBV) prior to their release. Pellet-reared bass will be fed live fish (e.g. mosquitofish *Gambusia affinis*) before being stocked, which should enhance their ability to capture live prey and increase their survival in the wild. Current research efforts are focused on creating genetic markers using microsatellite DNA technology to differentiate hatchery fish from wild bass, and developing an experimental artificial diet to avoid a liver disease (that has been observed in bass cultured on commercial high-protein salmonid diets) and still yield acceptable growth rates. Other research plans include developing and evaluating different post-release strategies, such as stocking hatchery-reared bass into microhabitats and acclimation of hatchery-reared fish in temporary holding pens. To assess the success of these new stocking programs, pre- and post-stocking evaluation protocols will be developed and implemented.

Abstract Number: 101086

Contributed Oral Presentation

Evaluation of Biweekly versus Monthly Stocking of Channel Catfish in the Arkansas Urban Fishing Program

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Declines in recreational fishing participation, under-representation of women and minorities among the angling population, and increasing urban flight have prompted many state management agencies to start urban fishing programs. Arkansas Game and Fish Commission (AGFC) currently stocks channel catfish biweekly as part of their Urban Fishing Program (UFP), and the transportation costs can be prohibitive because frequent stockings at many locations are required. We evaluated monthly stocking as an alternative to biweekly stocking in the UFP. In 2005 and 2006, we conducted creel studies from the first week of April to the first week of August on six ponds stocked with channel catfish by AGFC. Each year three ponds received the AGFC standard biweekly stocking, and three ponds received monthly stocking at double the biweekly density with stocking frequencies reversed the second year of the study. Bus-route type roving creel surveys at the study ponds were used to collect data on angler demographics, effort, catch, and attitudes. African-American made up 82% of urban pond

anglers both years. Effort, catch, and harvest of catfish varied greatly between the six ponds over the two years with average catch rate of catfish (CPUE) ranging from 0.21 to 0.61 per pond. The majority (63% yr 1, 68% yr 2) of anglers had not caught any catfish when interviewed, but most (56% yr 1, 58% yr 2) anglers still rated their overall trips as good or excellent. The mean CPUE for the three ponds stocked monthly (0.45 catfish/h yr 1, 0.36 catfish/h yr 2) was not significantly different than ponds stocked biweekly (0.36 catfish/h yr 1, 0.36 catfish/h yr 2), nor did angler ratings of fishing success differ significantly between the two stocking frequencies.

Abstract Number: 101087

Contributed Oral Presentation

Fatty acid profiles as indicators of fish health and environmental effects in sauger, white bass, and paddlefish in the Ohio River

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Fishes are biological sentinels of water quality. The lipid content of fishes, and the fatty acid (FA) composition of these lipids, depends on biological and physiological processes and environmental conditions. Fatty acids are the chemical precursors to the biosynthetic pathways that regulate and mediate immune response, inflammatory response, blood clotting, cardiovascular tone, renal function, neural function, and reproductive function. This research was conducted to determine if FA composition in fish muscle indicates subpopulations of fishes within the Ohio River from the existence of lock and dam systems. Samples were collected from six locations along the Ohio River including the Hannibal, Belleville, Greenup, Meldahl, Cannelton and Smithland Pools. Statistical evaluation determined that sampling season and species were significant, while age did not significantly affect percent lipids in lean fish such as sauger and white bass. Sampling location was determined to be a significant factor affecting percent lipids and most FAs. FA data indicated that sauger and white bass were divided into upper and lower subpopulations at approximately Ohio River mile 341.0. The upper Ohio River subpopulation of sauger and white bass contained more polyunsaturated FAs, n-6 FAs, and 22:5n-6; fewer monounsaturated FAs, 14:0, 16:1n-7; 18:1n-7, 18:3n-3; and lower ratios of 20:5n-3/20:4n-6, and 18:3n-3/18:2n-6 than the lower Ohio River subpopulation. River mile exhibited positive correlations with 16:1n-7 and 18:3n-3 in sauger and white bass and with 14:0 and 18:2n-6 in sauger. Relative weight, W_r , an indicator of fish health and condition, was significantly higher in sauger in the lower Ohio River subpopulation.

Abstract Number: 101098

Contributed Oral Presentation

Effects of commercial gill net bycatch on black crappie abundance and angler catch at Lake Dora, Florida

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Bycatch, the incidental catch of non-target species with fishing gear, occurs in almost all commercial fisheries. A commercial gill net fishery was initiated at Lake Dora, Florida in March, 2005 to reduce the abundance of omnivorous gizzard shad *Dorosoma cepedianum*. Black crappie *Pomoxis nigromaculatus* are the primary bycatch of this fishery, as well as the primary sport fish targeted by recreational anglers. Thus, black crappie bycatch associated with the gizzard shad fishery is of concern to anglers and agency personnel. We assessed total black crappie bycatch and bycatch mortality, and measured recreational harvest and effort to measure the population-level effects of bycatch on the black crappie fishery. Commercial fishing occurred in the spring of 2005 and 2006. Total black crappie bycatch was determined from onboard observations of commercial fishers, and bycatch mortality rates were assessed via cage experiments. A recreational creel survey was conducted during 2005 and 2006 to assess recreational fishing effort, catch, and harvest of black crappie. Trawl surveys were conducted annually for a fishery-independent assessment of age/size composition, and carcasses from the recreational catch were collected annually for age/size composition data from the recreational fishery. A tagging study was conducted in 2006, which provided estimates of exploitation for the recreational and commercial (i.e., bycatch) fisheries. Results indicated approximately 17,000 and 30,000 crappie were captured in the commercial fishery and mortality rates of crappie captured was 31% and 47% in 2005 and 2006, respectively. Creel survey analysis indicated that 31,000 and 38,000 crappie were harvested in the recreational fishery in 2005 and 2006, respectively. We use an age-structured population model to evaluate the population-level effects of black crappie bycatch.

Efficiency of quadrat sampling for riffle-dwelling crayfish

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Quantitative sampling of crayfish can be challenging due to clustered distributions produced by a variety of factors. We tested the efficiency of the 1-m² quadrat sampler for estimating riffle-dwelling crayfish density. Sampling efficiency was evaluated in an Ozark Plateau stream through a mark-recapture study. We stocked three marked crayfish m² into enclosed 50 m² riffle sections and then randomly sampled five 1-m² quadrats in each of 12 riffles. We determined efficiency by comparing crayfish density estimates to the known value of marked crayfish. We found that sampling efficiency of the quadrat sampler was generally high (mean of 69%) but variable, as density estimates across our study riffles ranged from low underestimates to positively biased over-estimates. Coefficients of variation revealed that replicating habitat units within a stream or stream reach may provide more precise crayfish density estimates than replicating quadrat samples within a single habitat unit. No physical habitat or water chemistry variables we measured were correlated with sampling efficiency. A power analysis of confidence interval precision demonstrated moderate precision was achievable at reasonable sampling effort. The 1-m² quadrat sampler can be effective for quantitatively sampling lotic crayfish. This information should benefit researchers and managers interested in quantitative estimates of crayfish density.

Development of a mitigation plan for the Arkansas River Navigation Project

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The U.S. Fish and Wildlife Service, Arkansas Game and Fish Commission, Oklahoma Department of Wildlife Conservation, navigation industry consultant, and the Corps of Engineers in the Little Rock and Tulsa Districts cooperated to develop a mitigation plan for the Arkansas River Navigation Project. A fast-track habitat evaluation procedure was used to develop mitigation habitat units. The mitigation plan includes approximately 200 dike and revetment notches, improving connectivity to 30 backwaters or side channels, modifying or moving 75 dredge disposal areas, and construction of islands in 30 locations. A major requested environmental feature not included in the mitigation plan was upland disposal of dredge spoil in Arkansas. Mussel surveys, relocations, and propagation are ongoing to insure conservation of native mussels. The Corps has agreed to include long-term monitoring and adaptive management as mitigation features to insure successful conservation of habitats and species. Our cooperation will continue through active involvement in the mitigation, monitoring, and adaptive management committee.

Using microsatellites to characterize the population genetic structure of redline and greenside darters in the upper Tennessee River basin

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Microsatellite markers are powerful genetic tools that have been used to answer questions concerning population structure, population demography, and influences of landscape features on populations. Because microsatellites have become widely available and relatively affordable only recently, they have so far seen little use in non-game stream fishes. As a preliminary assessment of the utility of microsatellites for understanding the population genetic structure of such species, we (1) screened a suite of 18 microsatellite markers developed for various darter species for applicability in redline and greenside darters, two locally abundant fishes of the upper Tennessee River basin (UTRB), and (2) used a set of 5 and 7 applicable markers, respectively, to characterize population genetic patterns of the two species at 16 sites spread throughout the UTRB. For both species, overall gene diversity ($H_E = 0.71-0.80$) and allele richness ($A = 7.7-8.7$) were high, whereas genetic differentiation ($F_{ST} = 0.06-0.08$) among sites was low. Moreover, differentiation appeared to be driven more by genetic drift than by mutation. This indicates generally weak population structuring across the UTRB. Genetic differentiation among sites was unrelated to the fluvial or aerial distance separating them, but was strongly related to the presence or absence of large dams between them. Because of their high variability and ability to indicate recent alterations of population dynamics (e.g., due to anthropogenic barriers), we expect microsatellites to prove useful in future large-scaled studies of population structure in darters and other fishes.

Effects of Discard Mortality on Fishery Sustainability and Performance

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Fishery collapses cause substantial economic and ecological harm, but common management actions often fail to prevent overfishing. Minimum length limits are perhaps the most common fishing regulation used in both commercial and recreational fisheries, but their conservation benefits can be influenced by discard mortality of fish caught and released below the legal length. We constructed a computer model to evaluate how discard mortality could influence the conservation intent of minimum length regulations. We evaluated policy performance across two disparate fish life history types: short-lived high-productivity (SLHP) and long-lived low-productivity (LLP) species. Length limits failed to prevent recruitment overfishing when discard mortality rate exceeded about 0.2 for SLHP species and 0.05 for LLP species, and reductions in overall fishing mortality (e.g., lower fishing effort) were required to prevent recruitment overfishing if discard mortality exceeded these values. Similarly, relatively low discard mortality rates (gt 0.05) rendered maximum yield unobtainable and caused a substantial shift in the shape of the yield response surfaces. Analysis of fishery efficiency showed that length limits caused the simulated fisheries to be much less efficient, potentially exposing the target species and ecosystem to increased negative effects of the fishing process. Our findings suggest that for overexploited fisheries with moderate to high discard mortality rates, reductions in fishing mortality will be required to meet management goals. Resource managers should consider impacts of discard mortality on fishery sustainability.

