Arkansas Chapter
American Fisheries Society
1999 Annual Meeting

Museum of Discovery
Little Rock, Arkansas
February 8th – 10th, 1999

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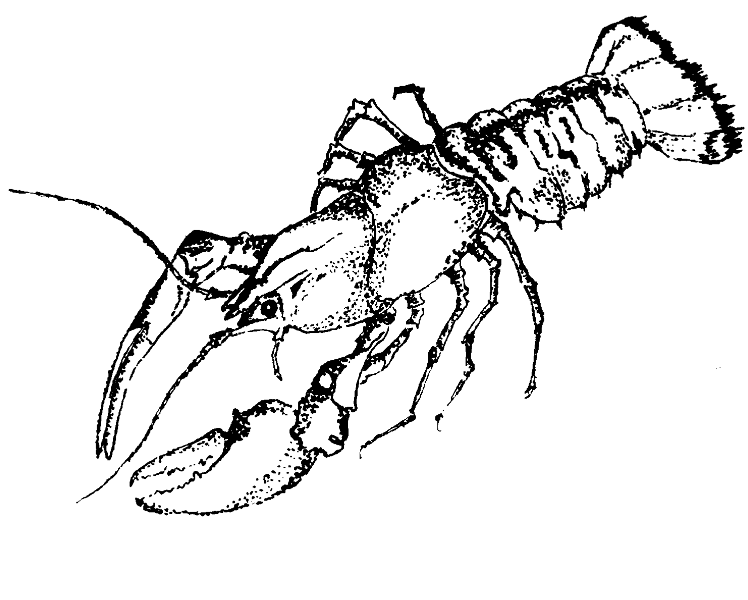

Arkansas Aquatic Turtles

Dr. Stan Trauth

1:00 Introduction - "Aquatic Turtles of Arkansas" - S. E. Trauth, Department of Biological Sciences, Arkansas State University

Presentations:

1:30 "Population structure of spiny softshells, *Trionyx spiniferus*, in a small urban stream (Gin Creek, Arkansas)," by M. V. Plummer and N. E. Mills, Department of Biology, Harding University

2:00 - 2:20 BREAK

2:30 "Alligator snapping turtles, *Macroclemys temminckii*, in a northeast Arkansas stream (Salado Creek, Independence Co.)," by S. E. Trauth and J. D. Wilhide, Arkansas State University

3:00 - 3:15 BREAK

3:20 - 4:00 Panel Discussion –
"Conservation Status of Arkansas Aquatic Turtles"

Participants:
Stan Trauth, Arkansas State University
Mike Plummer, Harding University
Betty Crump, U.S. Forest Service
Brian Wagner, Arkansas Game & Fish Commission

4:00 - 5:00 Posters and Exhibits – Hands on ID and life history displays

Technical Session Abstracts

Possible Limiting Factors For A Sustainable Crappie Fishery in the Salt River Chain of Reservoirs, Arizona

Chris Horton

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The dynamics of crappie populations in southwestern reservoirs are not well documented. In order for managers to enhance a crappie fishery, they need to understand the factors that control populations. I examined potential limiting factors for black crappie in 4 sequential reservoirs on the Salt River, Arizona.

Only in Roosevelt Reservoir, the uppermost reservoir, were crappie relatively abundant. I identified 3 possible limiting factors. Apache, Canyon, and Saguaro reservoirs lacked sufficient spawning substrates. All 4 reservoirs lacked sufficient cover. Finally, the lower 3 reservoirs are less productive during the fall according to chlorophyll a levels than Roosevelt Reservoir. Low productivity may have resulted in fewer zooplankton and possibly a limited forage base for juvenile crappie. Options such as spawning platforms, artificial cover, fertilization, and stocking are discussed as ways to improve the crappie fishery in these reservoirs.

