



Southeastern Fishes Council Annual Meeting Abstracts November 13 & 14, 2008 Chattanooga, Tennessee

Abstracts are listed alphabetically by presenter in three different sections: Desperate Dozen Symposium, Contributed Oral Presentations, and Posters.

Desperate Dozen Symposium

SFC Desperate Dozen: Pearl Darter (*Percina aurora*)

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The Pearl Darter, a Candidate for federal protection since 1999, is historically known only from the Pearl and Pascagoula River drainages in south-central and southeastern Mississippi and extreme eastern Louisiana. The species has not been taken in the Pearl River since 1973, and its extirpated has resulted from channel instability and blocked migration routes due to reservoir construction. It survives in the Pascagoula River system, but persists only in low numbers in less than 50% of its former range. The Pearl Darter depends on mainstem portions of large major tributaries and is sensitive to environmental disturbances common in these habitats, including geomorphic instability and poor water quality. Increased urban and commercial development within the Pascagoula River watershed has resulted in increased runoff and sedimentation along with increased withdrawal and discharge demands. Coordinated efforts among local, state and federal conservation agencies and water boards through a watershed management plan must be implemented to maintain natural flow regime and high water quality in the Pascagoula River system. Listing of the Pearl Darter as federally endangered with critical habitat will provide additional tools to bring about these crucial improvements to the Pascagoula River system.

Desperate Dozen Symposium

SFC Desperate Dozen: Conasauga Logperch (*Percina jenkinsi*)

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The Conasauga Logperch, a long, tiger-striped darter, was first collected in 1969 and listed as federally Endangered shortly after its description in 1985. While never known to be more widely distributed than a single population in the mainstem Conasauga River (Mobile Basin) in northwestern Georgia and southeastern Tennessee, its observed numbers have consistently declined over the past 20 years, and some localities are no longer occupied by the species. Similar declines in other fishes, invertebrates, and aquatic vegetation have also been documented. This is likely due to recent changes in agricultural practices, leading to increased sedimentation, nutrient enrichment, and pesticide runoff. Successful conservation of the Conasauga Logperch requires further coordination with governmental officials, public utilities, and landowners for stream bank restoration and installing riparian buffers. Education on best land use practices in the watershed can be enlarged with the help of many regional partners. Finally, captive propagation is necessary to develop ark populations and potentially augment the wild population. Preliminary research into the genetic structure of the species suggests the effect of balancing selection, a form of natural selection which acts to maintain genetic diversity in small populations. Preventing the extinction of this species requires immediate action to improve the overall health of the Conasauga River, simultaneously benefitting ten other federally listed species.

Desperate Dozen Symposium

SFC Desperate Dozen: Pygmy Sculpin (*Cottus paulus*)

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Cottus paulus, as the common name suggests, is the smallest sculpin species, rarely exceeding 40 mm in length. The species is restricted to Coldwater Spring and the associated spring run (Coosa River drainage) in Calhoun County, Alabama. Due to this highly restricted distribution, the species has been considered imperiled since its description, and it was listed as a federally threatened species in 1989. Like any organism restricted to just a single population, the pygmy sculpin is at risk from stochastic events. Additional threats come from pollutants from the nearby military base, which is drained by Dry Creek, a tributary to the Coldwater Spring run. The spring ground water may also suffer from seepage of contaminants. Fortunately, since water from Coldwater Spring is used by the city of Anniston, Alabama for human consumption, the water quality of the spring is closely monitored. A plan for cleaning up potential contaminants needs to be realized, however. An ecological threat may be posed by competition or predation with banded sculpin (*Cottus carolinae*), a larger species found in the spring run, and it may be critical to prevent this species from entering the spring pool. A current investigation of the habitat use and food habitats of banded sculpin in the spring run is underway, and the downstream distribution of pygmy sculpin in the spring run is also being determined. At the present time, movement of pygmy sculpin into Dry Creek seems limited by a beaver dam which impounds the stream near its confluence with the spring run. As opportunities for expansion of the range of this species seem limited, it is critical to continue to protect Coldwater Spring for the persistence of this species.

Desperate Dozen Symposium

SFC Desperate Dozen: Alabama Cavefish (*Speoplatyrhinus poulsoni*)

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The federally endangered Alabama Cavefish is restricted to Key Cave within the Tennessee River drainage in northwestern Alabama, with a total population of perhaps less than 100 individuals. This species is highly vulnerable to extinction due to its extremely small range and subterranean specialization. Although the Key Cave National Wildlife Refuge has been established in the high recharge area of Key Cave, its aquifer and is still threatened by urban and industrial growth and agricultural practices in the remaining recharge area which can lead to lowering of water table, diminished winter flows (cues to synchronize spawning), and acute and chronic water pollution. Disruption of the Gray Bats (*Myotis grisescens*) colony could interrupt critical nutrients entering the Key Cave ecosystem. The most important conservation action is to protect Key Cave aquifer by more precisely delineating the recharge area and by establishing a management plan that addresses land use within the recharge area to prevent habitat degradation in Key Cave. Additional conservation actions include developing protocols for ongoing monitoring within Key Cave of Alabama Cavefish and Gray Bats populations and water quality and quantity, gathering additional life history information for Alabama Cavefish, and examining caves in the vicinity of Key Cave for additional populations.

Desperate Dozen Symposium

SFC Desperate Dozen: Vermilion Darter (*Etheostoma chermocki*)

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The federally endangered Vermilion Darter is restricted to 12 km of Turkey Creek and two of its tributaries in the Locust Fork system of the Black Warrior River drainage in north-central Alabama. Population estimates from the late 1990s are low, from 1,667 to 2,919 individuals. Still variably common at scattered locations, however several populations have shown significant decline. The Vermilion Darter is vulnerable to extinction due to its extremely small range, fragmented populations, and benthic specialization. Threats include increasing and often poorly regulated urban development leading to heavy sedimentation, eutrophication, streambed modifications, flashy runoff, and fluctuating flows. Previous conservation actions include status surveys, examination of population genetics, a life history study, and propagation techniques using *Etheostoma bellator* (Warrior Darter) as a surrogate. The most important conservation action for the Vermilion Darter is to bring together all public and private stakeholders to develop and implement a watershed management plan designed to encourage BMPs to reduce sedimentation, nonpoint source pollution, and stormwater runoff, improve water quality, and enhance riparian zones. Other important actions include developing protocols for ongoing monitoring of populations, water quality, and flows, and obtain additional life history and habitat data.

Desperate Dozen Symposium

SFC Desperate Dozen: Chucky Madtom (*Noturus crypticus*)

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The Chucky Madtom, *Noturus crypticus*, is a small, recently described catfish from the upper Tennessee River drainage. The species is historically known from Dunn Creek in the Little Pigeon River drainage and Little Chucky Creek in the Nolichucky River drainage. Despite several intensive survey efforts, the species has not been seen in Dunn Creek since 1940, and only 14 specimens are known from Little Chucky Creek since 1991. Threats to the species include small population size within an extremely restricted range, agricultural runoff, and a lack of basic knowledge. *Noturus crypticus* is considered a level 2 candidate species at the federal level and is considered endangered by the state of Tennessee. It is imperative that existing candidate conservation agreements be monitored and fulfilled, and other entered into in the Little Chucky Creek watershed. We propose that there be continued intensive surveys throughout the French Broad River drainage and that surrogate species be used to develop a captive breeding program that can be quickly implemented upon capture of additional specimens.

Desperate Dozen Symposium

SFC Desperate Dozen: Alabama Sturgeon (*Scaphirhynchus suttkusi*)

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One of the rarest vertebrates globally, the Alabama sturgeon is also the smallest of eight North American sturgeon species. The Alabama sturgeon was classified as endangered in 2000, is considered Highest Conservation Concern in Alabama and has a G1 global conservation ranking. The range of the Alabama sturgeon encompassed 1600 km of large rivers in the Mobile River Basin. Currently, it occupies only 524 km of its historical range. Unrestricted commercial harvest likely triggered the initial decline of the Alabama sturgeon in the late 1890's, followed by large-scale habitat alteration (i.e., navigation lock and dam construction, dredging, channel modification), which proved detrimental to the Alabama sturgeon. Since 1985 only 13 specimens have been collected and only 2 in the last 9 years. The last specimen was captured on April 3, 2007, below Claiborne Lock and Dam. The fish was determined to be a mature, reproductively-inactive male and the second largest ever captured. The fish was implanted with a 48-month sonic tag and returned to the capture site on April 17, 2007. Tracking this fish will provide unprecedented insight into habitat, movements, and new sampling sites where additional Alabama sturgeon may be collected for propagation and restoration.

Desperate Dozen Symposium

SFC Desperate Dozen: Spring Pygmy Sunfish (*Elassoma alabamae*)

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The Spring Pygmy Sunfish ranks among the most geographically restricted vertebrates in North America. Since 1937, two of the three known populations have been extirpated, each within five years of their discovery. The remaining native population occupies a 5-mile stretch of Beaverdam Creek, a small tributary to the middle Tennessee River. In 1981, *Elassoma alabamae* was proposed for federal protection, but the motion was suspended due to conflicting reports of the species' rarity. Five years later the species was successfully reintroduced to a nearby spring pool, but today this population is of marginal viability. Since 2005, chronic regional drought has reduced rates of surface water flow and aquifer recharge, and drastically increased rates of groundwater withdraw for irrigation. These compounding factors have resulted in reduction of standing water levels in spring pools, which has desiccated shoreline vegetation and eliminated critical habitat for the Spring Pygmy Sunfish. In 2007, excessive groundwater withdraw lead to extirpation or extreme population reduction in four spring pools. Additionally, the Beaverdam Creek watershed is under immediate threat of rapid industrial and suburban development. Any additional development within the area further threatens the population through contamination, groundwater withdraw, disruption of aquifer recharge, impervious surface runoff, and sedimentation.