**Growth and Condition Indices for a Native Puerto Rico Fish, Bigmouth Sleeper
*Gobiomorus dormitor***

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Bigmouth sleepers *Gobiomorus dormitor* are an amphidromous riverine species native to Puerto Rico. This species has been extirpated from many upper river reaches due to river impoundment, but may grow well in reservoir environments when introduced. Bigmouth sleepers are a locally popular sport fish on the island, and are of primary interest for future sport fish restoration and management. In this study, we assessed bigmouth sleeper growth potential under high prey availability, and suggest standard weight parameters and length categories for relative stock density (RSD) analyses. Growth (mm) per day decreased with the initial size of fish: 100-199 mm bigmouth sleepers averaged 0.46 mm/day (SE + 0.02); 200-299 mm fish averaged 0.21 mm/day (SE + 0.04); and fish greater than 300 mm averaged 0.05 mm/day (SE + 0.02). The regression-line-percentile technique was used on data from eight Puerto Rico river populations to determine the standard weight equation for bigmouth sleepers. The standard weight equation was: $\text{Log}_{10}(W_s) = -5.131 + 3.018 * \text{Log}_{10}(\text{TL})$ ($r^2=0.99$; SE + 0.004) with minimum size of 100 mm. Suggested length categories for this species were determined using published methods based on the world record catch of 610 mm. Minimum lengths for each category were: stock = 150 mm, quality = 230 mm, preferred = 300 mm, memorable = 380 mm, and trophy = 480 mm. This information will be useful for future management of this species.

Trophic relations of introduced flathead catfish in an Atlantic Slope river

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The flathead catfish, *Pylodictis olivaris*, is an obligate carnivore that has been widely introduced along the Atlantic Slope and has been reported to cause declines in native fish populations. The objectives of our field research in the upper Cape Fear basin of North Carolina were to (1) determine diet selectivity based on occurrence in the flathead catfish diet and the abundance of forage fish populations available; and (2) analyze mechanisms of the predator-prey relationship by determining preferences among prey items and the influence of depth and cover. Flathead catfish diet samples were collected using non-lethal pulsed gastric lavage. We conducted a series of overnight field tethering experiments using redbreast sunfish, *Lepomis auritus*, and snail bullhead, *Ameiurus brunneus*, as prey items varying the presence or absence of cover and depth of prey. Sunfish (Centrarchidae) were the most abundant prey item in the diet by weight, and mayflies (Ephemeroptera) were most abundant by number. The flathead catfish that we studied coexist with the rare Carolina redbreast, *Moxostoma spp.*, and the endangered Cape Fear Shiner, *Notropis mekistocholas*, but neither of these species occurred in the flathead catfish diet. We found that diet and selectivity differed between a shallow, high-velocity upstream reach and a deeper, slower-moving downstream reach. We detected no significant influence of prey species, depth, or the presence of cover on flathead catfish feeding preference. Understanding the trophic relations of introduced flathead catfish will allow resource managers to better determine their impacts on native fish populations.

Hatchery-reared v. wild-caught lake sturgeon: comparing their efficacy for telemetry research in the Coosa River, Georgia.

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Radio-telemetry studies are used often as a tool to describe movements or habitat preferences of fishes. Although hatchery-reared (naïve) fishes provide a readily available source of subjects for biotelemetry studies, the relative effectiveness of using naïve versus wild-caught fish has not been well evaluated. From 2004 to 2006, we used radio telemetry to monitor 10 naïve and 12 wild-caught juvenile lake sturgeon (*Acipenser fulvescens*) in the Coosa River, Georgia to compare their efficacy in telemetry studies. We also conducted habitat transect surveys collecting depth, current velocity, substrate, and dissolved oxygen data to evaluate habitat areas believed to be important to juvenile lake sturgeon. We used t-tests ($\alpha = 0.05$) to analyze data and identify significant differences in relative survival and post-stocking distance traveled between naïve and wild-caught sturgeon. Wild-caught sturgeon had significantly higher relative survival than naïve sturgeon. Post-stocking distance traveled was significantly lower for wild-caught than for naïve sturgeon. Additionally, initial analysis of habitat data paired with telemetry data suggests that juvenile lake sturgeon prefer reaches with diverse substrates, intermediate flow rates, and high dissolved oxygen levels. The telemetry data suggests that wild-caught lake sturgeon are more effective for radio-telemetry studies than naïve lake sturgeon. We suggest that researchers use wild-caught sturgeon, whenever possible for radio telemetry studies unless research goals dictate otherwise. We believe that using wild-caught fish may increase the amount and quality of data recorded during telemetry studies.

Physiological parameters as indicators of activity level in twelve species of sharks

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Anatomical indicators such as body shape, gill surface area, and caudal fin aspect ratio have been used as indicators of activity level (i.e. sustained, aerobic swimming) in fishes. In sharks, a fusiform body shape and a high aspect ratio caudal fin are indicative of highly active species such as shortfin mako sharks *Isurus oxyrinchus* and salmon sharks *Lamna ditropis*. Sluggish shark species, such as nurse sharks *Ginglymostoma cirratum* and Pacific sleeper sharks *Somniosus pacificus*, typically have more anguilliform (eel-like) body shapes and low aspect ratio caudal fins. In this study, I calculated caudal fin aspect ratio (AR, an easily measured external morphological characteristic) and used those values as an indicator of activity level. I then searched for correlations between AR and various physiological parameters. Twelve species of sharks, ten from the Gulf of Mexico and two from the Bering Sea, were examined for caloric, glycogen, and water content of hepatic and skeletal muscle tissue, cardio-somatic index (CSI), hepato-somatic index (HSI), and hematocrit. The salmon shark had the highest aspect ratio (4.10) and the nurse shark had the lowest aspect ratio (0.760). Aspect ratio was found to be significantly correlated with CSI ($p < 0.0001$), hematocrit ($p < 0.0001$), skeletal muscle water content ($p = 0.0053$), and skeletal muscle glycogen content ($p = 0.0022$). Furthermore, hepatic caloric content was the only liver characteristic to approach a significant correlation with aspect ratio ($p = 0.0930$). Hepatic water content and HSI were not as strongly correlated with caudal fin aspect ratio and may be associated with buoyancy control. The Bering Sea species (salmon and Pacific sleeper sharks) which greatly differed in activity level had similar HSI, caloric and hepatic water contents, which may be a result of their environment.

Tennessee Stream Mitigation Program (TSMP): Tennessee's In-Lieu-Fee Program

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The Tennessee Stream Mitigation Program (TSMP) was established as Tennessee's first in-lieu-fee program in 2003. The TSMP is administered by the TN Wildlife Resources Foundation, a 501c(3) non-profit. Since its inception the program has made great strides to provide mitigation to offset stream impacts permitted through §404/401 of the Clean Water Act. The TSMP is committed to providing meaningful mitigation on degraded streams to improve in-stream and riparian habitat and overall water quality. Employing principles of natural channel design and process-based methodologies, the TSMP continues to identify and develop stream restoration and enhancement projects across the state. To date, the TSMP has completed 13 projects resulting in the restoration or enhancement of over 120,000 linear feet of Tennessee degraded streams. Many of these projects were made possible through strategic partnerships with state and federal agencies as well as non-profit environmental/watershed groups. These accomplishments did not happen overnight. It has taken more than three years to build the program from the ground up and develop a streamlined approach to implementing stream mitigation projects. The program continues to refine its process and procedures as the science of stream restoration continues to develop. With oversight from regulatory and resource agencies and the continued support and participation of other non-profit organizations, the TSMP promises to provide meaningful mitigation to improve degraded stream resources in Tennessee. For more information, please visit ww.tsmp.us.

Aggressive interactions between the endangered Nashville crayfish, *Orconectes shoupi*, and two coexisting crayfish species

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The Nashville crayfish (*Orconectes shoupi*) is the only federally protected crustacean in Tennessee. There are no studies addressing competition between *O. shoupi* and other sympatric species. Thus, aggressive interactions, differences in chelae size, and the effect of chelae size on outcomes of aggressive interactions were studied in a laboratory setting between *O. shoupi*, *O. placidus*, and *O. durelli*. Differences in aggression were examined with videotaped contests between body size-matched hetero- and conspecific pairs of crayfish. Differences in chelae length and chelae width for individuals of each size-matched trial were also analyzed. Male and female *O. shoupi* were significantly more aggressive than *O. placidus*. However, results from female *O. shoupi* vs. *O. durelli* trials indicated that female *O. durelli* won more encounters and were marginally more aggressive than female *O. shoupi*. Differences in chela sizes were detected in some species and gender pairings. Although chelae size seems to play a role in dominance, it was not the only factor influencing outcomes of aggressive interactions. Results of this study suggest that translocations of *O. shoupi* into habitat occupied by *O. placidus*, for the purpose of expanding the range of *O. shoupi*, are possible. Although male *O. durelli* do not pose any initial threat, female *O. durelli* may be a threat to female *O. shoupi*. However, aggression between species in the presence of a vital resource (e.g., food or shelter) was not tested here and should be further investigated to provide a more comprehensive evaluation of possible threats to *O. shoupi*.

Abstract Number: 101148

Contributed Oral Presentation

Productivity gradients in Lake Murray, SC: a possible means of optimizing stocking site selection for striped bass.

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The overall goal was to optimize the striped bass stocking strategy for Lake Murray, a mainstem reservoir. As part of this stocking assessment, we measured longitudinal and vertical profiles of temperature, dissolved oxygen, light penetration, and chlorophyll in May and June, 2005 and 2006. Our objective was to define productivity gradients within the reservoir and major embayments. Density of chlorophyll was highest in the upstream areas of the lake but total chlorophyll production per unit of surface area tended to increase in mid-lake areas due to increased light penetration. The lower half of the reservoir had relatively low productivity. If we assume that higher productivity areas have higher growth and survival potential, a method of selecting stocking sites is suggested. This hypothesis is presently under field evaluation.