Supplemental Stocking Of Crappie in Lake Chicot, AR

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The populations of black (Pomoxis nigromaculatus) and white (Pomoxis annularis) crappie in Lake Chicot, AR have declined noticeably in recent years. Crappie recruitment has been more variable in recent years than in the past. Indications of potentially strong year classes have not seemed to materialize. There is no apparent relationship between 1-3" young-of-the-year crappie in one year and 3-6" crappie in the next year. Although this suggests a problem with overwinter survival, the factors responsible for the crappie decline are not clear. The largemouth bass (Micropterus salmoides) population has seemed to increase in recent years and is one potential contributor to the crappie decline. An effort to supplementally stock crappie in Lake Chicot has been initiated by the Arkansas Game and Fish Commission. Approximately 130,000 fingerlings from the Joe Hogan State Fish Hatchery in Lonoke, AR were released at four locations on November 17, 1998. Crappie were immersed for six hours in a 500 mg/L bath of oxytetracycline buffered with 2000 mg/L dibasic sodium phosphate. Two to three parts per thousand NoFoam were added to cut down on foam-related mortality during the immersion process. The same marking protocol was followed when an additional 6,400 fingerlings, raised locally in Lake Village, were released on December 10, 1998. A 100' by 6' purse seine was unsuccessful at sampling the released fingerlings. Electrofishing efforts also yielded no YOY crappie. Trap nets with half inch mest have allowed collection of crappie fingerlings. Although fingerlings are not completely recruited to this gear, the catch per net night is a reasonable means of assessing changes in relative abundance and short-term survival of stocked fingerlings. Summer population samples will be used to assess long-term survival and overall contribution of stocked crappie to the population.

A Pilot Urban And Community Fishing Program for Central and Southeast Arkansas

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Urbanization is increasing in Arkansas. As greater numbers of youth grow up in urban neighborhoods, fewer children learn to enjoy recreational fishing. Without positive childhood outdoor recreational experiences, fewer Arkansans will have an appreciation of the state’s natural resources or of the recreational benefits of fishing. The purpose of this 3-year project is to develop and test a program designed to increase fishing among young people in urban areas and communities in Central and Southeast Arkansas. This project is a collaborative partnership among the University of Arkansas at Pine Bluff Aquaculture/Fisheries Center, the Arkansas Game and Fish Commission, and the Biological Resources Division of the U.S. Geological Service. Specific objectives of the program are 1) to enhance fishing opportunities; 2) to increase knowledge of fishing techniques and aquatic resources stewardship values; and 3) to increase local community involvement in the creation and enhancement of fishing opportunities for youth. The project is in its first year with Little Rock, Pine Bluff, and Lake Village selected as the pilot communities. Program brochures are being developed, youth and community groups are being contacted, and fishing activities are being created.

Icthyofaunal Distribution on the Upper, Middle and Lower Reaches of the Strawberry River

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Physical, chemical and biotic variables were sampled on three sites (upper, middle, and lower reaches) of the Strawberry River in Fall, 1996. The primary objective was to investigate the relative distributions of gamefishes within those reaches and the biotic and abiotic variables most associative with those distributions. Numerically dominant gamefishes among the upper reach were the smallmouth bass, shadow bass, green sunfish, largemouth bass and spotted bass; the middle reach was identified by smallmouth bass, green sunfish, shadow bass and spotted bass; the lower reach was dominated by channel catfish, spotted bass and bluegill. Associated with change in icthyofaunal distribution in the lower reach were reductions in slope and alkalinity, as well as increases in total flow, sedimentation, fine particulates and turbidity.

The Arkansas Natural Heritage Progran

Cindy Osborne

The Arkansas Natural Heritage Commission (ANHC), an agency of the Department of Arkansas Heritage, was established in 1973 with the mission of identifying and protecting natural areas. In 1978, under a cooperative agreement between the ANHC and The Nature Conservancy, the Inventory Research Program began systematically collecting information on the state's flora, fauna, and natural communities. This Inventory Program was assumed by the ANHC and became the agency's research section. Although interested in the full range of the state's biodiversity, the research section focuses most of its limited resources on the identification and protection of rare species and high quality examples of natural community types. Data on aquatic species and habitats make up a significant component of the information collected by the research section.

At present the agency is collecting information on over 70 sensitive aquatic species. ANHC staff utilize this data in the review of projects ranging from navigation and flood control to wetland conversions, gravel mining, streambank stabilization, and highway construction. Through its information sharing program, the agency makes data available for research and environmental planning. The Research Section is one of several arms of the ANHC working to provide protection for Arkansas' aquatic resources.