Desperate Dozen Symposium

SFC Desperate Dozen: Slender Chub (*Erimystax cahni*)

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Since 2000, Conservation Fisheries (CFI) has conducted surveys in the Clinch and Powell rivers of Tennessee and Virginia to determine the status and range of the slender chub, *Erimystax cahni*. Over 800 person-hours of effort have been expended by CFI and cooperators trying to collect specimens. No slender chubs have been found. A single specimen collected from the Clinch River (Grissom Island) in 2002 by CFI was originally identified as a slender chub, but has since been reevaluated and determined to be an aberrant streamline chub, *E. dissimilis*. Other entities have also made numerous collection efforts in the Clinch and Powell Rivers over the years. Only one specimen has been collected in more than 20 years of searching! Factors that may have contributed to the decline of this minnow including: severe chronic and acute water pollution from factories, sewage, and coal mines, excessive sedimentation from agricultural runoff, and gravel removal. If specimens can be obtained, there are plans in place for captive propagation. CFI has successfully propagated *E. dissimilis* and *E. insignis* as surrogates for *E. cahni*, which we assume to have at least similar reproductive strategies.

Desperate Dozen Symposium

SFC Desperate Dozen: Bayou Darter (*Etheostoma rubrum*)

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The bayou darter (*Etheostoma rubrum*), one of the smallest members of the subgenus *Nothonotus*, is endemic to the Bayou Pierre system of southwestern Mississippi. Described in 1966, the bayou darter was listed as “threatened” by the USFWS in 1975 and later designated as “endangered” by the state of Mississippi. The bayou darter is a well studied species with a wealth of information known regarding its distribution, associated habitat, reproduction, diet, larval ecology and conservation genetics. However despite this valuable insight, the darter is considered imperiled due to the potential impact of accelerated erosion in the form of headcutting occurring within the Bayou Pierre system. The species occurs along a 50 km mainstem reach of Bayou Pierre and lower sections of major tributaries with greatest densities occurring in the zone of active headcutting. The bayou darter has moved upstream following the zone of active erosion in response to the development of upstream riffle habitat. The rate of knickpoint movement has varied from 48-750 m/year (1940-1994). While headcutting results in the creation of upstream riffle habitat, it also promotes sedimentation of suitable downstream habitat. The Bayou darter continues to persist downstream of the active headcut but in low numbers.

Desperate Dozen Symposium

SFC Desperate Dozen: Relict Darter (*Etheostoma chienese*)

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The Relict Darter, *Etheostoma chienese*, described in 1992 and federally listed as Endangered in 1993, is endemic to the Bayou du Chien drainage in extreme southwestern Kentucky. Population size has been estimated between 9,533 and 31,293 individuals occupying 47 linear km (29.3 mi.) of stream habitat. This species is restricted to the upper half of the Bayou du Chien drainage, where it is currently known from 16 sites in five streams. The combination of having a small native range and population fragmentation resulting from continued habitat deterioration puts the Relict Darter at high risk of extinction. Proposed conservation actions include: 1) increased efforts to protect and restore habitat in the Bayou du Chien watershed, 2) new surveys to determine current distribution and abundance, 3) genetic structure, 4) juvenile habitat preference and movements, and 5) additional use of artificial spawning substrates (e.g., ceramic tiles) to enhance reproduction.

Desperate Dozen Symposium

SFC Desperate Dozen: Diamond Darter (*Crystallaria cincotta*)

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The diamond darter *Crystallaria cincotta* was described in January 2008 as a new species from the Cumberland, Elk, Green, and Muskingum river drainages of the Ohio River basin. *Crystallaria cincotta* is extirpated from most of its former range within the Ohio River drainage, but is extant and rare in the Elk River, West Virginia. The scarcity of *C. cincotta* in the lower 36 km section of Elk River is supported by a total of 16 individuals from extensive sampling efforts from 1980 to 2008. Little is known about habitat use or basic life history of this species. Most collections of *C. cincotta* have occurred in moderate flows over a sand, gravel, and cobble mix of benthic substrate. This species commonly burrows in sand based on recent aquarium observations. Habitat loss and availability related to substrate embeddedness and landuse practices are conservation concerns for *Crystallaria cincotta* in the Elk River drainage. In addition to a habitat emphasis, further conservation actions include assisting USFWS with a species status assessment, as well as further monitoring of the Elk River population. Additional actions include the development of a captive breeding program, sustainment of a captive population, and drafting a plan for a reintroduction program. Also, studies of reproductive biology and early life history as additional components of the captive breeding program will contribute toward conservation and management of this species.

Oral Presentation

Crayfish faunal regions and conservation planning in Mississippi

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About 63 described crayfish species belonging to six genera live in Mississippi, along with several undescribed species. We compiled a spatially explicit database of species distributions from five data sources and used a GIS to link collection records to hydrologic units and ecoregions. Using multivariate analyses, we delineated crayfish faunal groups and explored relationships between faunal group distributions and hydrologic and geographic distances and ecoregions. Faunal group distributions did not correlate with drainage patterns to the degree typically seen for southern fishes. We will touch on potential hotspots for crayfish conservation in the state and how these relate to priority conservation areas identified by The Nature Conservancy for fishes and mussels.

Oral Presentation

Morphological Phylogeny of Cavefishes

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The standard view of cavefish phylogeny has been an almost anagenic, progressive adaptation towards cavelife. This is easy to see as the Swampfish (*Chologaster cornuta*) is fully pigmented and epigeal, the Spring Cavefish (*Forbesichthys agassizzi*) is slightly depigmented and trogliphilic, and amongst the troglobites the Southern Cavefish (*Typhlichthys subterraneus*) retains some response to light, the Ozark Cavefish (*Amblyopsis roseae*) and Northern Cavefish (*A. spelaea*) are intermediate in cave attributes, and the Alabama Cavefish (*Speoplatyrhinus poulsoni*) is considered the most cave adapted. Despite the importance of these animals in the study of cave adaptation, no one has published a phylogenetic analysis of all of the species, and no one has examined the relationships using morphology. To test whether or not cavefish have a phylogeny that suggests a progressive reductionism of characters normally lost with cave adaptation and an expansionism of characters that would putatively help in cave adaptation (increased life span, age of maturity, and offspring size), morphological characters that seem unrelated to cave adaptation were coded, and the phylogenetic relationships of the cavefishes were explored. The dataset found the full cave adapted species (*Typhlichthys*, *Amblyopsis*, and *Speoplatyrhinus*) forming a well-supported monophyletic group sister to the clade with the two species that can be found in surface waters (*Chologaster* and *Forbesichthys*). The addition of three cave characters (loss of pigment and eyes, and the increase in size of neuromasts) did not alter the relationships, although they did alter support values. No evidence was found for the monophyly of *Amblyopsis*, and it is recommended that *Troglichthys* be resurrected for *A. roseae*.

Oral Presentation

Wrong place at the wrong time: illegal take of endangered pallid sturgeon in a commercial caviar fishery

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Commercial fishing in the Mississippi River has been listed as a threat to the recovery of endangered pallid sturgeon *Scaphirhynchus albus*. We quantified the bycatch of pallid sturgeon in Tennessee's shovelnose sturgeon (*S. platyrhynchus*) caviar fishery by accompanying fishers and monitoring their catch in April-May 2007. Fishers removed 327 live sturgeon from their gear in our presence, of which 93 were harvested; we also obtained the carcasses of 20 sturgeon harvested out of our sight. Two of 113 harvested sturgeon were confirmed pallid sturgeon based on microsatellite DNA analyses. Additionally, fishers gave us five, live pallid sturgeon that they caught. If the take of pallid sturgeon (1.8% of all sturgeon harvested) was similar in the preceding two commercial seasons, at least 169 adult pallid sturgeon were harvested by commercial fishers in the Tennessee waters of the Mississippi River in 2005 and 2006. We also observed the recovery of a ghost net from which 53 dead or moribund sturgeon were removed; one of those fish was a confirmed pallid sturgeon. Three other states along the middle Mississippi River are currently preparing to assess the illegal take of pallid sturgeon in their shovelnose sturgeon caviar fisheries.

Oral presentation

Conservation planning for eight fish species on the Cumberland Plateau

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The Cumberland Plateau is home to rich natural resources and resource uses including forestry, agriculture, coal mining, oil and gas production, and water impoundment are prevalent. A Habitat Conservation Plan (HCP) is required to apply for an Incidental Take Permit under Section 10 of the U.S. Endangered Species Act. Permit applicants may elect to cover multiple listed and nonlisted species and any number of landuse activities that could cause incidental take of the covered species. A HCP provides scientists and managers the opportunity to work with landowners and private interests to develop innovative means to both use and conserve an area's natural resources. We are currently developing two HCPs, one dealing with growth and development and the other with forestry activities for the Cumberland Plateau in northern Tennessee. Here, we present a suite of eight rare fishes including Spottfin Chub (*Erimonax monachus*), Emerald Darter (*Etheostoma baileyi*), Ashy Darter (*E. cinereum*), Arrow Darter (*E. sagitta*), Tangerine Darter (*Percina aurantiaca*), Olive Darter (*P. squamata*), Sickie Darter (*P. williamsi*), and Tennessee Dace (*Phoxinus tennesseensis*). We use teams of scientific experts to help corroborate our conservation planning. Here, we describe the role of these experts in the conservation planning effort.

Oral Presentation

Genetic and morphological variation in *Notropis chlorocephalus* (Greenhead Shiner); evidence for unrecognized diversity

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Notropis chlorocephalus (Greenhead Shiner) is a member of the *Notropis* subgenus *Hydrophlox* and has been recognized as a single species, sister to the Yellowfin Shiner (*N. lutipinnis*). Field observations revealed striking nuptial color differences between populations not previously mentioned in the literature. Variation in mtDNA (ND2) and nuclear ITS1 sequences reveal some evidence for genetic isolation. Maximum likelihood phylogenetic approaches and haplotype networks are used to explore the relationships between the two color morphs. Additionally, morphological correlates of genetic variation are being investigated.