Abstract Number: 101149

Stream and River Mitigation Program Symposium

Multi-agency Cooperation and Development of the Arkansas Stream Mitigation Program

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The Service has cooperated with the Corps of Engineers and other federal and state agencies to develop a stream mitigation program in Arkansas called the "Little Rock Method". The Little Rock District has now implemented this method for assessing and requiring stream impact mitigation for Section 404 permits; however, further development of stream mitigation banks and policy is needed to finalize the program. Memphis and Vicksburg districts have indicated interest in adopting this methodology for their own mitigation programs. We are assisting the Arkansas Natural Resources Conservation Commission and Arkansas Game and Fish Commission in developing a stream mitigation bank program for restoring and obtaining conservation easements on streams. However, private banks in the form of conservation and/or preservation easement agreements along riparian buffers and streams would likely far surpass the state's ability to perform restoration. The districts are resistant to using preservation or conservation easements as mitigation and often do not require mitigation for many types of stream impacts arguing that certain impacts such as those authorized by Nationwide Permits are minimal and should not require mitigation. Many of these actions are themselves minor in impact, but significant when considered cumulatively. We anticipate that tens of thousands of feet of streams annually will begin to receive mitigation restoration/enhancement/conservation protection within the next year in Arkansas as a result of this cooperation. Our office initiated this request and was the driving force in its implementation and design.

Gene Flow and Genetic Structuring of a Species of Concern, the Yellowcheek Darter (*Etheostoma moorei*), in the Little Red River Watershed, Arkansas

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Yellowcheek darters, *Etheostoma moorei* (Raney and Suttkus), are endemic to the four headwater streams of the Little Red River in north central Arkansas. Construction of Greers Ferry Dam by the United States Army Corps of Engineers and the inundation of the Little Red River watershed above the dam beginning in 1962 resulted in much of the known range of *E. moorei* being converted from the riverine habitat required by this species to reservoir habitat. Population estimates have shown an 80 % decline in numbers over a 30 year period, resulting in a present status as a species of special concern. We had previously studied 85 individuals in 1996 from seven sites using allozyme analysis, with each stream population partitioning into distinct subpopulations. Fin clips were later collected in 2005 from 139 individuals for six sites. DNA was isolated using DNeasy® (Qiagen), with AFLP analysis detecting polymorphisms for 120 loci. Results demonstrated significant genetic structuring among streams ($F = 0.415$) and sites within streams. Slight genetic differences were even observed among riffles for a single site. These riffle-specific differences were supported by our previous mark recapture work, which demonstrated high site fidelity for yellowcheek darters within riffles. Management of this species should consider each stream population as distinct.

Hydrilla's altering effects on aquatic habitat complexity and fish foraging behavior

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Aquatic plants mediate ecological processes in aquatic habitats, specifically predator-prey (bluegill [*Lepomis macrochirus*]-macroinvertebrate) interactions. Individual growth rates of many fish species are positively related to foraging success. Exotic invasive plant species, such as *Hydrilla verticillata*, may alter the available structure in aquatic habitat thus affecting foraging. We investigated the hypothesis that a shift from a native aquatic plant bed to an invasive plant bed would alter aquatic plant bed complexity and therefore alter bluegill foraging success. Experimental treatments included: (i) intermediate densities of native-mixed plants and (ii) 50% native, 50% hydrilla, (iii) hydrilla, (iv) high density of hydrilla. We observed a significant treatment effect on aquatic plant bed complexity and bluegill foraging behavior. Bluegill searched faster, exhibited 60% more mean bouts, and recognized 38% more food items in native mixed habitat versus a hydrilla-dominated habitat. We suggest a hydrilla-dominated habitat disrupts predator-prey interactions by directly altering native habitat complexity, thus decreasing predator foraging success and prey recognition.

Population Status and Environmental Correlates for the Rare Striated Darter, *Etheostoma striatulum*, in the Duck River, Tennessee

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Etheostoma striatulum, the striated darter, is a barcheck darter of the subgenus *Catonotus*. The striated darter is considered a naturally rare and declining species throughout its range; yet it has escaped the attention of many ichthyologists. *Etheostoma striatulum* is found in the mid-to-upper Duck River drainage in five Tennessee counties. Much of this area has been degraded by a number of anthropogenic disturbances. The most recent status survey for the striated darter was conducted in 1992. Thus, a major goal of this research was to denote the status of the striated darter at the ten sites where it was successfully collected in 1992 and determine its status (presence/absence) at 20 additional sites. Associations between striated darter presence/absence and a suite of environmental variables were also investigated at the 100-m site scale. The sites were sampled by seining (26 sites) or snorkeling (4 sites) methods. One population estimate for *E. striatulum* was calculated and demographic information was gathered regarding age-class structure for this population. A total of 102 striated darters were either collected or observed from the 30 sites, and the species was present in 6 of 10 "1992 sites" and 11 of 30 sites in the wider study. There were no strong associations between striated darter presence/absence and any of the environmental variables measured (all $P > 0.20$). Our results are in agreement with previous assessments that this species indeed has a limited distribution and abundance within its known range. Its status warrants attention by those parties charged with species management and conservation.

Abstract Number: 101153

Contributed Oral Presentation

Determining the degree of hybridization in the smallmouth bass population of Broken Bow Reservoir and the Mountain Fork River

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The Elk River population of smallmouth bass either carries a low frequency of non-native alleles (<7%) or the genetic structure reflects a low level of allele-sharing between natives and the Byron Hatchery stock of the Tennessee Lake strain. The genome of the Broken Bow Reservoir population is about 40% non-native, whereas the stream populations in adjacent sections of the primary tributary, Mountain Fork River, carry a low frequency (approximately 3%) of putatively non-native alleles. The upper end of Broken Bow Reservoir is at least a partial barrier to the movement of hybrids from the down-lake area into the river. But, with time the river population will carry higher frequencies of non-native alleles. The results of this study suggest that a small amount of non-native genetic material has made its way into the river. Similarly, if non-natives are introduced into Grand Lake, the Elk River population in Oklahoma and Missouri may eventually carry significant amounts of non-native genetic material.

Abstract Number: 101157

Contributed Oral Presentation

Using SWAT models to assess sources of impacts to water quality on a watershed scale.

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The Saugahatchee Creek watershed (approx. 570 square km), located in eastern Alabama and part of the Alabama-Coosa-Tallapoosa basin, is currently facing a number of environmental issues due to changes in the area. Specific concerns that are affecting the water quality in the watershed include population growth, wastewater treatment runoff, sediment runoff, quarries and mining, and impervious surfaces. In this study we used a Soil and Water Assessment Tool (SWAT) model to simulate biophysical processes to estimate the impacts of various land use policies in the most urbanized part of the study area and evaluated change in environmental parameters between 1992 and 2001, coincident with National Land Cover Data (NLCD). SWAT, along with Geographic Information Systems (GIS), integrated available input data, such as soil type, land use, crops, topography, weather, nutrient and pesticide loading to predict the long-term impact of land use/management decisions. SWAT predicted increases in several environmental parameters that ultimately affect water quality. Most apparent were a 30% increase in total N runoff (kg/ha), a 21% increase in total P runoff (kg/ha) and a 212% increase in total sedimentation (tons). In addition, total water yield increased by only 6%; whereas, surface runoff increased by 42%. Ultimately SWAT provides a tool for assessing watershed level impacts to water quality related to changing land use patterns and can be used for conservation and development planning.

Abstract Number: 101159

Contributed Oral Presentation

Population dynamics, movement and growth of the Grotto Sculpin (*Cottus carolinae*) in Perry County, Missouri

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The Grotto Sculpin, endemic to caves in Perry County, was listed as a federal candidate species in 2002 and assigned a priority number of 2, indicating an imminent threat to the species exists. Due to the unstable nature of the cave environment in Perry County, Missouri, it was imperative to obtain baseline data on the population ecology of Grotto Sculpin and factors influencing their ability to repopulate caves in response to a catastrophic event (e.g., a contaminant spill). As with most cave species, few quantitative data are available on general life history characteristics. The objective of this study was to examine population dynamics, movement and growth of the Grotto Sculpin in two cave populations and their primary resurgence stream. Cave sites were divided into 10 m increments and individual fish were uniquely marked with visual tags at four to six week intervals between August 2005 and September 2006. A total of 811 fish were tagged during the study. A fish kill was observed in the upstream portion of one of the cave sites in August 2005. Throughout the course of the study, few individuals were observed in this section while only one tagged individual migrated into this affected region of the cave. Approximately 70% of individuals in cave populations moved less than 20 meters between sampling intervals. Maximum movement of an individual was 270 meters. Based on our data, the relatively sedentary nature of the Grotto Sculpin may limit their ability to recolonize habitats. Population estimates and growth rates for each sampling site will also be discussed.

Abstract Number: 101163

Contributed Oral Presentation

Evaluation of hoop net size and bait selection for sampling channel catfish in Iowa impoundments

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We compared seasonal catch of channel catfish *Ictalurus punctatus* in large (76 cm frames and 25 mm mesh bar measure) versus small (61 cm frames and 19 mm mesh bar measure) tandem hoop net series and two different bait types within these hoop nets (soybean cake and waste cheese) during 2004. Size structure data collected by both gears provided similar estimates of proportional stock density (PSD) for the gear and bait types within impoundments. Catch across seasons was similar within impoundments; however, estimates of PSD varied by season. Large hoop nets captured substantially more fish than the small hoop nets. Bait type did not significantly affect CPUE of hoop nets except in summer when nets baited with soybean cake captured significantly more (more than 1.5 times) channel catfish than nets baited with waste cheese. CPUE precision was greatest with the large hoop nets baited with soybean cake during summer or fall. We suggest summer sampling with large hoop nets and soybean cake be used as a standard sampling regime. Soybean cake-baited large hoop nets caught more fish, provided the most precise estimates of CPUE, channel catfish mortalities were low, and most management biologists have more time to devote to channel catfish sampling in summer versus other seasons. In addition, soybean cake is preferred over waste cheese because it produces less odor, has fewer storage problems, and can be obtained easily from local suppliers.