Occurrence and Reproduction of the Alabama Shad, *Alosa Alabamae*, in the Ouachita River Drainage System of Arkansas

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Don Turman, Colton Dennis, Stuart Wooldridge, and Brett Hobbs
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The Alabama shad, *Alosa alabamae* Jordan and Evermann, has drastically declined in recent decades throughout its historic range, and only three records (all pre-1900) of that anadromous species are known from Arkansas. Fish sampling in the Ouachita River drainage system in July and August, 1997 and 1998 produced several new locality records for juvenile Alabama shad. One adult specimen, taken in April 1997, was also documented. Our data demonstrate that this migratory species is still able to ascend the Ouachita River and spawn successfully, despite the completion of four locks and dams on that river in Louisiana and Arkansas in the 1980s.

Status and Distribution of Pallid Sturgeon, Blue Sucker and other Large River Fishes In the Red River, Arkansas

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The Arkansas portion of the Red River was intensively sampled during 1997 and 1998 in an attempt to document the occurrence of the endangered pallid sturgeon (Scaphirhynchus albus). A total of 378 hoop net nights, 24 gill net nights, 8 trotline nights representing nearly 5,000 net hours failed to capture a single specimen of the species. A significant blue sucker population was present, and blue suckers used habitats that were relatively deep and with fast current. The shovelnose sturgeon occurred throughout the Red River in Arkansas. It remains doubtful that the pallid sturgeon occurs in the Red River, although the river appears to have habitat suitable for the species.

Genetic and Meristic Variations between and within Populations of *Etheostoma moorei* (Yellowcheek Darter)

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The yellowcheek darter is an endemic species, found only in four headwater streams of the Little Red River, above Greers Ferry Lake. In 1980, population estimates ranged from 36,000 (Middle Fork) to 5,000 (Devils Fork). The populations have been isolated since 1962, when the lake was created. If biological diversity has begun to occur, it may be appropriate to consider protecting one or more populations. Collections for the present study began in March 1998. Preliminary results indicate two findings. First, the populations in all four streams have declined significantly. During the dry season of the year the streams become intermittent nearly to the lake. Second, the Devils Fork population appears to differ from the other three in some of the enzyme systems. This latter point agrees with observations in 1984 that the individuals in the Devils Fork population were different. At that time, they were observed to be larger and have a longer spawning period.

Cavefish Stewardship

G. O. Graening
Department of Biosciences
University of Arkansas

The stewardship of obligate cave-dwelling fish faces formidable challenges because of their restrictive life history traits and the difficulty of protecting their habitat. The ultra-oligotrophic nature of subterranean aquatic habitats have induced specific physiological and evolutionary changes (troglomorphy) upon cavefish genera such as *Amblyopsis*, including depressed metabolic activity, growth rate, and melanin production, low reproductive rates, the atrophy of the eyes, and the hypertrophy of other sense organs. Such K-selected traits make these blind cavefish populations extremely sensitive to mortality factors and extremely slow to recover from them. *Amblyopsis rosae,* for example, has a clutch size of only 23 eggs, an average of 0.6 reproductions per lifetime, a population growth rate of about 3%, and a doubling time of 23 years. The use of the logistic growth computer model STELLA Research 4.0 demonstrates the phenomenal impact of the loss of even one individual from a small deme. Thus, one management objective is the reduction of mortality factors, especially the cessation of invasive research or collection, and predation by introduced species such as trout or surface species such as sculpin or crayfish. Habitat degradation is another stressor upon amblyopsid populations. The *A. rosae* deme in Cave Springs Cave, for example, is chronically exposed to elevated heavy metal concentrations and significant fecal loads from agricultural waste and/or septic systems. Furthermore, a 14-year eutrophication trend has been detected at this cave complex. The ramifications of rapidly nutrifying a habitat whose organisms have adapted to starvation over thousands of years is unknown.

Finally, the *Myotis grisescens* populations, whose guano purportedly fuels these cave food webs, have decreased by as much as 90% in some maternity caves. Yet, protecting water quality in these habitats is no simple task when the recharge zones for these cave complexes are experiencing intensive agricultural use and the rapid expansion of sub-urban development. Educational outreach programs are needed to unify the seemingly opposing goals of profiting from land use and development and the conservation of the natural resources of the Ozarks.