Oral Presentation

Patterns of co-existence and hybridization among two topminnows (*Fundulus euryzonus* and *F. olivaceus*) in a riverine contact zone.

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We ask if the relative proportions of ecologically similar species in a contact zone are correlated with predictable abiotic or biotic factors. If so, do measures of fitness correlate with these gradients in predictable ways? If hybridization occurs, are hybrids ecological or morphological intermediates? Two killifish (*Fundulus olivaceus* and *F. euryzonus*) were studied in a contact zone in the West Fork of the Amite River of the Pontchartrain. These two species are thought to be ecologically very similar, though their ranges differ markedly in size. We sampled the full fish assemblage and measured a suite of environmental characteristics at ten sites. Killifish were genotyped to identify individuals of hybrid ancestry. We compared the abundance and distribution of parental species in the context of overall fish assemblage structure and environmental variables. Hybridization was generally rare with only nine of 244 genotyped killifish exhibiting evidence of hybrid ancestry. The relative abundance of the two killifish was related to site assemblage structure, species diversity and number of environmental variables. Both species were in better condition and females were more fecund at sites with greater abundance of *F. olivaceus*. Hybrid individuals were not morphological or ecological intermediates.

Oral Presentation: student competition

The distribution and status of *Hybopsis amnis*: an analysis of patch occupancy from historical records

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A total of 1094 *Hybopsis amnis* (pallid shiner) records, dating from 1891 to 2006, were compiled from data provided by 36 museums, universities, and government institutions. Records were grouped into 25 population 'patches' coinciding with the drainages of the Mississippi River basin and western Gulf Coast tributaries within the known distributional range. From 1940 to 2006 successive three-year intervals were delineated to determine the presence or absence of the species within a patch. Based on the presence/absence data, a frequency ratio of species occurrence for each patch was calculated. The frequency ratios for pre-1979 and post-1979 were compared to elucidate recent trends in *H. amnis* occurrence. Eight of twelve pre-1979 patches with a frequency ratio less than 0.21 had a ratio of zero post-1979. Further evaluation of the frequency ratios revealed five patches to be stable, eight patches potentially imperiled, and twelve patches imperiled. Overall, there has been a decline in the presence of *H. amnis* in its historical range. A watershed analysis for each patch is in progress to determine possible reasons for the decline of this poorly known species.

Oral Presentation

Phylogenetic Systematics, Life History, and Biogeography of the Crayfish Genus *Cambarus* (Decapoda: Cambaridae)

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Crayfishes are a significant component of biodiversity in freshwater ecosystems. Nearly 70% of all recognized crayfishes are described from North America, and 86% of these are recognized from three genera. One genus, *Cambarus*, is widely distributed across eastern North America and currently contains 98 species, or 16% of the worldwide fauna. The purpose of this study was to construct the first phylogenetic hypothesis for genus *Cambarus*, to investigate species-level relationships, as well as test taxonomic hypotheses of subgeneric monophyly, historical hypotheses for geologic changes to river drainages from the region, and how life history may have impacted the evolution of genus *Cambarus*. Results indicate that *Cambarus* as currently constructed is not monophyletic, subgeneric monophyly based on morphological characteristics of the chelae is predictive of some relationships, but it is not explicitly supported in all cases. Instead, a distinct biogeographic component for phylogenetic relatedness is recovered for much of the diversity of *Cambarus*. Additionally, ancestral character state reconstructions indicate that the ancestor for the entire clade inhabited subterranean burrows. From this burrowing habitat, ancestral members of the genus repeatedly colonized open-water riverine ecosystems and subterranean cave environments while continuing to take advantage of the ancestral burrowing condition.

Oral Presentation – Student Competition

The Effects of Rainbow Trout on Native Fishes in a Southern Appalachian Stream

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Rainbow trout are widely stocked worldwide, yet there is little information on their effects on native fishes. We are using a BACI protocol to test the effects of stocking trout on biodiversity (richness and abundance) and microhabitat use of nongame fish in Betty's Creek, Georgia. The pretreatment sampling period occurred from fall 2003 – summer 2005. Between fall 2005 and spring 2008 (Impact), we introduced trout in spring and fall in one or both treatment sites. Flow variation during the study was high including both floods and droughts. Species richness and abundance varied both within (seasonally) and among sites. Species diversity was negatively correlated with seasonal and yearly flow. The primary habitat gradient tracked flow and substratum composition and a minor secondary gradient tracked the presence of coarse substratum and depth. Most species were over-represented in deep microhabitats dominated by coarse substrata. Species belonged to water column or benthic guilds, with a lower water-column guild occasionally present. Trout introductions (N=9) did not elicit strong shifts in species richness but microhabitat shifts were observed in several species. The potential impact of trout on habitat use of nongame species should be considered when trout are stocked in streams containing species of concern.

Oral Presentation (Student competition)

Phylogeography and conservation genetics of the federally threatened Slackwater Darter, *Etheostoma boschungii*

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The federally threatened Slackwater Darter has a disjunct distribution throughout four independent tributaries to the south bend of the Tennessee River, including Shoal, Cypress, and Swan creeks and the Flint River, and headwater streams of the Buffalo River system in the Duck River drainage. *Etheostoma boschungii* has precipitously declined in abundance throughout its range and there is reduced connectivity among breeding (spring seeps) and non-breeding (stream) habitats due to stream channel incision and road culvert construction. A captive breeding program has been initiated to maintain “Ark” populations, yet nothing is known about the genetic composition of this species throughout its range. Phylogenetic relationships within *E. boschungii* based on nuclear S7 and mitochondrial ND2 DNA sequence data revealed two highly divergent clades to the east (Flint River and Swan Creek) and west (Cypress and Shoal creeks and Buffalo River) of the Elk River. Mitochondrial DNA sequence data revealed substantial genetic structure within the eastern and western clades. These results will serve as a baseline to guide the ongoing propagation program and as a framework in which to investigate microsatellite based estimates of migration, gene flow, and population size.

Oral Presentation

The fish community of the Pearl River: A historical test of community persistence and stability

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The Pearl River is a diverse Gulf Coastal drainage located in Mississippi and Louisiana, which harbors approximately 119 species of freshwater fishes. Multiple environmental perturbations have occurred throughout the basin including river impoundments, stream channelization, and poor land-use practices. Historically, quarterly surveys were conducted by Royal Suttkus in the Pearl River at selected historically sampled sites from Monticello, Mississippi (Upper Pearl River survey: 8 sites) southward to Bogalusa, Louisiana (Lower Pearl River survey: 8 sites) from the 1950's through 2005. Since 2006, we have continued gathering data from these historic sites using the same methodologies employed during the historical surveys. This combination of these data sets allows for a thorough examination of fish community changes in the Pearl River. Therefore, the objective of this study was to assess persistence and community stability of fish assemblages of the Pearl River over the past 20 years (1988-2008) using historical and contemporary fish community data. This data was analyzed using univariate and multivariate statistical analyses and the implications of these results and future directions of this study will be discussed.

Oral Presentation

**Using occupancy to estimate population status of the Conasauga logperch
Percina jenkinsi.**

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Estimating population status for infrequently seen (or seined) species poses a challenge – is a species rarely observed because of low abundance, low probability of detection, or both? The Conasauga logperch has never been caught in large numbers, has a restricted range, and is considered critically imperiled. To contribute information on the status of the Conasauga logperch, we are exploring the application of an occupancy model to repeat survey data across the species' historic range. We are either searching with multiple snorkelers, or sampling with replicated seine-sets, the locales (n = 20) where the logperch has been observed historically. We have observed the Conasauga logperch at four out of 10 locales sampled to date. We detected the logperch at three out of four sites where water clarity permitted snorkel searches, but detections were limited to one in three (two sites) or one in six person-hours of searching. At the single site where we seined a Conasauga logperch, one individual was caught in 110 seine-sets. Surveys will be completed in October 2008 and data used to model detection probabilities for each sampling method and the proportion of historically-occupied sites that are currently occupied.

Oral Presentation (Student Competition)

Phylogeographic analysis of the Barrens Darter, *Etheostoma forbesi*.

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The Barrens Darter, *Etheostoma forbesi* (Percidae: Etheostominae), is a rare, endemic species of the Barren Fork and Collins River in the Caney Fork River system. Previous analyses and distributional records indicate that it is distributed in a small number of Caney Fork tributaries and co-occurs with another *Catnotus* spottail darter, *E. crossopterum*; and that specimens from adjacent tributaries of the upper Duck River system are morphologically intermediate between *E. forbesi* and *E. nigripinne* and may represent hybrids between these two species. I use phylogenetic analyses of nuclear and mitochondrial gene sequences to assess the occurrence of possible hybrids between *E. forbesi* and *E. crossopterum*, and the relationships of upper Duck and Caney Fork populations. I will also present an analysis of genetic variation of *E. forbesi*. Preliminary results indicate that *E. forbesi* is restricted to the Caney Fork system, it does not hybridize with sympatric *E. crossopterum*, and *E. forbesi* likely experienced a recent population bottleneck that has resulted in an extremely low genetic diversity at the sampled nuclear and mitochondrial genes.