Abstract Number: 101164

Contributed Oral Presentation

Florida's largemouth bass stocking programs: a historical perspective

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The Florida Fish and Wildlife Conservation Commission (FWC) has produced and stocked more than 6.5 million largemouth bass *Micropterus salmoides* out of the Richloam Fish Hatchery since the 1960s. We will provide a historical perspective of our agency's bass stocking programs, which changed over the years from supplemental stocking to stocking new waters or stocking degraded populations following drought conditions or fish kills. With the recent renovation of Richloam Fish Hatchery, emphasis has shifted back to supplemental stocking of advanced-sized (~100-mm TL) bass raised on artificial diets. Our early research on stocking of advanced sizes of bass indicated that pellet-reared bass had difficulty transitioning from artificial feed to live prey after being stocked. Several laboratory studies collectively indicated that the feeding behavior and predation success of naïve pellet fed largemouth bass differed from experienced wild fish, and that learning of naïve bass occurred following limited exposure to live prey. Also, fish health problems were suspected from vitamin C (ascorbic acid) deficiencies and indigestible fatty acids in artificial diets; suggesting the need for a more nutritionally complete and species-specific diet. The time of year that fish were stocked may have also affected the survival of stocked fish. Lake Talquin stocking efforts were more successful when the reservoir was stocked with live-feed-reared largemouth bass at a time when age-0 shad were available as prey. Research findings are being incorporated into hatchery protocol and new stocking programs.

Abstract Number: 101165

Contributed Oral Presentation

A nonparametric, multivariate approach to comparing length and weight distributions

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For many experiments, the final outcome of interest is whether a length or weight frequency was altered. Frequently, this comparison is done using either a chi-square test or a Kolmogorov-Smirnov test. We present a different method for comparing and visualizing changes in frequency distributions. This new method uses replicate samples of the distributions to estimate within versus between-sample variance, and utilizes a permutation test for comparing the ranked similarities of the multiple distributions. We will present two examples illustrating how this technique can be used to compare length frequencies following a regulation change or some similar perturbation to a system.

Developing nutrient criteria for reservoirs: how it may impact you

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EPA has mandated that states develop numeric nutrient criteria for reservoirs. Under the EPA these criteria are based on using the currently pristine waters within a state and having all waters conform to those values. This approach assumes that all developed waters were once equivalent to those waters that have remained pristine. This is a tenuous assumption. Fortunately, the EPA has allowed the states to develop alternative approaches to development of these criteria. Three approaches have been forwarded in Texas, a use-based approach, a parametric approach based on "minimally-impacted" regions, and a nonparametric approach that considers each reservoir as unique. Other states have adopted various other approaches including weight-of-evidence. We will discuss the various approaches that have been used to develop nutrient criteria and involvement in the development of nutrient criteria within your state's waters could be critical for future fisheries management activities.

Can fishing for common carp *Cyprinus carpio* become an important component of freshwater recreational fishing in Texas?

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In Texas, a small but extremely avid group of anglers target common carp, and much of this fishing activity occurs in urban areas. In fact, anglers have discovered that some urban water bodies offer the potential for catching world-class carp. Austin-area impoundments, in particular, have garnered fame for world-class carp fishing and have attracted tournaments with international participation. As part of Texas Parks and Wildlife Department's efforts to better understand this fishery, we conducted angler surveys at two tournaments held in Austin during 2006. The 125 tournament participants incurred \$102,798 in tournament-related expenditures. We also conducted a survey of 2500 licensed anglers in the Austin area to assess general angler interest and participation in carp fishing. Twenty-eight percent of respondents characterized their interest in carp fishing as "somewhat interested" or "very interested", and 38% had previously fished for carp. Over 79% of carp anglers practiced catch and release of carp. Over 55% of Austin-area anglers reported that neither they nor a family member owned a powerboat, highlighting the need for bank angling opportunities. Texas Parks and Wildlife recognizes the potential for our carp fisheries to provide unique angling opportunities to our constituents, especially those in urban areas.

Development of Procedures for Evaluating Dam Operation in the Southeastern United States

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Through 2010, the United States Fish and Wildlife Service (USFWS) will evaluate the relicensing of more than 200 dams in the Southeastern United States licensed by the Federal Energy Regulatory Commission (FERC). The USFWS Southern Rivers Integrated Science Initiative has recognized a critical need for new tools to evaluate the relicensing of these dams. Under the management context provided by R.L. Harris Dam on the Tallapoosa River, Alabama, we created a template for incorporating adaptive management and decision analysis into the FERC relicensing process. Such an approach incorporates both existing and new data and multiple management objectives, while providing a structured framework for decision-making. Following evaluation of stakeholder objectives and formation of faunal response hypotheses, relations between flow, biotic response, and stakeholder satisfaction were modeled in a Bayes' network using probabilistic dependencies derived from empirical data and expert opinion. From the model results, we determined the optimal decision and conducted sensitivity analysis to ascertain which components of the model had the greatest influence on the decision. By using the decision model, stakeholders were able to gain a clear understanding of the decision and its effects on stakeholder values, enabling them to effectively reach consensus. Therefore, this template provided the necessary framework for evaluating relicensing of FERC-licensed dams and for making decisions regarding flow modification in regulated river systems.

Abstract Number: 101174

Contributed Oral Presentation

Habitat use of the Grotto Sculpin (*Cottus caroliniae*), a troglobitic fish species in Perry County, Missouri Gerken*, J.E., and Adams, G. Department of Biology, University of Central Arkansas, Conway, AR 72032 jeg00004@cub.uca.edu

Habitat studies in caves have been limited to qualitative studies providing general descriptions of the habitat utilized by fish populations. The lack of quantitative habitat use data for troglobitic species makes it hard to examine important ecological traits such as the effects of habitat change or evidence of habitat specialization. This study quantitatively examined the habitat use of two Grotto Sculpin (*Cottus caroliniae*) populations and corresponding populations in the primary resurgence stream in Perry County, Missouri. We specifically examined differences between the habitat use of epigeal and hypogean populations and the effects of siltation in hypogean streams. Perry County, Missouri has a high abundance of sinkholes which allow a large amount of agricultural runoff to directly enter the cave. Silt from this runoff can drastically alter the habitat available for the Grotto Sculpin to use by replacing cobble substrate with silt. The loss or reduction in cobble substrate availability can affect Grotto Sculpin populations both directly and indirectly. The increase of silt may have a direct impact on Grotto Sculpin reproduction. When spawning, Grotto Sculpin utilize cobble substrate by attaching their eggs to the undersides of available rocks. Additionally, the loss of cobble substrate may reduce the availability of isopods and amphipods, the primary food source for Grotto Sculpin. We will present a quantitative evaluation of habitat use and the possible effects of altering this delicate habitat. Benefits from this study will reach beyond Grotto Sculpin populations and help us to better understand the habitat use of other benthic fish in hypogean ecosystems.

Abstract Number: 101175

Contributed Oral Presentation

Characteristics of supplemental stockings of largemouth bass: A literature review Heitman*, N. Elizabeth, S & ME, Inc. Louisville, TN 37777, and Colvin, Michael A., Missouri Department of Conservation elizabeth.heitman@hotmail.com

We reviewed 26 published articles and theses that evaluated supplemental stockings of largemouth bass (N = 114 stockings) to determine relationships between important stocking variables and stocking results. Largemouth bass have been stocked at sizes up to about 315 mm TL, but most stockings were fish that were < 150 mm TL. Generally, as stocking size increased, stocking rate decreased. Stocking rates as high as 600 fish/ha were reported, but most (75%) were < 100 fish/ha. Percent contribution to the year class in either the fall after stocking or the following spring was the most commonly used statistic to evaluate supplemental stockings. When contributions were measured in both fall and spring, there was a high correlation between the two periods ($r^2 = 0.53$). We found a significant correlation between stocking rate and percent contribution in the spring ($r^2 = 0.28$), but not between size of stocked fingerlings and percent contribution ($r^2 = 0.02$). The mean contributions of stocked largemouth bass were similar (about 9%) when stockings were deemed either successful or unsuccessful, but it averaged about 25% when no opinion concerning success was given by the authors. Results of this review indicate that there are no consistent criteria for determining success of supplemental stockings of largemouth bass and that factors such as the size of the wild year class should be incorporated into stocking analyses.

Abstract Number: 101178

Contributed Oral Presentation

Patterns in largemouth bass (*Micropterus salmoides*) population dynamics in the lower Arkansas River

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Largemouth bass is one of the most popular sport fishes in Arkansas, especially in the impounded lower Arkansas River. However, little information exists upon which to conduct science-based management of this fishery. This is especially important given the perceived decline in the fishery over the past decade and the popularity of largemouth bass tournaments in the river. The primary objective of this study was to conduct an intensive stock assessment of the lower 11 pools (500 km) of the Arkansas River over 2 years to support future management of this fishery. Population age structures were skewed towards younger fish, with a low numbers of individuals older than age 3. Largemouth bass size structure varied by pool and year. Proportional stock density (PSD) values throughout all pools averaged 51 ($\pm 3 = SE$) in 2004 (range 33-67) and 55 (± 3) in 2005 (range 27-61). Average annual mortality values computed from catch curves were 49% (range 28-65%) and 47% (range 28-64%) for 2004 and 2005, respectively. Mean total lengths (mm) at age for largemouth bass for ages 1-6 were 205, 289, 345, 392, 427, and 418 for 2004 and 167, 264, 345, 388, 419, 434 for 2005. These length at age estimates were comparable to similar impounded river systems in the region. Results of the study suggest a quality largemouth bass fishery in the lower Arkansas River, though we recommend continued monitoring of populations in light of continuing environmental changes in the river.

Abstract Number: 101179

Contributed Oral Presentation

Catch Comparison Between Two Types of Gillnets in Lake of the Ozarks, MO

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It is desirable to prevent fish from getting too near generator intake structures in hydro power reservoirs to prevent impingement. At Lake of the Ozarks, MO, it was determined that a barrier net would accomplish this goal. There was concern that the net might catch as many fish as were impinged. A net made of Dyneema material similar to the proposed barrier net was constructed and used as a test net. As a catch comparison a monofilament net was constructed in a like manner. Each net was 90 feet long and 15 feet deep with equal panels of one inch and two-inch (square measure) mesh. The nets were fished simultaneously and adjacent. The monofilament net caught a total of 156 fish and the Dyneema net caught only one fish.