The Arkansas Field Office of The Nature Conservancy – Three New Initiatives Designed To Protect Arkansas' Aquatics

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The mission of The Nature Conservancy is to preserve plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. The Nature Conservancy is a private, non-profit organization recognized for its successful non-confrontational approach to conservation. Internationally, The Nature Conservancy has been responsible for the protection of millions of acres in 1,600 preserves -- the largest private system of nature sanctuaries in the world. This Task has been accomplished through a variety of tools, including land acquisition, land donations, conservation easements, and management agreements. The Conservancy's approach to conservation has not changed much since the 1970s. It still uses the best scientific methods to identify, protect and manage elements of biodiversity and their associated habitat. However, an important new method is emerging through the establishment of community based projects -- locally based offices that use education and innovative techniques as the means to accomplish the conservation agenda. The Arkansas Field Office is in the process of establishing three such projects, one in the Strawberry River Watershed, one in the recharge area of Bear Hollow Cave, and one in the "Big Woods" of the Mississippi River alluvial plain. Each project will center around the preservation of threatened or rare species, such as the Strawberry River orangethroat darter, *Etheostoma fragi*.

Smallmouth Bass Movements in Crooked Creek during Low Streamflow in Summer

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and
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Natural hydrologic conditions cause the surface flow of many streams in the interior highlands to dry extensively during the summer. Consequently, fish in these reaches must move to more perennial reaches or perish. The objective of this study was to determine how smallmouth bass respond to summer dewatering of Crooked Creek. Twenty-four smallmouth bass were surgically implanted with radio transmitters in late May and early June (1998) and tracked an average of three times a week through August. The 15.2-km study section was already 60% dry (by length) in late June and reached 70% dry by the end of August. In June, net movement for the group of fish ranged from 200 to 900 m upstream of initial capture and release sites. During the remainder of the study, the fish moved less and were found an average of near 400 m upstream, except on three occasions. When water temperature exceeded 30°C for the first time during the study, mean net movement decreased to only 100 m upstream. Twice when water temperature reached it lowest point at 26°C, mean net movement increased to 600 m upstream. Most of the fish (66.7%) were still swimming in the stream at the end of the study. Twelve and a half percent of the transmitters were found in the stream with no fish, one of these was found at the bottom of a dried pool. The remaining 20.8% vanished from the study section. In Crooked Creek, the upstream reaches were more perennial; thus, our data were consistent with the hypothesis that smallmouth bass movement patterns increase their chances for survival. This preliminary study will be repeated in 1999 in a section of Crooked Creek that typically dries more extensively.

Assessment of Gravel Mining on Channel Stability and Other Factors in Crooked Creek

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Arkansas Department of Pollution Control and Ecology, Technical Services Division
Little Rock, AR 72219

Crooked Creek, in the north central part of Arkansas, is a major tributary of the White River, arising near Harrison, Arkansas and flowing in an easterly direction across Boone and Marion Counties to the White River. Crooked Creek is one of the most intensively mined streams in the Ozark region for river gravel. This survey was done to evaluate the effects gravel mining may have on an Ozark Highland stream and, if feasible, to develop a methodology for quantitatively measuring gravel mining effects.

A total of twenty stream sites were initially investigated to assess their potential as survey sites. Of these twenty, six sites were selected. These included two sites where gravel mining had taken place (disturbed sites), two “least disturbed” sites, at which no gravel mining had taken place, one site about 1/2 mile below one of the mined sites (a “downstream” site), and a site about 1/2 mile above a mined site (an “upstream” site).

From this work, a rational method has been developed to quantify physical changes that may occur at mined sites. In addition, a family of stream geometry curves and equations have been developed that provide the width, depth, and cross-sectional area for stable, least disturbed streams. These curves can be used at a given site to determine if stream channel geometry and shape have become unstable or altered from a normal configuration. They can also be used for stream restoration at sites where channel geometry has been altered.

Stream channel geometry, such as the ratio of the stream width to its depth (width to depth ratio) and cross-sectional area, was different at disturbed sites compared to least disturbed sites. Width to depth ratios and the ratio of cross-sectional area in square feet to the drainage area in square miles were both over twice as large compared to least disturbed sites. These changes contribute to channel instability, such as increased lateral channel migration and associated bank erosion.

Three of the sites surveyed had a change in the stream cross-sectional area of 20% or more, including both scouring and deposition of gravel, over the survey period. The amount of gravel loss or deposition at these sites, if occurring uniformly over 100 feet of channel length, would amount to about 60 or more dump truck loads of sand and gravel for every 100 feet of channel length. Gravel loss was occurring at the “upstream” site, and gravel deposition was occurring at sites where channel geometry had been altered by mining (the disturbed sites).