Oral Presentation

Phylogeography of *Percina nigrofasciata* (Percidae)

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The family Percidae includes over 180 species, predominantly composed of darters. Only recently have the relationships within *Percina*, the second largest genus of darters, been explored. One of the largest geographic ranges of the genus belongs to *Percina nigrofasciata*, which is widely distributed on the Gulf Coastal Plain. In 1956, a morphological study by Crawford identified two subspecies within *P. nigrofasciata*: *P. nigrofasciata nigrofasciata*, *P. nigrofasciata raneyi*, and a zone of intergradation. The existence of multiple morphologically distinctive forms (2 subspecies and a zone of intergradation) within *P. nigrofasciata* provides an excellent opportunity to examine the phylogeographic relationships within this taxon. We investigated genetic variation within *P. nigrofasciata* using the cytochrome *b* gene in order to test Crawford's morphologically based taxonomic designations. In addition, we combined our data with sequences of *Percina* from GenBank to examine the phylogenetic placement of these clades within a larger context. *Percina nigrofasciata* was not recovered as monophyletic under maximum parsimony and Bayesian analyses, and three clades of blackbanded darters recovered in our study generally correspond to the previously identified morphological groupings. The results and taxonomic implications of this work will be discussed.

Oral Presentation

Habitat use by larval and juvenile Cape Fear shiners (*Notropis mekistocholes*)

Andrew R. Henderson, Carol E. Johnston

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The factors responsible for imperilment of freshwater fishes can usually be categorized as some form of habitat loss or alteration. Understanding effects of various forms of habitat alteration on fishes is difficult, since basic knowledge of habitat requirements is usually lacking for non-game fishes. Cape Fear shiners are federally endangered and restricted to five localities in the Cape Fear River drainage, North Carolina. Our objectives were to document habitat use of larval and juvenile Cape Fear shiners (*Notropis mekistocholes*), in both natural and lab settings so habitat requirements in all life stages can be documented for conservation purposes. We measured habitat parameters of areas used by Cape Fear shiners in the summers of 2007-2008 in the Rocky River, NC. Field data suggests larvae (1-15 mm TL) use more shallow depths and reduced water velocities than adults. Juveniles 15-25 mm TL often school with adults. Experimental tanks were used to separate habitat variables in a lab setting. In larval and multiple juvenile size classes, Cape Fear shiners preferentially chose flow and depth microhabitats. In the laboratory larvae preferred moderate current velocities and shallow depths. Juveniles preferred moderate-swift current velocities and deep depths. These findings were consistent with field measurements and observations.

Oral Presentation

The effect of spatial position within stream networks on population persistence of Tennessee Dace (*Phoxinus tennesseensis*)

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Headwater streams are subject to periodic drying, and this seasonal process may be accentuated by drought. Fishes living in these small streams must move downstream to refugia or suffer mortality as streams dry up. If refugia are lacking, recolonization of re-wetted habitat may be hampered. Streams that are part of large networks may provide more appropriate refuges for dace than direct tributaries to large rivers. Tennessee Dace (*Phoxinus tennesseensis*) are headwater specialists restricted to portions of the Tennessee River drainage in Virginia southwestward through the Emory and Clinch rivers systems and south to the Hiwassee River System. Recent drought conditions caused local extirpation of several populations of Tennessee Dace. Our goal was to compare characteristics of streams where dace persisted post-drought to those where dace were extirpated immediately following drought. In particular, we are interested in spatial position within the watershed and dace persistence. We found significant differences in sites that contained and did not contain Tennessee Dace in elevation (p-value 0.0156), percent shading (p-value <0.0001), water depth (p-value <0.0001), and water flow (p-value <0.0001). Further investigation of land cover types and spatial analysis within delineated watersheds from the collection sites will be performed on using ArcGIS 9.1.

Oral Presentation

Temporal patterns of diversification and microendemism in Eastern Highland endemic barcheek darters (Percidae: Etheostomatinae)

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Eastern North America is the location of the world's most species-rich temperate freshwater fish fauna. Hypotheses regarding the geographic and temporal scale of teleost diversification in this region have not been broadly investigated using absolute divergence time estimates among the constituent lineages. This study used time calibrated molecular phylogenies estimated from mitochondrial and nuclear genes to investigate the temporal and geographic signatures of diversification within barcheek darters, a clade of allopatrically distributed species endemic to the Eastern Highlands. Results from divergence time estimates suggest that the barcheek darters are an ancient group with a crown node estimate of 16.6 mya, 95% highest posterior density (HPD): [12.4, 20.5], and that the clade is characterized by substantial intraspecific divergence times within several species. In particular, the Caney Fork endemic *Etheostoma basilare* comprises five strongly supported and deeply divergent clades with a most recent common ancestor estimated at 8.0 mya, 95% HPD: [5.6, 10.7]. These results are concordant with the hypothesis that geologically stable areas of eastern North America have facilitated both the generation and preservation of lineages across a substantial breadth of evolutionary time, and that allopatric speciation in darters has occurred at much smaller spatial scales than previously realized.

Oral Presentation

Constructional constraints in Lake Malawi cichlid and North American minnow heads

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Constraints on form should determine how organisms diversify. Due to competition for the limited space within the body, investment in adjacent structures may frequently represent an evolutionary compromise. For example, tradeoffs between eye size and jaw muscles in fishes are thought to represent a constructional constraint that influenced the diversification of both structures. To test the evolutionary independence of these structures in both cichlid fishes and the eastern North American cyprinids, we measured mass of the three adductor mandibulae (AM) muscles and eye volume in approximately 40 species from both groups. Using novel phylogenies and independent contrasts, we tested the evolutionary independence of these four structures. In both groups, we found evolutionary change in AM muscles was positively correlated suggesting competition for space has not influenced AM diversification. Furthermore, there was no negative relationship between change in total AM muscle mass and eye volume in cichlids indicating little effect of the evolution of eye size on their AM evolution. However, there is a negative relationship in minnows suggesting different developmental or constructional constraints operated during their craniofacial diversification. Our study highlights the potential for novel evolutionary analyses to utilize biodiversity collections like the University of Tennessee Research Collection of Fishes.

Oral Presentation: student competition

Genetic characterization of the rock darter species complex, *Etheostoma rupestre* (Teleostomi: Percidae)

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

Oral Presentation

Estimating darter survival and temporary emigration in a Piedmont bedrock shoal during record low-flows

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Hydrologic changes, such as drought or flow manipulations, can affect the survival of fishes and play an important role in sustaining river biota. Estimations of fish abundance, dispersal, and survival are important measures of how populations respond to environmental change, and mark-recapture methods offer an effective approach to estimating these parameters. We are evaluating the effects of record low-flows caused by drought and municipal water withdrawals on abundance, emigration, and survival of *Etheostoma inscriptum* in the Middle Oconee River (GA) with a robust-design, capture-recapture model. Preliminary data from July and September indicate an abundance of 1,400 to 2,600 individuals in our study shoal, low capture probability (0.11 across three successive sampling days during each month) and a high survival rate (0.87 with 95% confidence between 0.49 and 0.98). Applying the robust-design model over several months, with additional sampling in October and November, will allow us to estimate rates at which darters temporarily emigrate from the study shoal and to evaluate the impacts of low-discharge periods on fish survival. We hope to assess the applicability of open-population models in large-river settings where individuals may frequently move out of the study area and capture efficiencies may be low.

Oral Presentation (Student Competition)

Geographic and temporal aspects of mitochondrial replacement in the redline darter, *Nothonotus rufilineatus*.

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In the process of examining the phylogeography of *Nothonotus rufilineatus* we found that mitochondrial cytochrome *b* (*cytb*) haplotypes isolated from *N. rufilineatus* were not monophyletic and clustered in three distinct portions of the *Nothonotus* phylogeny. We found that phylogenetic analysis of three nuclear genes (S7, MLL, RAG1) resulted in monophyly of *N. rufilineatus* with significant support. The differences between mitochondrial and nuclear gene trees are consistent with mitochondrial introgression. We then inferred the geography and timing of introgression from the phylogenies, networks, and minimum pairwise distances and found: 1) all Cumberland River *N. rufilineatus* have *cytb* haplotypes most like *N. camurus* from the Cumberland River and introgression is very recent. 2) the vast majority of *N. rufilineatus* in the middle to upper Tennessee River system have *cytb* haplotypes most like *N. chlorobranchius* and introgression is very recent. 3) limited introgression between *N. rufilineatus* and *N. camurus* in the upper Tennessee River has resulted in *N. camurus* mitochondrial haplotypes found in *N. rufilineatus* and *N. chlorobranchius* haplotypes from *N. rufilineatus* found in *N. camurus*. Determining when mitochondrial exchange was initiated between these three species is difficult, because replacement of *N. rufilineatus* mtDNA in both river systems is complete and possibly recurrent.

Oral Presentation

Habitat fragmentation and genetic population structure of three Etheostomatine darters in the Duck River, TN.

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The greenside (*Etheostoma blennioides newmanii*), fantail (*Etheostoma flabellare*), and rainbow darters (*Etheostoma caeruleum*) are three abundant species found throughout the Duck River, Tennessee. We assessed genetic variation and structure from multiple populations for these species throughout the river system. Due to their varied ecological niches and life histories, we expected differing levels of population structure. A total of eight different microsatellite loci were analyzed from six different locations along Duck River. Five loci from 3 to 4 populations were scored for each individual species and were analyzed using multiple population genetics tools. It was found that the highest level of genetic structure ($F_{ST}=0.0842$) was present in *E. flabellare* with the lowest levels being found in *E. blennioides newmanii* ($F_{ST}=0.0338$). *Etheostoma caeruleum* had an intermediate level of population structure ($F_{ST}=0.0454$). Significant isolation by distance effects were shown for *E. blennioides newmanii* ($r=0.5494$) and *E. flabellare* ($r=0.5027$). The results of this study are consistent with the predictions based on previous life-history studies of these species.