Abstract Number: 100992 Imperiled Species Ecology and Management Symposium

Mechanisms for coexistence of the introduced western mosquitofish (*Gambusia affinis*) and native Barrens topminnow (*Fundulus julisia*) with an emphasis on density and artificial refuge

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The Barrens topminnow, *Fundulus julisia*, is disappearing from its native range as populations of the invasive western mosquitofish, *Gambusia affinis*, become more established. Once at a site, mosquitofish replace topminnow populations presumably through predation of young topminnow life stages and harassment of adults. We examined the ability of the topminnow to coexist in the laboratory with mosquitofish under different scenarios of density and refuge. Two experiments were conducted to identify a density where adult topminnows choose to coexist with adult mosquitofish in a "prime" habitat when given the choice to occupy a "less prime" habitat that is almost mosquitofish free. A third experiment was conducted to test whether an artificial habitat refuge could increase juvenile topminnow survival in the presence of mosquitofish. Adult topminnows left a prime habitat when mosquitofish comprised 80% or more of the total number of fish in the system. Early results also suggest an increase in survivorship of young topminnows 2-4 times greater in treatments with refuge. Our findings could help refine current topminnow stocking practices and manage sites with existing sympatric populations of both species.

Abstract Number: 101027 Imperiled Species Ecology and Management Symposium

Seasonal microhabitat use of the Threatened Spotfin Chub, *Erimonax monachus*, in the Emory River Watershed

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The threatened spotfin chub *Erimonax monachus* is a small, rare cyprinid fish endemic to the Tennessee River drainage. The objectives of this study were to: (1) determine habitat variables significantly associated with presence/absence of spotfin chubs at the microhabitat level within the Emory River Watershed and (2) describe seasonal variation in microhabitat use. Eight 200 m sites were selected to evaluate microhabitat use. These were sampled once per each season (spring, summer and fall) during 2006. Present microhabitats were located by snorkeling. Absent microhabitats were determined randomly. Habitat variables recorded for present and absent microhabitats included: (1) temperature, (2) conductivity, (3) depth, (4) substrate, (5) velocity, (6) habitat unit and (7) distance to bank. Using logistic regression, spotfin chub presence/absence was modeled as a function of one or more of these habitat variables. Across all three seasons, spotfin chubs were more likely to be present in microhabitats within runs with depths between 16-60 cm and boulder and bedrock substrates. In spring, they were more likely to be present at velocities greater than 0.06 m/s at the substrate and between 0.15-0.67 m/s at 60%. In summer, they were more likely to be present at velocities between 0.09-0.37 m/s at the substrate and 0.09-0.43 m/s at 60%. In fall, they were more likely to be present at velocities between 0.09-0.30 m/s at the substrate and 0.15-0.43 m/s at 60%. Temperature and conductivity were significant in summer and fall, but trends were inconclusive. Distance to bank was not significant in any season.

Abstract Number: 101132 Imperiled Species Ecology and Management Symposium

Population densities and performance of predictive habitat models for the threatened blackside dace (*Phoxinus cumberlandensis*)

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The blackside dace, *Phoxinus cumberlandensis* Starnes and Starnes, 1978, is a rare cyprinid restricted to small tributaries in the Upper Cumberland River system in southeastern Kentucky and northeastern Tennessee. The objectives of this study were (1) determine presence/absence and population densities of *P. cumberlandensis* within its historical range and (2) to validate the effectiveness of logistic regression habitat models to predict *P. cumberlandensis* presence/absence. Forty-seven 200-m reaches within 27 streams were sampled via single-pass backpack electrofishing; seven sites were double-sampled to allow estimates of population size. Blackside dace were found to inhabit 18 of 27 streams and 26 of 47 reaches; although, most reaches (72%) had catch rates of < 10 dace per 200 m. Population estimates for the 26 reaches harboring blackside dace averaged 91 ± 147 dace per 200 m, and associated densities averaged 16.8 ± 23.7 dace per 100 m². Environmental variables were measured at 47 reaches to validate previously developed logistic regression habitat models. Models were generated from streams that historically harbored blackside dace, with gradient at the stream scale and turbidity, water temperature, conductivity, percent riffle, and link magnitude at the reach scale predicting the probability of blackside dace presence/absence. Model performance was assessed with Cohen's kappa, which resulted in one model indicating moderate performance (kappa = 0.4 - 0.6), seven models indicating slight performance (kappa = 0.0 - 0.4), and four models indicating poor performance. The strongest models included conductivity as a predictor variable, with the combination of conductivity and temperature producing the strongest performance (kappa = 0.41).

Abstract Number: 101138 Stream and River Mitigation Program Symposium

Evaluating Mitigation Requirements of Corps of Engineers Navigation and Flood Control Projects

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The Corps of Engineers has developed capabilities to quantify adverse impacts and mitigation of federal flood control and navigation projects. Most of these capabilities are based on the concept of the Habitat Evaluation Procedure, which uses Habitat Suitability Indices (HSI) to weight acres of affected habitat. EnviroFish was developed to quantify impacts and mitigation of flood control on fish reproduction in the floodplain of the Mississippi river and tributaries. The conceptual basis of EnviroFish requires integration of hydroperiod, land use, and HSI values. The Index of Biotic Integrity (IBI) is another concept used to evaluate large scale impairment in the Mississippi River Delta where long-term flood control projects have occurred. The IBI tracks the degree of impairment in delta streams and the rate of recovery for watersheds where mitigation or restoration have occurred. Different procedures are used to evaluate adverse impacts of navigation projects. The Navigation Predictive Analysis Technique (NAVPAT) is a computer simulation program that links physical effects of individual towboats to biological impacts on fish and other aquatic organisms. In some cases, the size of the project area and constraints of money and time require best professional judgment to develop HSI values. An example is the Arkansas River 12-foot Navigation Project where a group of biologists utilized remote sensing data, limited field data, and personal experience to quantify impacts of channel deepening, loss of gravel bars, and adverse impacts of dikes. Ultimately, a mitigation package was agreed upon along with long-term monitoring to validate predictions.

Abstract Number: 101144 Imperiled Species Ecology and Management Symposium

Swimming performance of the Barrens topminnow (*Fundulus julisia*) and western mosquitofish (*Gambusia affinis*): Implications for barrier design and topminnow conservation

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Flow-through velocity barriers have been shown to restrict or prevent upstream movement of fishes. These obstructions could have undesirable effects on native fish communities but also could serve to restrict dispersal of invasive species. *Gambusia affinis*, the western mosquitofish, is an invasive fish known to be harmful to the Barrens topminnow, *Fundulus julisia*, a species endemic to springhead pools and runs in middle Tennessee. We evaluated the feasibility of using fish-exhaustion barriers to screen mosquitofish but allow passage of topminnows by conducting swimming performance tests on both species. Time-to-fatigue trials were completed in a laboratory flume for 168 topminnows (28-86 mm TL) and 138 mosquitofish (34-53 mm TL) during July and August 2006. All topminnow size classes out-performed the average mosquitofish. Mean topminnow and top-performing mosquitofish endurance times were used to predict exhaustion thresholds in order to identify velocity and barrier length combinations that would result in a selectively permeable barrier.

Abstract Number: 101160 Imperiled Species Ecology and Management Symposium

Habitat Use and Movement Patterns of Robust Redhorse Released in the Ocmulgee River, Georgia Grabowski*, T.B., Warnell School of Forestry and Natural Resources, The University of Georgia, Athens, GA; and Jennings, C.A. U.S. Geological Survey, Georgia Cooperative Fish and Wildlife Research Unit, the University of Georgia, Athens, GA 30602 tgrabow@uga.edu

Ongoing restoration efforts for the imperiled robust redhorse include establishing refugial populations within the species historic range. However, uncertainty regarding the permanency of stocked fish raised questions about the success of reintroduction efforts. Radio telemetry was employed to assess habitat use, movement patterns, and to estimate the proportion of stocked fish remaining within the study reach of the Ocmulgee River, Georgia. Thirty 30 robust redhorse were captured from stocked populations in late March and early April 2006, surgically implanted with radio transmitters, and released at the upstream end of the study reach. Radio-tagged fish were tracked weekly; location, temperature, dissolved oxygen (DO), depth, current velocity, turbidity measurements, and qualitative habitat (i.e., cover & substrate) assessments were recorded for each fish relocated. Initially, most (93%) of the fish remained within the study reach. However, 11 individuals passed over the downstream low-head dam during their first month at-large. The 19 fish remaining above the dam made regular movements between the two dams (about 30 river km). These movements were not correlated to river flows or the other environmental variables measured. Individuals that left the study reach have been mostly sedentary and generally make only short (< 2.0 km) distance, irregular movements. Individuals below the dam typically inhabit deeper, more-oxygenated, more-turbid waters than their counterparts above the dam. These out migrants are more likely to be associated with woody debris and sandy or muddy substrates. Habitat use differences between the two groups probably reflect differences in habitat availability above and below the dam.

Abstract Number: 101173 Imperiled Species Ecology and Management Symposium

Adaptive management and decision support analysis for conservation of imperiled fishes Irwin*, E.R. United States Geological Survey, Alabama Cooperative Fish and Wildlife Research Unit, Auburn University, AL 36849 irwiner@auburn.edu

Conservation efforts for imperiled fishes require both sound science and management applications to protect and restore populations. Often, management of imperiled species conflicts with societal needs (e.g., needs for water or power). In addition, there are degrees of uncertainty relative to how management affects biological and ecological processes. Adaptive management is an iterative process that facilitates learning by making predictions relative to system uncertainty (decision support or other models), applying the scientific process to monitor effects of management actions that are applied to optimize resource variables, and updating the knowledge base (relative to predicted responses) for potential modification of management actions. I describe a study where a decision support model assisted in development and implementation of an initial experimental flow regime and monitoring program on a highly regulated Southeastern river using an adaptive management framework. The Bayesian probability model incorporates values of multiple stakeholders and uses both empirical data and expert opinion regarding predicted biological responses of several "at-risk" species to management actions. The project is in its second year of experimental manipulation of flow and model probabilities are being updated. Although experimental manipulation is a potential panacea for learning effects of management on imperiled species, many stakeholders are risk adverse and consequently most adaptive management projects fail in the planning stages. I contend that careful implementation of adaptive management for imperiled fishes in multiple systems will allow us to learn more rapidly for conservation efforts.

POSTERS

Abstract Number: 100934

Poster

Instream Flow: What is it and why is it important?