Instream fish cover was lowest at a recently mined “disturbed site” compared to the other sites. Smallmouth bass cover was lost. Large boulders located in a pool were imbedded due to upstream material washing down from a mined site, and cover was lost at a mined site when the original stream channel was abandoned and started flowing down the excavated mine site.

The amount of fine material, such as sand and silt, increased downstream of mined sites. Fine material equal or less than 1 mm in size averaged 37% below a “disturbed site” and 7% at a “least disturbed” site.

Based on limited sampling, instream water temperature increased downstream of mined sites. A temperature of 33.3 degrees Celsius was measured just downstream of a mined site. Optimum temperature range for growth of smallmouth bass is 28 to 29 degrees Celsius.

To preserve normal stream channel stability and maintain localized instream fish cover, gravel mining should not take place below the bankfull depth elevation, except at selected sites as determined by a case by case evaluation.

Putting the Crooked Back in the Creek

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Crooked Creek is a nationally known smallmouth bass (Micropterus dolomieu) stream in north central Arkansas. Various land use patterns and watershed/channel alterations, particularly instream gravel mining and riparian area clearing, have modified the creek in some areas. These land use changes, in turn, accentuate the damaging effects of floods on the creek's channel and the riparian area. A section of Crooked Creek near Yellville was such an area, where an inadequate riparian area, coupled with previous gravel mining on a point bar allowed the creek to cut across a bend in the river, effectively shortening the creek's length and increasing the local gradient. This bendway cut began a serious erosion problem on the new primary channel bank with the landowner losing 2-3 m of bank per year. Local Arkansas Game and Fish Commission fisheries biologists worked with Arkansas Stream Team personnel, Natural Resource Conservation Service professionals, county conservation agents, and the landowner to repair this eroding bank and channel capture. The necessary funding for the project ($26,336) was primarily taken care of using NRCS's Environmental Quality Incentive Program Farm Bill Program, AGFC's manpower and equipment donation, the Arkansas Stream Team grant money, and out-of-pocket and in-kind contributions from the landowner. Monitoring of the site has demonstrated that rehabilitation of the creek and riparian area has been successful, largely through the use of "soft" biotechnology to control bank erosion and to move the creek from the new modified and highly erosive channel back into the old, established and relatively stable channel.

Selection of Spawning, Minimum, and Temperature Control Flows
in the Tailwaters of Bull Shoals and Norfork Dams

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Although trout (particularly brown trout) in Arkansas' White River System already reach world-class proportions, historic challenges to trout management exist in these tailwater fisheries. Specifically, inadequate minimum flows, and episodes of warm water temperatures are detrimental to the further development of these fisheries. Typically used methods of determining suitable flows are difficult if not impossible to apply due to the extreme water level fluctuations found in peaking power tailwaters in the White River System. Therefore TVA's ADYN-RQUAL Dynamic Flow Model was chosen for application to the tailwaters of Bull Shoals and Norfork dams.

Objectives of the modeling included the development of flow regimes suitable for wild brown trout (Salmo trutta) spawning (redd construction), increased permanent wetted area, and water temperature control during off-peak hydroelectric demand. Techniques unique to the ADYN-RQUAL Model such as high resolution aerial videography, rhodamine dye tracing, and continuous on-site meteorological and water temperature monitoring were applied along with more commonly used flow determination methods such as channel transects during 1996.

Various alternatives to achieving the stated study objectives are presented along with recommended release options. Additional applications of the ADYN-RQUAL Model include a dissolved oxygen reaeration subroutine and brown trout bioenergetics. Implementation of the recommended flow regime and other applications should further increase reproduction of wild brown trout, and growth and carrying capacity of all trout in these nationally known waters.

USFWS Ecological Services Office in Conway

Raye Nilius
Farm Bill Coordinator
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My presentation will be a broad overview covering the FWS mission, history of the Arkansas Field Office which opened in Conway in August, 1998, and the services we offer.

Education:
B.S. Biology 1990, Athens State College, Athens, Alabama.
M.S. Biology 1998, University of Central Arkansas, Conway, Arkansas. Research: Energy flow in stream ecosystems - the River Continuum Concept.