Oral Presentation

The Role of Sound Production in Aggressive and Courtship behavior of the pygmy sculpin, *Cottus paulus* (Cottidae)

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Many signals produced by fishes are used for assessment and mate choice. For example, vocalizations may portray male size or quality. The pygmy sculpin, *Cottus paulus*, is an unusual representative of the family Cottidae having bright male breeding coloration (orange and black), small adult size (< 40 mm), almost year round spawning and a diurnal activity period. Similar to other cottids, *C. paulus* use nest cavities for egg deposition that are defended by males. This study documented pygmy sculpin sound production in aggressive and courtship contexts. The study took place in Coldwater Spring near Anniston, Alabama, the only known location. Trials used wire enclosures so fish were close to each other, a hydrophone and a video camera. A male and his nest cavity were observed in encounters with a female (courtship) or male (aggressive). Sounds were recorded and analyzed using Raven 2.0. The behavioral observations were made with underwater video. Breeding male pygmy sculpin produce single knocks and knock trains (2-6 pulses). A single knock may come from a guarding male in its nest or with a courtship display with a female near. A knock train is emitted in a more aggressive context, such as chasing away another male.

Oral Presentation (student competition)

Mullet Mayhem: A taxonomic and systematic review of Southeastern US Mulletts

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Mulletts (Family Mugilidae) represent a group of fishes found in all temperate and tropical oceans worldwide. The family currently includes about 17 genera and approximately 72 species. Although the monophyly and taxonomic validity of the family is largely uncontested, this family represents a remarkably understudied group of fishes, despite its economic and ecological importance throughout the world. Much of the difficulty in studying this group is due to the fact that morphological variation within the family is relatively conserved and recovering an accurate understanding of species diversity and phylogenetic relationships has long been troublesome. However, in other studies, the inclusion of molecular data has proven to be beneficial for investigating these types of questions. The objective of this presentation is to review the taxonomic diversity and phylogenetic systematics of mulletts with an emphasis on species of the Southeastern United States. The taxonomic and systematic history of the family will be reviewed and the results from several ongoing phylogeographic projects (*Agonostomus* and *Mugil cephalus*) will be discussed.

Oral Presentation

Post-Katrina survey for the rare blackmouth shiner (*Notropis melanostomus*) in southern Mississippi: What has changed since 1995?

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The blackmouth shiner (*Notropis melanostomus*) has a limited range, occurring only in select drainages of southern Mississippi, southern Alabama, and western Florida (AFS status = threatened; NatureServe rank = G2, "At high risk"). In southern Mississippi it is found in ephemeral ponds, oxbow lakes, backwaters, and other floodplain habitats. We surveyed 35 sites in 1995 and found eight new populations of *N. melanostomus* in the Pascagoula River floodplain. To assess possible impacts of Hurricane Katrina on these *N. melanostomus* populations and habitats, we re-surveyed the area in 2007-2008. Of the eight localities discovered in 1995, only two yielded *N. melanostomus*. Three 1995 oxbow lake sites were repeatedly sampled in 2007-2008 but no *N. melanostomus* were collected. The remaining three 1995 sites were either partially or wholly dry. Expanding our sampling efforts south in 2007, we discovered a new population of *N. melanostomus* in Luther Lake. While we are encouraged that the species is still present and that more undiscovered populations likely exist, there is concern about the decrease in *N. melanostomus* localities over the last twelve years. For example, recent clear-cutting activities adjacent to one historic site threaten the largest and most consistent population of the species in Mississippi.

Oral Presentation: Student Competition

Molecular Systematics of the *Etheostoma* Subgenus *Doration*: Genetic Divergence among Drainages within Mississippi

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To infer relationships and assess levels of genetic diversity in *Etheostoma stigmaeum* taken from the major drainages of Mississippi, the mitochondrial cytochrome *b* and ND2 genes were sequenced from samples taken from the Lower Tennessee, Tombigbee, Yazoo, Big Black, Bayou Pierre, Pascagoula, Pearl, and Amite drainages. Based on parsimony analysis of the cytochrome *b* sequences, relationships among the samples from the Tombigbee, Lower Tennessee, and Big Black River drainages are unresolved, but a well supported clade of coastal plain drainages (Pascagoula, Pearl, and Amite) is recovered. Levels of divergence range from ~3%, found between the Tombigbee and coastal plain drainages, to ~4.5%, found between the Big Black and both the Tombigbee and coastal plain drainages. This study represents the first comprehensive study of genetic divergence among fish species in the drainages of Mississippi, and molecular analysis of the entire subgenus is ongoing.

Oral Presentation

Phylogeny, biogeography, and species boundaries within the brook silverside (Atherinopsidae: *Labidesthes sicculus*)

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Labidesthes sicculus (Teleostomi: Atherinopsidae) is a ubiquitous, schooling, top-water species that is abundant in streams, rivers, and lakes throughout eastern North America. Historically, two subspecies of *Labidesthes* have been recognized. The nominal form, *Labidesthes sicculus sicculus*, was described by Cope from the Detroit River, Michigan and is widely distributed in the Mississippi and Great Lakes basins and in several Gulf Coast drainages. *Labidesthes sicculus vanhyngini*, the Florida Brook silverside, was described by Bean and Reid, from Prairie Creek, near Gainesville, FL. Until recently, the taxonomic status of *L. s. vanhyngini* and the specific limits of its distribution have been in question. This present study was undertaken to determine the geographic pattern of genetic variation within *Labidesthes* across its range. Mitochondrial DNA sequence data (ND2) was obtained from more than 50 individuals and results indicate that there is a high level of genetic variation (>10%) between the putative subspecies and that the distribution of genetic variation is generally concordant with the proposed distribution of the taxa within the genus.

Oral Presentation

Comparative phylogeography of three imperiled darter species in the upper Coosa River system

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We have utilized both mitochondrial sequence and microsatellite data to compare the genetic population structure and phylogeographic patterns of three darter species endemic to the upper Coosa River system; the Cherokee darter (*Etheostoma scotti*), Etowah darter (*E. etowahae*) and amber darter (*Percina antesella*). Mitochondrial sequence and multi-locus microsatellite data along with male coloration support the division of the endangered Cherokee darter into three evolutionary significant units corresponding to the upper, middle and lower portions of the Etowah River. The Cherokee darter is narrowly sympatric with the Coosa darter in streams along the Blue Ridge/Piedmont physiographic region boundary. Similar studies on the endangered Etowah darter reveals it occupies isolated regions in the lower Etowah River, ~100 River KM downstream of its previously known range, and is narrowly sympatric with its sister species the greenbreast darter along the same physiographic boundary. Contrary to these finer scale phylogeographic patterns, the endangered amber darter fails to show mitochondrial distinction between the two dramatically fragmented sections of its range in the Etowah and upper Conasauga River systems.

Oral presentation

Intensive, regular sampling and removal of large numbers of fishes shows no measurable impact on stream fish populations.

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Recent discussions in the ichthyological community and restrictions on collecting by state fish and game managers indicate a growing concern regarding the impact of field sampling on native fish populations. To evaluate the validity of these concerns, data from 5 life history studies conducted in Cherokee County, Georgia were used to test the hypothesis that regular sampling has a negative impact on fish populations. Number of individuals collected was divided by time collecting to calculate Catch per Unit Effort (CPUE) as an indicator of relative population size for each species. The collecting sequence (i.e. the number of times a species had previously been sampled prior) was regressed against CPUE for each of the 5 species. Despite monthly electrofishing and removing hundreds of individuals of each species, there was no significant relationship between combined CPUE and the collecting sequence ($R^2 = 0.1\%$, $p = 0.82$). Analyses of data from each species individually also showed no relationship between CPUE and collecting sequence. These data suggest that even intensive, regular sampling and removal of large numbers of individuals from the same reach of a small stream (< 6 m wide) has no measurable long-term impact on stream fish populations.

Oral Presentation

Conservation status of the longhead darter, *Percina macrocephala*, in Kinniconick Creek, Kentucky

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Percina macrocephala, the longhead darter, is endangered in Kentucky and is uncommon to rare throughout its range. Prior to this survey, this species was known from Kinniconick Creek from only eight specimens collected in 1981. We surveyed 54 stream km of Kinniconick Creek to determine the conservation status of *P. macrocephala*. Reaches were defined as the crest of one riffle to the crest of the next riffle, with a pool in between. The survey portion was divided into 155 reaches; 55 of these were sampled by snorkeling; 14 of the snorkel reaches were seined and backpacked electrofished. A total of 93 *P. macrocephala* were encountered; which extends the known range in Kinniconick Creek to 50 stream km. Both young-of-the-year and adults were found. Most specimens were encountered by snorkeling, which was found to be an effective technique for observing *P. macrocephala*. We judge *P. macrocephala* to be uncommon to locally common in lower Kinniconick Creek (below the mouth or Laurel Fork); and rare in upper Kinniconick Creek (above the mouth or Laurel Fork). Although *P. macrocephala* populations apparently have not declined, increased sedimentation from gravel mining is the primary threat.

Oral Presentation

Linville River Chubs: Prehistoric Interbasin Transfer or Stream Capture 101?

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River chubs (*Nocomis micropogon*) were discovered in Linville River above Linville Falls, North Carolina, in 2006 during a National Park Service inventory of fishes along the Blue Ridge Parkway. Previously only bluehead chubs (*N. leptocephalus*) were thought to inhabit Linville River, a Catawba River drainage stream. Presence of river chubs in Linville River, along with several other cyprinid species, indicates stream capture of a former Tennessee River drainage stream. This presentation describes an amusing sequence of events documenting river chubs in Linville River and a discussion of a stream capture event said to have occurred several thousand years ago.

Oral Presentation

Fishes of Georgia: Coming Soon to an Internet Connection Near You!!