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Instream flow is defined as any quantity of water flowing in a natural stream channel at any time of year. Instream flow is more than just water in the stream. It consists of five components that are hydrology, geomorphology, biology, water quality, and connectivity. All of these components are important in establishing an effective Instream Flow Program. In addition to the five riverine components, instream flow must take into account public involvement and the legal/institutional frameworks. Instream flow is important in providing adequate flow in streams for all organisms that live there. Flow affects the life histories which in turn affects population numbers and the relative health of the stream. Tennessee Wildlife Resources Agency (TWRA) is establishing an Instream Flow Program as part of the Environmental Services Division. This program will lay the foundation for future instream flow protection in the state of Tennessee.

Abstract Number: 100945

Poster

Virginia Landowner Incentive Program

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The Landowner Incentive Program (LIP) is a grant program funded by US Fish and Wildlife Service and administered by state wildlife agencies. The Virginia Department of Game and Inland Fisheries has received a LIP grant and is using it to support the implementation of specific landowner incentive projects for at-risk wildlife species on private property. As in many other eastern states, the majority of Virginia's land is in private ownership (86.6% of 25.5 million acres). Given the relative proportion of private land, effective technical assistance to and coordination with private landowners is a critical component of habitat and species protection, recovery, and management. The Virginia Wildlife Action Plan identified 925 species of wildlife as rare or at-risk; over half (465) of those species depend on aquatic habitats. The objective of the program is to manage, enhance, and protect Virginia's rare aquatic resources by protecting and restoring habitats and improving water quality through stream restoration projects. Project activities will include livestock exclusion, providing alternative watering systems, stream crossings, and riparian buffer establishment. Severely degraded stream banks will be stabilized with a combination of bank shaping, in-stream structure installation, and bioengineering techniques such as willow tree fascines, root wad installation, and cedar tree revetments. Landowners are required to contribute 25% cost share, which may consist of in-kind services or contribution of materials. Signed water quality and habitat improvement agreements between landowners and the department will have a minimum length of 10 years and require a vegetated riparian buffer zone of 35 feet.

Abstract Number: 100947

Poster

A model describing the association between landscape-scale environmental characteristics and abundances of catchable sport fishes in Mississippi wadeable streams

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During 2004-2005, the U.S. Environmental Protection Agency conducted the National Wadeable Streams Assessment (NWSA). For Mississippi's contribution to the NWSA, we sampled reach-scale and landscape-scale environmental characteristics as well as benthic macroinvertebrates from 13 randomly selected wadeable streams. In conjunction with the NWSA environmental sampling protocol, we sampled sport fishes by angling on multiple occasions. Our objectives were to identify landscape- and reach-scale environmental associations to sport fisheries abundances, determine the appropriate spatial scale and then create and test statewide models for catchable sport fish abundances in Mississippi wadeable streams. We found that largemouth bass *Micropterus salmoides*, spotted bass *M. punctulatus*, longear sunfish <> and bluegill *L. macrochirus* were primarily correlated with landscape-scale characteristics, including watershed size, land use, vegetative cover, and stream size. Consequently, we used a landscape-scale approach to generate a comprehensive and parsimonious regression model for these sport fishes. Conceptually, the model predicts that largemouth bass, total bass, longear sunfish and total sunfish abundances (CPUE: fish/angler-hour; % composition) tended to increase when watershed forest cover increased and elevation at the reach mid-point decreased ($R^2=0.62$; $P=0.01$). This model was validated with an independent dataset (Sign test; $P=0.59$), and the model correctly

predicted the outcome (i.e., observed values were within 95% C.I. for predicted values) in 73% of the samples from the independent dataset (N=11 streams). This landscape-scale model can be used as a rapid assessment tool to target candidate streams in Mississippi for sport fish management and restoration.

Abstract Number: 100954

Poster

Oklahoma's probabilistic monitoring programs

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In the early 2000's, several of Oklahoma's water quality monitoring agencies determined that the inclusion of a probabilistic design in Oklahoma's overall monitoring strategy was a necessity. In 2003, the Oklahoma Water Resources Board (OWRB) took the lead in developing a strategy and securing funding for the program. Top priority was to initiate a statewide probabilistic monitoring program. A monitoring plan developed by the Oklahoma Conservation Commission (OCC) and the USEPA NHEERL Ecology Group in Corvallis, Oregon, was used as the framework. The initial plan was built around a 5-year monitoring plan using Oklahoma's eleven planning basins, including both statewide and regional estimates. The first two years of the study are successfully completed. The second priority was to develop regional or project specific probabilistic programs. To date, two such programs have been initiated. In 2004, Oklahoma participated in the USEPA's National Wadeable Streams Assessment (NWSA). In addition to monitoring at 19 randomly targeted and 10 non-random reference sites, Oklahoma collected data for both a habitat and benthic macroinvertebrate methods comparability study. Moreover, in 2005, the OWRB received a CWA 104(b)3 Cooperative Grant from USEPA Region VI for a two-year project in Oklahoma's Illinois River scenic river watershed. Using a probabilistic design including over 50 stations, the project's goal is to make watershed estimates of aquatic health using measures of the fish, macroinvertebrate, and algal communities as well as intensive surveys of habitat. The study will provide valuable information about the relationships between periphyton biomass/algal cover and nutrients in Ozark streams.

Abstract Number: 100961

Poster

Solunar Tables - Fact or Fiction?

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Diel and seasonal changes in the environment can affect fisheries both directly and indirectly. Understanding these effects can provide insight into the biology, ecology and management of the fishery. These environmental parameters may include temperature, barometric pressure, precipitation, time, sunlight, and lunar phases. Despite reliable scientific evidence, the effects of lunar phases on fish activity have long been acknowledged in popular magazines with published 'solunar tables'. These tables predict the feeding activity of fish, and the likelihood of being caught, based on the location of the moon relative to the angling location. In this study, factors influencing angling success, including solunar tables, were evaluated for urban fishing ponds with put-take stocking of channel catfish, *Ictalurus punctatus*. Catch-per-unit-effort (CPUE) of 491 individual fishing trips on six ponds were compared to temperature, barometric pressure, days post-stocking, time of year, time of day, and published lunar activity. The only variables correlated to CPUE was days post-stocking and time of day ($p = 0.005$ and $p = 0.020$, respectively). There was no correlation with the solunar table ($p = 0.147$). These results suggest that fish activity in these urban fisheries is not controlled by lunar phases, but other environmental factors and management activities.

Abstract Number: 100973

Poster

Is native fish richness declining in North Carolina Piedmont streams?

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Streams in the North Carolina Piedmont are influenced by changing land use. Native fish in Piedmont streams are susceptible to environmental changes associated with these land-use changes. Thirty sampling sites were selected to represent changes along an urbanization gradient. The sites were chosen on the basis of an urban-intensity index, a measurement tool used in the U. S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Program. The sites were sampled using a standard two-pass backpack electrofishing technique to compile an observed-species list. An expected-species list also was compiled from historical records for the 30 individual sites using information from the North Carolina Department of Environment and Natural Resources, the North Carolina Museum of Natural Science, and published fish records. The observed-species list was compared to the expected-species list. The native fish richness was less than expected in all Piedmont streams sampled along the urban gradient. Currently, the USGS is investigating environmental changes that lead to native fish reduction, such as urbanization. Future sampling will enable monitoring of native fish richness over time.

Abstract Number: 100989

Poster

An update on the zoogeography of West Virginia's fish fauna

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During the past five years, we have synthesized and compiled data on historic and recent fish collections in West Virginia into a georeferenced database. The West Virginia fish database will be used to produce a spatial and temporal atlas of fish distributions, and currently includes over 8,000 site records from fish collections during 1853 to 2005. Species distribution data will be depicted by time periods which reflect the substantial contributions and efforts of Ebenezer Andrews, Spencer Baird, Charles Bollman, William Hay, E.L. Goldsborough, Carl and Laura Hubbs, Milton Trautman, A.H. Wright, John Addair, Ed Raney, L.W. Wilson, E.A. Seaman, P.E. Swasey, H. Van Meter, Anthony Bodola, Frank Schwartz, Ron Preston, Bob Denoncourt, Charles Hocutt, Jay Stauffer, Rich Raesly, West Virginia Division of Natural Resources personnel, as well as collections from the authors. Over 2000 of the 8,000 site records are represented at museums, and we have verified species identifications of most of the individual lots of these records at Cornell University, University of Michigan Museum of Zoology, American Museum of Natural History, North Carolina State Museum, United States National Museum, and Ohio State University Museum. Additionally, we will include dichotomous keys (with illustrations) for identification of families, genera, and species. The general format, highlights, and illustrations of this upcoming book are presented.

Abstract Number: 101018

Poster

Monitoring experimental streambank stabilization techniques in Missouri streams

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Excessive erosion of streambanks is a continuing problem for landowners along many streams. Techniques currently used in Missouri to slow excessive erosion and protect streambanks are effective when applied appropriately, but have limitations that prevent them from being useful in all situations. A literature review was conducted to find if other options existed for helping landowners deal with erosion. While a large number of biotechnical and structural techniques were found in the literature, very few have ever been monitored to determine their effectiveness. As a result MDC is evaluating six techniques to determine their applications and limitations. The six techniques are: log weirs, farm rock weirs, toe protection using farm rock, back sloping and revegetation, gravel rolls for toe protection, and grade control structures. The techniques are being tested and evaluated on MDC areas. The techniques are being evaluated at multiple locations across the state under a variety of conditions. They are being evaluated with detailed physical surveys and photo points over several high flow events to determine their effectiveness. Once a technique has been evaluated and determined to be effective it will be added to the list of techniques that we can use to help landowners deal with erosion problems.