Experience:

Regulatory Project Manager/Biologist, U.S. Army Corps of Engineers, Little Rock District, 1992-1998. Section 404 permitting, wetland identification and delineation, wetland mitigation and restoration, mitigation banking, hydrogeomorphic functional methodology

Farm Bill Coordinator, U.S. Fish and Wildlife Service, Arkansas Field Office, 10-26-98 to present. Provide support and technical assistance to NRCS and private landowners regarding Wetland Reserve Program, Conservation Reserve Program, Environmental Quality Incentives Program and NRCS' other conservation programs. Develop wetland mitigation and restoration plans, conduct wetland functional assessments, and provide technical assistance on swampbuster activities.

Use Of Hydraulic Habitat Data Collected at Multiple Spatial Scales for Evaluating the Use of Micro-Scale Habitat Data

Edmund J. Pert* and Donald J. Orth
Virginia Tech
Blacksburg, VA

We collected habitat data (depth and velocity) in a Sierra Nevada river for young-of-the-year (YOY) rainbow trout at three spatial scales surrounding the exact point where fish were located (microhabitat) in order to assess whether the depth and velocity of micohabitat differed from the area surrounding the point where microhabitat is collected. Our objectives were: 1) To determine if microhabitat data collected for YOY rainbow trout is representative of the surrounding habitat, up to 1 square m in size. 2) To compare fish habitat data for YOY rainbow trout collected at three different spatial scales, up to 1 square m in size. 3) To determine patterns in spatial habitat arrangements surrounding YOY rainbow trout that are likely to influence habitat selection. We found that micro-scale habitat was not representative of much of the surrounding habitat, and habitat measured at different spatial scales differed in important ways. In addition we noted characteristic patterns of hydraulic conditions that offered insight into YOY trout habitat selection. Based on our results, we feel that the standard techniques of using microhabitat data may be unsuitable for describing the hydraulic conditions that YOY trout use to select stream position. If flawed, frequently-used techniques to collect microhabitat data could result in inappropriate prescription of instream flows.

* Current: Aquaculture and Fisheries Department, University of Arkansas at Pine Bluff

Degree of Cottus Predation on Trout Eggs/Fry in the Bull Shoals Lake Cold Tailwaters

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In the Greers Ferry Lake cold tailwater, brown trout grow well to a length of approximately 14-16 inches, then growth declines. At this size, diet typically becomes piscivorous. In the Bull Shoals and Norfork cold tailwaters, trout at this size primarily utilize sculpins as food. Sculpins are not present in the Little Red River system. Introduction of sculpins has been discussed. However, sculpins may predate trout eggs or compete for benthic invertebrates. To clarify this potential problem, sculpins (kick seine) and benthic invertebrates (Portable Box Sampler) have been collected monthly from two stations in the Bull Shoals Lake cold tailwater since summer 1998. More recently, sculpin-size brown trout have been collected monthly by electroshocking. The sampling program is nearly complete, and analysis of data continues.

An Overview of the Relation between Biological Communities and Environmental Factors in the Ozark Plateaus, Including Preliminary Analyses of Macroinvertebrate and Periphyton Data

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The U.S. Geological Survey has been conducting a water-quality study of the Ozark Plateaus of Arkansas, Kansas, Missouri, and Oklahoma as part of the National Water-Quality Assessment (NAWQA) Program since 1991. Land use and other human activities appear to have substantial effects on factors such as nutrients, fecal coliform bacteria, organic compounds, trace metals, and riparian shading. One objective of this study is to investigate the relation between fish, invertebrate, and periphyton communities and other environmental factors, including water quality.

Fish communities of streams in predominately agricultural and forest settings differ noticeably. Communities in agricultural settings typically have a greater relative abundance of stonerollers and a lesser relative abundance of darters and sunfish than communities in forested settings. De-trended correspondence analysis, canonical correspondence analysis, and two-way indicator species analysis (TWINSPAN) indicated that land use can influence fish community structure of Ozark streams. Water quality, substrate, stream morphology, and riparian measures appear to be affecting these fish communities.