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Georgia ranks in the top five U.S. states for freshwater fish diversity, but there is no comprehensive, source for distributional information on this fauna. Because of this vast diversity, a resource to provide information on Georgia's freshwater fish species is needed. Distributional atlases help facilitate awareness of Georgia's freshwater fishes and are valuable resources for government, educational and public use. Georgia hosts over 300 freshwater fish species including eight federally listed species, 57 state listed species, eight endemic species, eight that are likely extirpated, and over 15 introduced species. We have gathered data from museum, government, and private collections to compile a database to use for distributional maps. The subset of data used for maps, at the time of this abstract, contains 145,659 unique fish occurrences within 17,927 collections at 5,556 sites. Each draft map has been reviewed for accuracy, and any questionable records either verified or eliminated from the distribution. As new information becomes available, maps can be updated to provide the most current distribution available. The website will also contain photos, distributional notes, and taxonomic information. The website is scheduled to go online in December 2008. Please check <http://naturalhistory.uga.edu/> for the launch of the Fishes of Georgia website.

Oral Presentation

If you rebuild it they will come: Okaloosa darter colonization in a restored stream.

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Mill Creek is the smallest of six coastal watersheds inhabited by the federally endangered Okaloosa darter and almost the entire length of Mill Creek flows through golf courses on Eglin Air Force Base. Despite routing the stream through impoundments and under fairways, the darter has persisted in the headwaters and in remnants of free-flowing stream between the ponds and culverts. The section of Mill Creek that flows through the Falcon golf course was re-designed to accommodate a natural channel with floodplain access. Approximately 1,000 linear meters of stream channel with floodplain and native vegetation were restored. A skylighted, bottomless culvert was installed to facilitate fish passage underneath a fairway. We monitored Okaloosa darter abundance, instream habitat, and other physical parameters on a seasonal basis throughout the restored stream. Okaloosa darters were marked with elastomeric dyes to assess fish passage through the skylighted culvert. Okaloosa darters had colonized the entire Mill Creek restoration project within 3 months of project completion and persisted through the first year of study. Dramatic shifts in stream habitat were observed in the created stream channel and darter recruitment was observed in year 2. Future restoration projects are planned and will be compared to the Mill Creek project.

Oral Presentation

Systematics and conservation status of the Arrow Darter, *Etheostoma sagitta* (Percidae: *Litocara*)

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The Arrow Darter, *Etheostoma sagitta*, restricted to upland streams of the Cumberland Plateau, has been recognized as a polytypic species. *Etheostoma s. sagitta* is endemic to the upper Cumberland River drainage and *E. s. spilotum* to the upper Kentucky River drainage. Material acquired from recent surveys was used to re-assess the taxonomic status of *E. s. spilotum*. Differences in meristic characters, such as fewer total and pored lateral scales in *E. s. spilotum*, were consistent with previous studies. While comparison of freshly caught nuptial males revealed no apparent differences in color or pigment pattern, principal components analysis effectively differentiated the two forms based on aspects of adult (>45 mm SL) body shape. Based on mitochondrial DNA, the two taxa were recovered as divergent, reciprocally monophyletic clades. Divergence in morphology and DNA between Kentucky and Cumberland basin populations suggest two evolutionary lineages and bring into question the validity of prior subspecific designations. *Etheostoma s. spilotum* has declined considerably throughout its range during the past two decades. It was encountered in only 29 of 50 historic streams sampled in 2007 and 2008. Arrow darters were rarely found where conductivity levels exceeded 200 μ S, a condition linked to coal mining.

Oral presentation

The Fish Community of Paddy Creek, 1922 – 2007.

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The fish community of Paddy Creek (Burke County, Catawba River Basin) was investigated in 1922 by R. E. Coker from whence he described *Richiella brevispina*. Since then, the fish community has been sampled periodically by graduate students and state agency biologists. The creek is a typical Eastern Blue Ridge Foothills stream with cobble, boulder, and bedrock riffles, runs, and plunge pools. Habitat scores are in the moderately high range, typical of a regional reference site; specific conductance measurements average < 15 $\mu\text{S}/\text{cm}$. The watershed is 90% forested ; the creek is classified as Class C, Trout Waters; and the headwater reaches are managed as Wild Trout Waters. The community is dominated by Central Stoneroller and the Bluehead Chub. Seven of the 12 species collected in 1922 are still extant, but that is not the case for the Greenfin Shiner, Thicklip Chub, Eastern Silvery Minnow, Sandbar Shiner, and the Piedmont Darter. Twelve additional species have been collected, including Brown Trout, Smallmouth Bass, and Yellow Perch. The intolerant Highback Chub, Fieryblack Shiner, and Seagreen Darter and common upper river basin species, such as the Warpaint Shiner, have never been collected from the creek. The community is usually rated as Good-Fair with diversity metrics scoring low and nutrient enrichment metrics scoring high. Anthropogenic and natural stressors are hypothesized as being detrimental to the fish community – localized habitat and water quality degradation from poor landuse practices in the middle to lower portion of the watershed; displacement of indigenous species by nonindigenous species; hydrologic extremes exacerbated during the past decade; and habitat fragmentation and geographical isolation from downstream recolonization refugia.

Oral Presentation

Discovery of *Ammocrypta clara* (western sand darter) in the upper Ohio River of West Virginia

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Ammocrypta clara (western sand darter) occurs primarily in western portions of the Mississippi River system, but also includes records from a Lake Michigan drainage and a few eastern Texas Gulf Slope rivers. Additional range records depict a semi-disjunct distribution within the Ohio River drainage, including collections from Wabash River in Indiana, the Cumberland, Green, Kentucky, and Big Sandy rivers of Kentucky, and the upper Tennessee River in Tennessee and Virginia. This study documents *A. clara* from the upper Ohio River drainage within the lower Elk River (Kanawha System), West Virginia, based on collections from 1986, 1991, 1995, 2005, and 2006. The Elk River population, consistent with those of other Ohio River drainages, has slightly higher counts for numbers of dorsal-fin rays, scales below lateral line, and lateral line scales when compared to data from populations outside of the Ohio River drainage. Modal counts of meristic characters are similar among populations, except for higher modal counts of lateral line scales in the Ohio River population. The discovery of the Elk River population extends the range distribution of *A. clara* to the Eastern Highlands region, and documents wide distributional overlap and additional sympatry with its sister species, *Ammocrypta pellucida* (eastern sand darter).

Oral presentation (student competition)

Fluctuating asymmetry and condition in fishes exposed to varying levels of environmental stressors

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The ability of an organism to combat developmental stress correlates with its developmental stability which can be assessed by measuring fluctuating asymmetry. Fluctuating asymmetry (FA) is variation in bilaterally symmetrical traits, and deviations from perfect symmetry may point to developmental stress. This study assessed the potential link between FA and putative correlates of fitness by addressing the following questions: 1) Do any differences in FA and/or measures of fitness exist that correlate with position of the fishes upstream or downstream or with increasing distance from a potential source, and 2) Is there any correlation between FA and measures of fitness? Sites were selected from around the Leaf River Pulp Mill, New Augusta, MS, and collections from each of three species (*Lepomis megalotis*, *Cyprinella venusta*, *Carpionodes velifer*) were made in 2006. Morphometric measurements were taken from each fish to determine degree of FA. Percent lipids, Fulton's Condition Index, Gonadosomatic index, and fecundity were measured as correlates of fitness. Differences were seen in FA values with distance (*C. venusta*) and direction (*C. velifer*) from the source. No correlations between FA and measures of fitness were found. FA may be a better indicator of anthropogenic stress to an ecosystem than measures of fitness.

Poster Presentation

A selection of the crayfishes of Mississippi

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This is an educational poster intended to inform the public of the great diversity of crayfishes in Mississippi. It features photographs of 36 of the roughly 63 described crayfish species currently known from the state. Photographs were taken by Chris Lukhaup. Free copies of the poster will be available at the meeting.

Poster Presentation

Using snorkeling data to estimate detection probability and site occupancy for rare fishes: an example from the Toccoa River.

Brett Albanese, William Pruitt, Katherine Owers, and Deborah Weiler. Nongame Conservation Section, Georgia Department of Natural Resources, 2065 U.S. Highway 278 SE, Social Circle, Georgia 30025 (brett.albanese@dnr.state.ga.us)

Four state protected fishes occur in the Toccoa River of Georgia. These species are difficult to capture, which may confound status assessments because of failed detection. Our objectives were to estimate the proportion of sites occupied for these species in the mainstem Toccoa River, and to estimate detection probabilities from snorkeling data. We snorkeled 12 15-m long quadrats at each of 29 randomly selected sites during summer 2008. We detected *Percina aurantiaca* at 17 sites (60%), *Erimystax insignis* at 12 sites (41%), *Etheostoma vulneratum* at 9 sites (31%) and *Percina squamata* at 1 site (3%). The probability of detecting *P. aurantiaca* and *E. vulneratum* within a site was > 95%, but much lower for *E. insignis* (64%). Estimates of site occupancy that corrected for incomplete detection were almost identical to observed occupancy rates for *P. aurantiaca* and *E. vulneratum*, but much higher for *E. insignis* (64%). Our occupancy estimates can be used as a baseline from which to assess future population changes in the Toccoa River, which is being increasingly altered by residential development. While we were unable to estimate detection and occupancy for *P. squamata*, the rarity of this species in our survey is cause for concern.

Poster Presentation

Patterns of divergence and endemism in the Clinch and Duck rivers: data from the federally endangered Pygmy Madtom, *Noturus stanauli* (Siluriformes: Ictaluridae), and comparisons with other fishes

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The Pygmy Madtom, *Noturus stanauli*, is a highly imperiled catfish, known from only two localities, one each in the Clinch and Duck river, separated by over 1055 river km. We collected four individuals of *N. stanauli* from the Duck River and sequenced the mitochondrial cytochrome *b* gene to compare with previously published data from the Clinch River population (three individuals). Maximum parsimony and maximum likelihood analyses of a combined dataset, including all extant *Noturus* species (72 sequences) and six sequences from siluriform outgroup taxa (*Ameiurus*, *Chrysichthys*, *Ictalurus*, *Pylodictis*), revealed moderate to high bootstrap support for monophyly of Clinch and Duck river populations. There were two fixed nucleotide positions that separated the populations, resulting in an average of 0.32% sequence divergence. Intrapopulation divergence was 0.12% and 0.19% for the Clinch and Duck rivers, respectively. We compare population divergence between the Clinch and Duck rivers for other fishes to our data and discuss the conservation implications of population divergence in *N. stanauli* in light of replicated biogeographic patterns.