Abstract Number: 101045

Poster

A GIS-based landscape model to predict brook trout (*Salvelinus fontinalis*) distributions in West Virginia watersheds in support of the Eastern Brook Trout Joint Venture (EBTJV)

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The Eastern Brook Trout Joint Venture (EBTJV) was formed to implement range-wide strategies that sustain healthy, fishable brook trout populations. Hudy et al. (2005) recently completed a comprehensive analysis of eastern brook trout distributions representing a critical first step towards fully integrating brook trout conservation efforts in this region. The study identified distinct gap in our knowledge of the status and distribution of brook trout in West Virginia. Using data collected from the Potomac River drainage in the past ten years, we developed a landscape-scale predictive model for brook trout presence/absence. This model included five landscape variables and had a correct classification rate of 93% (100% correct classification for absent streams, 67% for present streams). We used the output from this predictive model to select 80 additional sites across the Potomac drainage. During the summer of 2006, we gathered detailed information on stream habitat, water chemistry, brook trout population structure and associated species composition from these sites. This newly acquired data is being used to create a landscape scale models that will predict brook trout density and biomass and identify critical areas in the watershed for protection and restoration. The results of this research will be used to update the EBTJV's distributional map and guide brook trout management actions throughout the Potomac River headwaters. A similar procedure will be used to update distributional maps in the Monongahela and Kanawha River basins.

Abstract Number: 101053

Poster

Latitudinal variation of life-history traits in Centrarchidae

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Few studies have investigated multiple life-history traits across a latitudinal gradient. Data were collected from the published literature for 47 populations of bluegill (*Lepomis macrochirus*), 57 populations of largemouth bass (*Micropterus salmoides*), 28 populations of black crappie (*Pomoxis nigromaculatus*), and 46 populations of white crappie (*Pomoxis annularis*). Collected data were used to calculate length-at-age 1 (*L1*), juvenile growth rate (*G*), asymptotic length (*Linf*), growth efficiency (*K*), and maximum age (*Amax*), and determine the presence of latitudinal trends. The strength of the statistical assessments varied among species, though a consistent pattern was evident. Generally, *L1*, *G*, *Linf*, and *K* decreased with latitude, whereas *Amax* increased with latitude. *L1*, *G*, and *Linf*, increased with lake surface area, whereas *K* decreased. Latitude was the most significant variable explaining the suite of life-history traits, and trends with lake surface area and associated interaction were inconsistent.

Abstract Number: 101080

Poster

Home range and habitat use of blacktail redhorse in West Fork Thompson Creek, Louisiana

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We studied the home range and habitat use of blacktail redhorse (*Moxostoma poecilurum*) in West Fork Thompson Creek, Louisiana. Blacktail redhorse are a common nongame species that range from eastern Texas to Florida and throughout Louisiana. Adult blacktail redhorse (n=33; 187-259 mm total length) were implanted with radio transmitters and tracked biweekly from February through September 2006. We also monitored fish every 30 minutes during six twelve-hour night and day monitoring periods. Our preliminary analysis indicated that home range size varied from 0.1 to 7.8 hectares among individuals. We found that some fish had multiple, separated home ranges, and other fish remained in the same pool throughout the entire experiment. Fish seldom used riffles and runs. During 12-hour night and day monitoring periods, fish remained within the same pools, and their movement between successive locations never exceeded 100m. Overall, blacktail redhorse spent the majority of their time foraging continuously in pools with in-stream cover and a depth greater than 0.5 meters. Blacktail redhorse appear to exhibit high site fidelity and may select pools based on pool depth and in-stream cover.

Abstract Number: 101081

Poster

Influences of site characteristics and water quality on aquatic macrophyte community composition in the Atchafalaya River Basin, Louisiana, USA

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Anthropogenic changes in the hydrology of the Atchafalaya River Basin (ARB) have resulted in changes in the native macrophyte community and increasing densities of more competitive invasive species. In 2005, we collected macrophyte community composition and water quality data from 107 ARB sites, and used cluster analysis to group sites by plants, water quality, and combined data. Cluster analysis based on plant community composition generated 6 poorly separated clusters, whereas analysis based on water quality variables was more parsimonious and representative of sites. Analysis of the combined data was similarly parsimonious to the water quality analysis and resulted in three clusters. Cluster 1 represented intermediate conditions and the typical heterogeneity of macrophyte stands in the ARB. Cluster 2 linked higher values of several water quality values with salvinia and water hyacinth, and may represent species tolerant of higher salinity and flow velocities. Cluster 3 grouped lower salinity and flow values with a dominance of salvinia, which is representative of stagnant areas in the ARB that are often dominated by this small exotic plant. The most meaningful analysis based on the combined plant and water quality data generated clusters that were similar to field observations, and cluster analysis was a particularly useful method for generating a meaningful simplification of this large, complex data set.

Abstract Number: 101085

Poster

Morphological differences between green sunfish from stunted and non-stunted populations

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Despite the ubiquity of the stunting phenomena in fishes, little research effort has been devoted to understanding morphometric implications of stunted morphotype expression. Stunted adult green *Lepomis cyanellus* (N=117) and non-stunted adult green sunfish (N=131) were collected from two ponds in west Texas. Fish images were digitized with *TPSDig* and gender was identified in the laboratory. Sixteen points were used to identify 28 morphometric measurements on each green sunfish. Discriminant function analysis was used to determine morphological differences between sexes (male/female) within and among populations (stunted /non-stunted). The stunted/non-stunted designation explained 83% of variation in the discriminant function, whereas the male/female designation explained 14% of the variation. Additionally, there appeared to be very little sexual dimorphism in stunted green sunfish, whereas considerable dimorphism was observed in non-stunted populations.

Abstract Number: 101107

Poster

Status of black drum (*Pogonias cromis* Linnaeus) in Texas: landings, fishing pressure and abundance by year and embayment

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Black drum have been the dominant finfish for commercial landings within Texas waters for a quarter century. In addition, Texas and Louisiana accounted for 95% of U.S. total commercial black drum landings (2610 metric tons) in 2004. We reviewed Federal & state agency data for commercial landings, recreational landings and fishing pressure, and abundance. Texas commercial landings from 1981 to 2001 averaged 731 thousand kg annually with a high of 1.9 million kg landed in 1996, and increased approximately five-fold for the period from 296 thousand kg to 1.14 million kg in 2001. Black drum commercial landings in the Upper Laguna Madre (ULM) for the twenty-year period 1982 - 2001 peaked at 916 thousand kg in 1996, and were significantly higher than landings for other Texas embayments. Galveston Bay (37,042 ± 5,611 black drum) (mean ± SE) dominated coastwide recreational landings (88,754 ± 7,777), and recreational fishing pressure (1.8 ± 0.061 million man-hours) in Texas from 1975 to 2002 which averaged 4.8 million man-hours annually with a maximum of 6.4 million man-hours in 1999. ULM black drum abundances estimated from fisheries-independent gill net catch rate (2.04 ± 0.28 black drum/hour) differed significantly from other embayments. Coastwide catch rates for black drum from 1976 to 2003 averaged 7.9 fish/hour peaking at 14.3 in 2001. TPWD & NOAA Fisheries data are not indicative of detrimental impact of fishing mortality on black drum populations or life-history attributes. However these attributes and high commercial and recreational value have distinguished black drum among finfish in Texas.

Abstract Number: 101129

Poster

Autumn and Winter Movements of Alligator Gar in Lake Texoma, Oklahoma-Texas

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Alligator gar populations have been steadily declining throughout their range. In Oklahoma they are listed as a Tier II Species of Special Concern due in part to a paucity of recent collections and limited information on the status of populations. One objective of a larger study on the ecology and distribution of alligator gar in Oklahoma is to determine their seasonal distribution, habitat use, and movements. Five brood-stock alligator gar from the Tishomingo National Fish Hatchery in Oklahoma were tagged with ultrasonic transmitters and released into the Washita arm of Lake Texoma on 20 September 2006. Fish were located monthly from September 2006 to January 2007 with a mobile telemetry receiver and stationary receivers that were deployed at three locations in Lake Texoma. They were frequently located near other large gar (longnose and alligator gar) and with other tagged fish. Fish moved 2.9- 63.5 kilometers between tracking sessions, primarily within the Washita arm. However, one fish traveled 63.5 kilometers up the Red River arm of the lake and then returned 9.5 days later. Preliminary home range sizes are 2.25-52.25 square kilometers. These telemetry data will be used to evaluate home range size and selection of resting, feeding and spawning habitats. This information will aid in the management and conservation of alligator gar in Oklahoma.

Abstract Number: 101130

Poster

Life history and population demographics of the fluted kidneyshell (*Ptychobranthus subtentum*) (Bivalvia:Unionidae)

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The fluted kidneyshell *Ptychobranthus subtentum* (Say, 1825) is a candidate for listing under the Endangered Species Act by the US Fish and Wildlife Service. Aspects of the fecundity, fish hosts, and sex ratio were determined during 2005-2006 for the fluted kidneyshell in the upper Clinch River, Hancock County, Tennessee. Females became gravid in mid-August and contained viable glochidia by mid-September. Glochidia were contained in ovisacs that resemble Simuliidae pupae. The number of ovisacs was related to mussel length ($r^2 = 0.94$; $p < 0.01$). The number of glochidia per ovisac increased with ovisac volume ($r^2 = 0.83$; $p < 0.01$). The median time of glochidial metamorphosis was 33 days and did not differ significantly between November and January (median test $p = 0.33$). Ten fish species were induced with glochidia in the laboratory. Two species were identified as marginally suitable hosts: bluebreast darter *Etheostoma camurum* and dusky darter *Percina sciera*. Metamorphosis also occurred on previously identified hosts (rainbow darter *E. caeruleum* and fantail darter *E. flabellare*). The observed ratio of males to females (1:2) differed significantly from 1:1.

Abstract Number: 101145

Poster

Evaluating jumping performance of the Barrens topminnow (*Fundulus julisia*) and western mosquitofish (*Gambusia affinis*)

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Natural and artificial structures present in streams could restrict or prevent upstream migration of fish. These structures are effective barriers to fish lacking the physical ability to navigate the obstruction. Vertical barriers in the form of perched culverts, waterfalls, and dams require fish to jump for passage to occur. Vertical barriers have been important in restricting the dispersal of introduced trout species, and could also serve a similar function with smaller non-game fish. *Gambusia affinis*, the western mosquitofish, is an invasive fish known to be harmful to the Barrens topminnow, *Fundulus julisia*, a species endemic to springhead pools and runs in middle Tennessee. Vertical barriers could be an effective management tool if a barrier height shown to prevent mosquitofish passage but allow topminnow passage could be identified. I measured jumping performance on both species using a living stream setup modified with adjustable jumping weirs. Topminnows were tested at eight waterfall heights (30-110 mm) and mosquitofish were tested at seven waterfall heights (10-70 mm). I observed successful jumps by topminnows up to 70 mm; in contrast, no mosquitofish jump higher than 40 mm. These results imply that the differential jumping ability displayed by the two species could potentially be exploited by managers wanting to screen mosquitofish from invading upstream topminnow habitats.