Invertebrate and periphyton data collected during 1993-1995 have been analyzed only in a preliminary and simplistic manner. Preliminary results indicate some differences exist between communities of streams draining forests and communities of streams draining agricultural and urban areas. Streams draining agricultural and urban areas usually had greater density of benthic macroinvertebrates and greater biovolume of blue-green algae. However, substantial variation in these data suggests that factors other than land use (such as water quality, stream morphology, velocity, substrate, and riparian measures) were important in determining density and biovolume of invertebrates and periphyton. More detailed study of the invertebrate and periphyton data, including use of biological metrics and multivariate analysis could determine if differences exist in the condition of these communities. More detailed analysis of the habitat data could characterize the importance of environmental factors such as water quality, velocity, depth, substrate, and shading. From these results, better understanding of the relation between biological communities and environmental factors (including water quality) could be achieved.

Effects of Blue Catfish, Ictalurus furcatus, Predation on Zebra Mussels, Dreissena polymorpha, in Lake Dardanelle on the Arkansas River

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We examined whether blue catfish could be potential predators on the introduced zebra mussel in the Arkansas River's Lake Dardanelle and how this might effect catfish bioenergetics. Prey selections were determined by examining gut contents of blue catfish ranging in size from 200-625 mm between July 1996 and January 1999. Zebra mussels were the primary prey selected by blue catfish from spring through fall, while shad, Dorosoma sp., were the primary prey during the winter. Blue catfish preyed on whole zebra mussels ranging in number from 1-589 mussels within a fish. Sizes of mussels ranged from 1-23 mm in total shell length. For blue catfish, unlike other zebra mussel predators, all zebra mussel sizes are consumed for most of the year. Therefore, they may aid other predators in significantly suppressing zebra mussel densities.
Bomb calorimetry revealed that whole shad averaged 6507 cal/g dry wt., zebra mussels 367 cal/g dry wt., and Asian clams, Corbicula fluminea, 351 cal/g dry wt. The large contrast in calories between fish and mollusc is a result of the shell biomass. Ashing revealed that zebra mussel are 91-95% ash, Asian clams 84-94% ash, and shad 11-22% ash. Thus, zebra mussels appear to be bioenergetically less valuable than other prey items. They may be taking up space and time within the gut, but provide little return. However, their high densities and ease of capture may compensate for this deficiency making them more profitable than their lower density predecessor the Asian clam. Further study is needed to clarify these findings and determine the effects this will have upon the ecology, bioenergetics, inter- and intraspecific competition, and populations of fish and mollusc species within Lake Dardanelle and the Arkansas River system.

Egg Staging of Pre-spawn Walleye in Lake Hamilton and Lake Catherine Arkansas

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A technique was developed in the spring of 1994 to stage pre-spawn walleye by taking a sample of the eggs using a glass catheter. Eggs from female walleye were graded from stage 1 through 4 with 4 being the closest to ovulation. Stage four fish were brought to the hatchery for spawning while stage 1 through 3 walleye were returned to the lake. One hundred percent of stage 4 fish ovulated after being returned to the hatchery and placed into hatchery holding tanks with temperatures only one to five degrees higher than the lake. No hormone injection or other spawning manipulation was necessary. Degree of egg fertilization and survival is directly related to how soon after ovulation the females are stripped of eggs.

Culture of Sunshine Bass in Tanks using Natural Zooplankton as a First Food

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Several investigators and large growers have achieved moderate success feeding cultured rotifers to fry raised in tanks. However, the effort and cost of raising algae for the rotifers, and rotifers to feed the fry is high. Our approach consisted of harvesting zooplankton from fertilized fingerling ponds, concentrating the appropriate size fraction (60-150 microns) using a rotating drum filter, and delivering the concentrate to fry. Our objectives were: 1) to verify that appropriate amounts of natural zooplankton could be harvested from ponds and delivered to fry; and 2) to obtain growth and survival estimates for tank-raised sunshine bass fed natural zooplankton. Two studies were conducted with concentrations of 50, 500, and 5000 food items per liter (study 1) and 5000, 10,000, and 15,000 food items per liter. There were three replicates for each of the treatments in both studies. Five-day-old sunshine bass were stocked at rates of 50 fry per liter (study 1) and 20 fry per liter (study 2) into 280-liter cylindrical black tanks. Fry were fed fresh zooplankton each morning. After eight days the diets were supplemented with a formulated meal at a rate of 5 g per tank per day split into three feedings. Each week 20 fry from each tank were collected and videotaped for growth analysis. The number of surviving fry was determined for each tank after a six-week period. All the fry in the 50 and 500 food items per liter treatments from study 1 were dead by the end of the first week. Growth rate of fry from study 1 was 0.69 mm/day. Five week survival in all three treatments of study 2 was less than 1%. Growth rates for the 5,000, 10,000, and 15,000 prey items per liter were 0.85, 0.91, and 0.79 mm/day, respectively. There was considerable variability in growth in both studies. Length at five weeks for fish in the 5000 prey items per liter treatments ranged from 23 to 35 mm in study 1 and from 27 to 47 mm in study 2.