Poster Presentation (Student Competition)

Ecology and Conservation of the Blackside Dace, *Phoxinus cumberlandensis*, a Threatened Stream Fish in Kentucky and Tennessee, USA

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The blackside dace, *Phoxinus cumberlandensis*, is a federally protected minnow native to small streams in the upper Cumberland River drainage of Kentucky and Tennessee, USA. The species is a key inhabitant of a watershed that has experienced water quality problems for many years. We recently studied blackside dace distribution, abundance, movement patterns, reproductive behavior, and habitat affinities to assist ongoing conservation and recovery efforts. Dace densities were estimated by mark-recapture experiments and averaged 12-17 individuals per 100 m². Many sites harbored dace populations existing at low densities. Most dace were residential and did not move >200 m over a year's time. However, a sizeable minority (20-40%) was mobile and moved up to 4 km, including one dace that migrated into a neighboring stream. We observed 25 spawning events, all associated with creek chub, *Semotilus atromaculatus*, nests containing clean substrate. Finally, we constructed logistic regression models to predict dace presence as a function of reach-scale habitat variables. The best-performing models predicted dace persistence in stream reaches with June-August water temperatures <19 °C and conductivities <240 µS. Through this research program we have described certain ecological conditions needed to promote conservation of a unique species in a global hotspot of biological diversity.

Poster Abstract

Slackwater darter habitat potential in the Flint River watershed

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The sustainability of suitable habitat for the threatened slackwater darter (*Etheostoma boschungii*) is of special concern in the Flint River watershed of Madison County Alabama due to increasing pressures of rapid urbanization. The primary focus of this study was to 1) identify suitable slackwater darter habitat within the Flint River watershed in an effort to preserve this sensitive habitat and avoid extirpation of the species from the Flint River system, and 2) raise community awareness and involvement about the plight of the Flint River watershed and the endangered slackwater darter through public educational outreach activities. GIS modeling was used to predict habitat suitable for the slackwater darter's unique breeding needs. Through volunteer workshops, habitat assessments determined whether predicted sites were probable locations for slackwater breeding habitats. Probable sites were later seined to determine the composition of the fish community. No slackwater darters were found; however, of the probable sites seined, greater than 85% of the fish collected at selected sites were known species associates of the slackwater darter suggesting that these sites were suitable. Out of 44 potential habitat sites assessed, 8 were suitable, 14 were questionable, and 22 were not suitable due to urbanization or improper land use practices.

Poster Presentation

A Survey of Fishes of Rock Creek, Kentucky, with Emphasis on the Impact of Stocking Rainbow Trout on Native Fishes

Stephanie Brandt and Sherry Harrel, Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475

Rock Creek, a tributary of the Big South Fork Cumberland River, is designated a wild and outstanding natural resource in Kentucky. Acid mine drainage (AMD) from coal mine portals has severely impacted aquatic populations in the lower Rock Creek watershed. Rock Creek supports five fish species of greatest conservation need (SGCN) and the federally endangered blackside dace (*Phoxinus Cumberlandensis*). Rainbow trout have been stocked annually from White Oak Creek upstream to the Tennessee/Kentucky State line since the early 1960s, but their impact to smaller native fishes has not been investigated. The objectives of this study are to: 1) document present distributions of fishes in Rock Creek and determine relative abundance, with emphasis on SGCN; 2) relate fish distributions to habitat quality 3) document the distribution and habitat usage of stocked rainbow trout in relation to SGCN; and 4) examine gut contents of stocked rainbow trout for the presence/absence of SGCN. Preliminary findings show that fish species richness and abundance have increased since reclamation using limestone began in White Oak Creek and lower Rock Creek in 2000. Preliminary examination of trout gut contents revealed mostly fish, causing concerns for potential effects on SGCN species.

Poster Presentation

Population structure of the imperiled “Sicklefin Redhorse”

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There are currently six species of redhorse native to the Hiwassee and Little Tennessee basins. Although the “sicklefin redhorse”, a candidate for federally endangered species status, has not yet been formally described, it is of great phylogenetic interest because it shares morphological resemblances to both *M. carinatum* and *M. breviceps*. The first portion of this study involved sequencing of the mitochondrial control region in order to investigate the phylogenetic relationship of “sicklefin redhorse”. Our results show that “sicklefin redhorse” are monophyletic, and sister to *M. carinatum*. However, no population structure between river drainages was shown for any species, so microsatellite markers were applied to *M. breviceps*, *M. carinatum*, and “sicklefin redhorse” from both the Hiwassee and Little Tennessee drainages. The results show that although there are distinct genetic differences between all three species, there is not much difference within *M. carinatum* or *M. breviceps* between the two rivers. However, the multilocus microsatellite genotypes appear to indicate significant differentiation between the Hiwassee and Little Tennessee river basins for the “sicklefin redhorse.”

Poster presentation

Habitat use of *Percina macrocephala* (longhead darter) in Kinniconick Creek, Kentucky

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Percina macrocephala (longhead darter) is uncommon and localized in the Ohio River basin and endangered in Kentucky. Published quantitative descriptions of habitat use are limited; researchers have hypothesized this species to inhabit pools with boulders. In the summer and fall of 2007 and 2008, we used snorkeling, seining, and electrofishing to examine microhabitat and macrohabitat (reach level) use by *P. macrocephala* in over 50 reaches in a 56 km section of Kinniconick Creek, Kentucky. Comparisons of microhabitat variables support the hypothesis that this species occurs in slow raceways and pool habitats just above riffles, in areas that typically have low flow, boulder and cobble substrates, and moderate depth (30-90 cm). Microhabitat data indicate that YOY and adults occupy similar habitats, except that adults tend to inhabit slightly deeper water. Comparisons of reach-level variables indicate that *P. macrocephala* is more common in reaches containing a long pool and with high widths, low turbidity, and coarse substrates. These habitats are most common in a middle section of Kinniconick Creek, where most darters were observed. Because of the low-flow and "edge" habitats that it typically occupies, *P. macrocephala* is particularly vulnerable to habitat alterations that increase sedimentation or alter riffle-pool frequency.

Poster Presentation

Prioritization of habitat for conservation of *Etheostoma boschungii*

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Etheostoma boschungii has a relatively widespread but disjunct distribution in the Tennessee River drainage, Alabama and Tennessee. *Etheostoma boschungii* has a complex life history, requiring specialized breeding and non-breeding habitats, and an unimpeded migration route between the two areas. Since 1974 when the species was described, it has undergone dramatic local extirpation. Our recent and historical survey data, coupled with data from previous surveys, indicate three primary factors that are most likely responsible for the loss of this species from historical habitat: culverts, channel incision and impoundment or destruction of seepage areas. These factors account for the loss of *E. boschungii* from approximately 80% of historical breeding sites, and have accounted for severe degradation of habitat used in the non-breeding season. We identify high priority areas within the current distribution of the species for conservation measures. Due to the fragile nature of the seepage areas used for breeding, and the immediacy of potential habitat destruction, we urge agencies to work with landowners to preserve seepage areas in the Upper Brier Fork and Cypress Creek systems.

Poster Presentation

Tennessee Fish Collection: Strengths and Development

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The Tennessee Fish Collection housed in the Department of Ecology and Evolutionary Biology at the University of Tennessee is the largest fish collection in Tennessee. This collection represents over 40 years of work by Dr. David Etnier and continues to grow. In terms of total species it ranks in the top 20 among North American Fish collections. The collection houses 35,220 lots to date, which contain ~425,000 specimens from 206 families. The hyper-diverse fauna east of the Rocky Mountains is well represented in the collection, and it contains the best darter collection in North America based on numbers of species + specimens + lots of rare specimens. The collection and associated information is widely used by government, private, and academic institutions and we would like to encourage increased use of and contribution to the collection's holdings. Since 2006, the collection has been housed in the Hesler Biology building in the heart of the UT campus. It is outfitted with modern compactors and its holdings are currently being digitized. The entire collection is projected to be searchable on the web by Fall 2009.

Poster Presentation (Student Competition)

A new species of *Nothonotus* darter from the Caney Fork River and paraphyly in its sister clade of *N. microlepidus* and *N. sanguifluus*.

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A new species of *Nothonotus* darter is described from the Caney Fork River in middle Tennessee, and the phylogenetics of *N. microlepidus* and *N. sanguifluus* are discussed. We used a mitochondrial gene (cytochrome *b*) and three nuclear loci (*S7*, *MLL*, and *RAG1*) to estimate gene trees and a species tree for *N. microlepidus* and *N. sanguifluus* sampled throughout their ranges in the Cumberland River system. *Nothonotus sanguifluus* from the Rockcastle River and Buck Creek were paraphyletic with respect to *N. microlepidus* from the Harpeth, Stones and Red Rivers. *Nothonotus cf. sanguifluus* from the Caney Fork River formed a clade that was the sister lineage to all other sampled *N. sanguifluus* and *N. microlepidus* populations. Variation in ten meristic characters was determined from more than 500 individuals sampled from all areas of the geographic distribution of each species. Discriminate Analysis (DA) identified the Caney Fork *N. cf. sanguifluus* as differentiated relative to all other sampled *N. sanguifluus* and *N. microlepidus* populations. The molecular phylogenies, meristics and distinct color characters support the recognition of the Caney Fork *N. cf. sanguifluus* as a distinct species.