Abstract Number: 101147

Poster

From backwaters to cypress swamps: Fish communities and environmental gradients in riverine wetlands with varying degrees of connectivity to the Arkansas River

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Large rivers and associated floodplains were historically dynamic, diverse ecosystems, but most have been modified to varying degrees. Lack of data typically hinders conservation/restoration efforts in these regulated systems. We initiated a study of fish communities in riverine wetlands of the Arkansas River to understand current patterns of diversity and environmental gradients. During summer 2005, we sampled fishes with a seine (3.1-mm mesh), mini-fyke nets (3.1-mm mesh), and experimental monofilament gill nets (3.8-8.9-cm mesh) at 31 sites along a 174-km reach of the Arkansas River (Pool 5 – Pool 9). Sites ranged in size from 0.5 – 390 ha and varied in degree of connectivity to the main channel (contiguous, intermittent, and isolated). We collected 62 taxa, and richness ranged from 5-32 species across sites. Samples contained a number of species with few previous records from the Arkansas River system (e.g., *Carpiodes cyprinus*, *Etheostoma fusiforme*, *Lepomis symmetricus*, and *Notropis maculatus*). Nonmetric multidimensional scaling ordination identified structuring of the fish community along a gradient from intermittently connected and isolated floodplain wetlands characterized by high vegetative cover, low dissolved oxygen, and low pH (e.g., *Centrarchus macropterus*, *Elassoma zonatum*, *Amia calva*, and *Aphredoderus sayanus*) to contiguous backwaters having low vegetative cover and relatively high dissolved oxygen and pH (e.g., *Dorosoma petenense*, *Menidia beryllina*, *Carpiodes carpio*, *Lepomis megalotis*, and *Opsopoeodus emiliae*). These data underscore the value of submergent vegetation to wetland fishes and suggest a mosaic of wetlands supporting a diversity of fishes continue to occur along the Arkansas River despite extensive modifications to the system.

Abstract Number: 101155

Poster

Monitoring redbreast sunfish spawning success for determining functional flow regimes in an adaptive management framework.

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In support of monitoring effects of adaptive management below Harris Dam, a peaking hydropower facility on the Tallapoosa River (Alabama), nesting redbreast sunfish *Lepomis auritus* were observed during their spawning season (May-August 2006). Snorkeling and underwater videography were employed to monitor nest success, as defined by production of swim-up fry, and nesting behavior related to flow regimes. Previous research indicated nest success was related to discharge but critical flows and spawning window length determination are important goals of the adaptive management project. Our study consisted of a set of experimental flows (no flow, one-unit, two-unit) implemented below the dam to determine critical flows and potential spawning window lengths. Snorkeling provided data necessary to determine nest success and experimental flows allowed us to determine effects on nest success during peaking events. Using underwater video we determined behavioral responses to stable and rapidly rising water during experimental flows. Stable flows allowed for high rates of nest success; whereas, one-unit generations altered nesting behavior, but did not appear to be sufficient to cause nest abandonment during early developmental stages. However, if swim-up fry were present in nests, a greater chance of abandonment and fry displacement was observed. No experimental two-unit flows were observed because of drought conditions; therefore, we were unable to observe responses to extreme flow conditions in 2006. Our data were valuable for updating probabilities associated with the faunal response model used in the adaptive management process.

Abstract Number: 101158

Poster

Timing is everything: evaluating spawning windows for fishes in the Tallapoosa River Basin.

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Timing of spawning is critical for fishes, especially for species that reside in rivers where flow and habitat are altered by dams. The objectives of this ongoing study are to examine the timing and progression of spawning of fishes in the Tallapoosa River, Alabama, below a hydropeaking facility, Harris Dam. Ultimately, we are attempting to determine if fishes are benefiting from current spawning windows provided in our adaptive management project. If not, we will determine if fishes could benefit from establishment of spawning windows at alternate times during their spawning season. Ovaries of minnows (*Cyprinella venusta* and *Cyprinella callistia*) and darters (*Percina palmaris* and *Etheostoma chuckwachatte*) were examined to determine relations between presence of eggs and hydrology in regulated (n= 111) and unregulated (n= 81) reaches in the Tallapoosa River Basin. Logistic regression was used to estimate the probability of fish having eggs in ripe or ripening stages. Preliminary results indicated that during spring/summer spawning seasons, minnows of the same size in the regulated reach had a lower probability of having eggs versus the unregulated reach. In addition, the probability of darters in the unregulated reach having eggs declined as average daily flow increased. These results suggest that environmental and/or bioenergetic factors may be affecting timing of spawning in the regulated reach, and that suitable spawning habitat may be limited by altered flows. This research will advance our understanding of how provision of ecologically functional flows may enhance reproductive success of fishes.

Abstract Number: 101161

Poster

Community effects of large-scale changes in plant composition: implications of a whole-lake herbicide treatment

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Since macrophyte density and species composition are important for community structure, it is natural to expect that changes in plant community may lead to cascading effects on invertebrates and fish. In ecosystems with a long history of invasion or a large-scale invasion that significantly changed or even eliminated native community, radical removal of exotic species may lead to unpredictable secondary effects. This study was designed to evaluate the long-term effects of whole-lake herbicide eradication of invasive Eurasian watermilfoil on fish and macroinvertebrate community. We present data on fish species composition and population dynamics after this large-scale vegetation removal. We also tested whether changes in structural heterogeneity due to the shift in plant community affected macroinvertebrate abundance and richness. Implications for invasive plant management in lakes are discussed.

Abstract Number: 101162

Poster

Native Aquatic Plant Introductions in a Fluctuating Oklahoma Reservoir

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The Oklahoma Water Resources Board received a grant from the U.S. EPA to attempt to establish native aquatic plants in Lake Stanley Draper in Oklahoma City. The goal of the project was to create founder colonies of emergent aquatic plants to help stabilize shorelines and reduce erosion-caused turbidity. The Oklahoma Department of Wildlife Conservation cooperated in the production and planting of the propagules with the goal of improving fishery habitat, and specifically, shoreline nursery cover. A record drought in 2006 resulted in low survival of some species but others have become established and are expected to recover when water levels return to normal pool.

Abstract Number: 101172

Poster

Using on-site angler surveys and a Geographic Information System for more effective marketing of an urban fishing program

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Texas Parks and Wildlife Department (TPWD) has implemented an urban fishing program with a goal of introducing angling to Texans who live in urban areas, especially members of demographic groups who are less likely to participate in angling. One challenge of the program is to find marketing methods that will effectively and cost-efficiently identify target demographics, and then recruit these target groups to the program. In the winter of 2005-2006, TPWD began year-round biweekly stockings of adult fish (rainbow trout in winter, channel catfish otherwise) in 8 lakes in major metropolitan areas throughout the state. On-site angler surveys were conducted on the stocking day and on the 2nd and 4th days following stocking to gain information about the number of different people fishing at the lakes, the degree to which they had previously participated in fishing, and their zip code of residence. A total of 1356 interviews were conducted on 29 days throughout the winter. We used a Geographic Information System (GIS) supported by ESRI's ArcView software, including ESRI's Business Analyst (BA) extension, to geocode each interviewee's zip code of residence. This allowed us to examine geographic distribution patterns of anglers and the distance anglers were willing to travel to the lakes. The software's databases of census and marketing survey data allowed us to learn about the demographics of people residing in the areas surrounding the lakes, as well as in the interviewees' zip codes. This information helped us evaluate our success in targeting the desired groups, and develop marketing strategies that would help us more effectively reach the desired groups. We found that the tools provided by a GIS incorporated with angler address information offers a way to obtain insight on sensitive demographic information (e.g., race and economic status) and provides essential background information that will help us more effectively and efficiently direct our marketing efforts.

Abstract Number: 101176

Poster

Preliminary assessment of the life history characteristics of bowfin (*Amia calva*) in Buffalo Swamp, Carrollton GA.

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Bowfin, *Amia calva*, is the last surviving member of the Amiidae. As an apex predator in the swamps of the Southeast they are an important factor influencing the fish community structure in Buffalo Swamp, Carroll County Ga. Although they support a local recreational fishery little is known about the life history of the species. An understanding of their life history characteristics such as population size and habitat utilization, age, growth, fecundity, and mortality are important population model parameters for the management of the species. Bowfin were collected biweekly from February – November 2006 using hoop-nets, fish traps, dip-nets, electrofishing and trot lines in Buffalo Swamp. Individuals were weighed, measured and sex determined, tagged and released. Preliminary data will be presented on growth rates, sexual dimorphism and habitat usage.

Nekton habitat use and responses to wetland restoration in the Mississippi River delta,

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Construction of levees along the Mississippi River has greatly reduced delivery of sediments to deltaic marshes, thereby increasing subsidence and loss of coastal wetlands. Resource managers often cut artificial crevasses in levees to restore flow, accumulation of sediments, and colonization of marsh vegetation. We evaluated patterns of habitat use and the responses of nekton to restoration of this deltaic ecosystem. A combination of 1-m² throw traps and minnow traps were used to collect fishes every other month from adjacent plots of emergent marsh (primarily *Sagittaria*) and submerged aquatic vegetation (e.g., *Myriophyllum*, *Potamogeton*) at 11 crevasse wetlands throughout the Mississippi River delta. These wetlands ranged from relatively young created wetlands to mature natural wetlands. In addition to sampling marsh and submerged aquatic vegetation, we also collected nekton from beds of invasive *Phragmites* that dominate much of this deltaic landscape. Topminnows, livebearers, gobies, and sleepers were numerically dominant fishes, whereas caridean shrimp and zygopteran larvae were numerically dominant invertebrates. Abundance and community composition varied considerably during the study period. Nekton abundance was highest in the late summer and early fall and then declined considerably as above ground vegetation senesced through the winter and spring. *Phragmites* provided an extensive over-wintering habitat. Salinity varied during the sampling period, which resulted in shifts in the relative abundance of freshwater and estuarine species. There were few differences in the abundance and composition of nekton communities in young and old crevasse wetlands, indicating that restoration of marsh habitat in the delta is succeeding from a fisheries perspective.