Predation on Sunshine Bass Fry by Cyclopoid Copepods

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Low and variable survival rates have been observed for sunshine bass fry in rearing ponds after following the standard procedures used to stock striped bass and palmetto bass fry. A mismatch between sunshine bass fry and forage of suitable size is regarded as the primary cause of mortality among the fry. Sunshine bass fry are about 3-6 mm (total lenght) and smaller than striped and palmetto bass fry (6-9 mm total lenght). Sunshine bass fry require a diet composed primarily of rotifers and nauplii since their ingestion capability is exceeded when large cladocerans and copepods dominate the zooplankton community. Although starving represents an important factor, mortality could also be due to direct predation on the fry by carnivorous copepods. To test this hypothesis, recently hatched sunshine bass fry were exposed to a concentration gradient of cyclopoid copepods (0, 5, 50, and 500 copepods/lt) during 24 hours. No significant differences in survival rates were found among the first three treatments, but the fry sample was wiped out in the last treatment (500 copepods/lt). Adult copepods are routinely found at those densities in fertilized ponds. Results of this research indicate that sunshine bass fry should be stocked in ponds containing zooplankton in the early stages of the succession to guarantee presence of suitable forage and to avoid predation by the larger zooplankton. Precautions should be adopted if pond water is going to be reused.

Comparison of Depletion Method Estimates for Use in Catfish Production Ponds

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A recently published study from researchers at the University of Arkansas, Pine Bluff found that the multiple-pass depletion method was useful for estimating the remaining, non-harvested catfish (Ictalurus punctatus) in aquaculture ponds. These researches used linear regression analysis to estimate the total weight of fish in ponds. Besides linear regression analysis, other methods can be used to estimate population size or total weight of fish using depletion data. The objective of this study was to determine if other population estimators more accurately predict total channel catfish weight in aquaculture ponds. Using the same data sets as the previous researchers, we estimated the total weights of channel catfish using a two-step-method estimator and a maximum-likelihood estimator. The two-step-method estimator consistently underestimated total catfish weight. However, this method may be useful under some conditions. Statistical analyses used for comparing the accuracy of all methods are under way.

Zooplankton Sampling Associated With Hybrid Striped Bass Culture

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Zooplankton production is an integral part of hybrid striped bass culture. Certain protocols are used by culturists to determine stocking times and stocking densities, which in turn enhance survival. While much is still unknown about water quality parameters and zooplankton densities, it has been determined that a minimum number of organisms per liter are necessary for hybrid striped bass survival. It is critical that measures are taken to ensure that there is an initial food source, especially small zooplankters such as rotifers, in place prior to stocking fry. The data we have accumulated at the Andrew Hulsey Hatchery from 1993-98 has shown those factors such as organisms/liter and rotifer percentage plays a vital part in hybrid striped bass fry survival.

Mammoth Springs NFH

Dewayne French

Mammoth Spring NFH is located in North Central Arkansas at the mouth of one of the world's largest springs with an average flow of 9.78 million gallons per hour. The high quality water at a constant temperature of 58 degrees F and a pH of about 7, coupled with a unique pond- raceway culture system makes the hatchery ideal for rearing a wide variety of fish and other aquatic organisms. Recently, with redefined priorities within the USFWS, the hatchery has begun to focus on restoration of species at risk, including paddlefish, sturgeon, and freshwater mussels. Paddlefish production has been ongoing at the hatchery for several years with production in 1998 exceeding 100,000 fingerlings and sub-adults. Fish production is coordinated with the Mississippi Interstate Cooperative Resource Association and fish are distributed back into their native watersheds in Arkansas, Missouri, Tennessee and surrounding states.