Poster Presentation

The Roebuck Spring fiasco in Birmingham, Alabama: Dam removal and dead Watercress Darters (*Etheostoma nuchale*)

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The federally endangered Watercress Darter is restricted to springs and spring runs, is highly associated with aquatic vegetation, and is limited to four native populations within the Black Warrior River drainage within the greater Birmingham metropolitan area in north-central Alabama. Roebuck Spring, located in Birmingham proper, has the largest habitat for and most robust population of Watercress Darters, although city park facilities (recreation center, tennis courts and a golf course) do impact the spring run. On 19 September 2008 city workers removed a dam that had created 1.5 acres of spring-pool habitat for Watercress Darters below the spring head. This action drained well over 50% of the spring pool and the rapid dewatering left a conservatively estimated 11,760 Watercress Darters stranded in aquatic vegetation and dead. Even though the park director knew of the presence of the imperiled darters, she ordered the removal of the dam to prevent beavers from increasing the dam's height and flooding the adjacent tennis courts. U.S. Fish & Wildlife Service law enforcement personnel are investigating the case. This fiasco demonstrates the need for constant education and communication between all public and private stakeholders within an imperiled aquatic species' watershed to minimize the potential for such disasters.

Poster Presentation

Mill Branch Stream Restoration for the Federally Threatened Blackside Dace (*Phoxinus cumberlandensis*) in Knox County, Kentucky

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Mill Branch, Knox County, Kentucky is one of 15 tributaries in the Stinking Creek basin that supports a population of federally threatened blackside dace (*Phoxinus cumberlandensis*). The Mill Branch Stream Restoration Project was specifically designed to provide improved spawning/ foraging habitat for the blackside dace, which occur in an approximate 4,000-foot reach of the stream. Restoration of 2,330 linear feet, extending from a perched culvert downstream to the Stinking Creek confluence, was completed in January 2008. Restoration was primarily accomplished in the dry within an abandoned terrace of the existing channel and included replacement of the perched culvert. Sampling efforts within the new channel during March 2008 yielded 177 fishes, representing 11 different species. While no blackside were observed in the new channel during the March 2008 survey, the population above the culvert appeared to be healthy and stable, with 406 individuals collected, despite the severe drought of 2007. During a site visit in early October 2008, four blackside dace were observed in the new channel approximately 20 feet from the culvert replacement. A full-scale survey of the new channel is scheduled for November 2008 to evaluate utilization of the new channel by blackside dace and other fish species.

Poster Presentation

A comparison of the aquatic biodiversity in eastern hemlock dominated and hardwood dominated forest streams within eastern Kentucky

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This research experiment is aimed at comparing the aquatic diversity between fish and invertebrate assemblages in eastern hemlock dominated forests and hardwood dominated forests. Eastern hemlock (*Tsuga canadensis*) forests are declining due to the introduction of the hemlock woolly adelgid (HWA, *Adelges tsugae*). In order to anticipate what effect the loss of hemlocks in hemlock dominated forests may have on aquatic biodiversity, we compared the species diversity and richness of aquatic assemblages in hemlock streams versus that of hardwood streams. Fish and macroinvertebrate samples were collected from 8 streams (4 hemlock dominated and 4 hardwood dominated) in central and eastern Kentucky and a comparison of the taxonomic and trophic diversity between hemlock and hardwood forest streams was performed to show any variations between the two types of stream habitats. Our initial hypothesis was that hemlock and hardwood streams would differ in taxonomic and trophic structure due to factors directly related to hemlock and hardwood habitats. The preliminary results seem to support our initial hypothesis, as differences in hemlock and hardwood streams can be observed by comparing fish, macroinvertebrate, and stream samples.

Poster Presentation

A 10 year monitoring plan for Spottfin chub in the Little Tennessee River, North Carolina: overview and results from the first two years.

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A 10 year effort to assess the Spottfin chub, *Erimonax monachus*, population in the upper Little Tennessee River began in August 2007. The monitoring protocol was designed to meet criteria defined in the species Recovery Plan (USFWS 1983) and is available as a model for population status assessment range-wide. Goals are: 1) assess spatial and temporal distribution and abundance over a 10 year period; 2) provide information to guide management decisions, recovery efforts, and further research; and 3) provide any additional life history and habitat use information as observed. Ten sites were selected within the 23 mile (37 km) occupied reach. Visual surveys (mask and snorkel) along fixed transects and timed, random searches were conducted at each site. In 2007, all 10 sites were sampled and the average number of chubs observed per hour of random search and per 50 m transect was 5.8 and 2.7, respectively. In 2008, a sub-set of 5 sites was sampled and the average number of chubs observed per hour of random search and per 50 m transect was 44.1 and 13.8, respectively. More chubs were observed in the lower half of the study reach in both 2007 and 2008.

Poster Presentation: Student Competition

Investigations into the Relationship between the Steroid Hormone 11-ketotestosterone and Reproductive Status in the Fish *Lythrurus fasciolaris*

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In many fishes, 11-ketotestosterone (11KT) is a critical androgen regulating primary and secondary sex characteristics. In the sexually dimorphic *Lythrurus fasciolaris*, dominant nuptial males display heavy tuberculation on the head and nape, dark dorsolateral vertical bars, and dramatic red coloration in the fins, venter, and operculum area. This study aimed to quantify 11KT circulating levels in males and determine its correlation with key reproductive status indicators such as nuptial coloration, size, and Gonadosomatic Index (GSI). Thirty-one wild-caught *L. fasciolaris* were divided into three groups according to reproductive status: dominant males (D), non-dominant males (ND) and females (F, control group). Physical measurements, digital imaging, and blood samples were used to quantify body size, GSI, nuptial coloration, and 11KT circulating levels. Dominant males had higher 11KT levels and nuptial coloration traits compared to ND males and Females (red area, hue, saturation), and a higher GSI than ND males. Non-dominant males had more 11KT and coloration than females. Increased 11KT levels corresponded to increased coloration, size and GSI.

Poster Presentation

A comparative ecological study of two disjunct, congeneric species of darters in Kentucky: *Etheostoma kantuckeense* and *Etheostoma lawrencei*

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Etheostoma kantuckeense and *E. lawrencei* are former members of the *E. spectabile* species complex. *Etheostoma kantuckeense* occurs in the headwaters of the Barren River Basin in southern Kentucky and northern Tennessee, while *E. lawrencei* occurs in the headwaters of the Green River, Salt River, and Cumberland River Basins. This isolation of populations has allowed a relatively recent evolutionary divergence, leading to slight differences in morphology. This study was conducted to address if geographical isolation has led to measurable differences in the ecology of these two species. In particular, habitat preference across three spatial scales and growth rates were examined. Twenty-four streams within the Upper Barren River Basin (2007) and thirty-five streams within the Upper Green River Basin (2001-2003) were sampled for fish community structure and environmental variables. In addition, two physically similar upland streams, one in the Upper Barren River Basin (*E. kantuckeense*), and one in the Upper Green River Basin (*E. lawrencei*) were sampled monthly from August 2007 through August 2008 to determine seasonal habitat preference and growth. Both species preferred smaller, lower order streams within the watersheds. Also, both species preferred run habitats over riffle and pool habitats over the course of the year, and both species exhibited similar seasonal habitat shifts. These results suggest that these species maintain similar ecological traits in their respective watersheds.

Poster Presentation

A molecular genetic investigation of hybridization between *Etheostoma osburni* and *Etheostoma variatum* in the New River drainage

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Etheostoma osburni, the candy darter, is endemic to the New River drainage of West Virginia and Virginia. Recently, a closely related species, *E. variatum*, the variegate darter, has invaded portions of the range of *E. osburni*. Preliminary genetic evidence indicates that these two species are hybridizing. In order to determine the extent of hybridization between *E. osburni* and *E. variatum* a suite of primers were developed for 15 microsatellite DNA loci and used to genotype 286 individuals. In addition, 1064 bp portion of the mitochondrial cytochrome *b* gene was sequenced in 115 individuals from the potential hybrid zone. Analysis of the genetic data identified the greatest numbers of hybrids at Anthony Cr., the upstream most collection site of *E. variatum* in the Greenbrier R. drainage, and the only site where *E. osburni* and *E. variatum* are known to be syntopic. Collections of *E. variatum* downstream of Anthony Cr. showed evidence of *E. osburni* introgression. Collections of *E. osburni* from above Anthony Cr. in the Greenbrier R. drainage did not show evidence of hybridization with *E. variatum* and appear to be a distinct population, separate from the downstream population of *E. variatum* and the Gauley R. population of *E. osburni*.

Poster presentation

Constructed microhabitat bundles for sampling fishes and crayfishes in Coastal Plain streams

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We investigated fish and crayfish use of standardized, microhabitats (bundles) in northern Mississippi streams. Two streams were channelized and incised and had little woody cover; the other was unchannelized and not incised and had abundant woody cover. We constructed three types of bundles (cane, leaf, and string) and deployed replicates of each in winter and spring. Occupancy of bundles by fish and crayfish was high and included 32 fish species representing 8 families. Fish abundance did not differ among bundle types or channel position (bank or mid-channel); abundance of crayfish showed mixed responses to bundle type and position. Fish and crayfish use of bundles was higher in channelized streams (89% occupied) than in the unchannelized stream (49% occupied). Furthermore, after a winter storm, fish use increased in channelized streams but not in the unchannelized stream. Bundles yielded abundance estimates with modest to poor precision (40-73%, fish; 37-125%, crayfish); about 110-140 bundles would be necessary to consistently achieve precision of 30%. Bundles were effective for sampling a subset of fish assemblages (e.g., darters, madtoms), but other species were underrepresented or absent in our samples relative to sampling by electrofishing and seining (e.g., open-water species, large individuals). Nevertheless, microhabitat bundles can be effective for sampling small fish and crayfish that are associated with woody cover and difficult to sample with conventional methods.