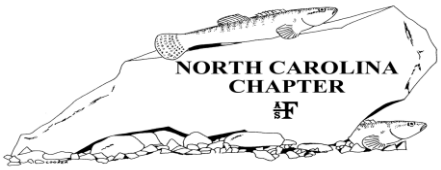
The Virginia and North Carolina Chapters

of

The American Fisheries Society

2007 Meeting Program



February 26 – 28, 2007
Comfort Inn
Danville, Virginia

Meeting Support Provided by:

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2007 Annual Meeting
Virginia & North Carolina Chapters of the American Fisheries Society
Danville, VA

Monday, February 26, 2007

3:00 – 4:00 Registration – Conference Center Lobby

5:00 – 6:00 VA Chapter AFS business meeting

7:30 – 9:30 Social (light)

Tuesday, February 27, 2007

8:00 – 8:30 Registration – Conference Center Lobby

8:30 – 8:40 Welcome and Introductions: Dan Michaelson, VA AFS President and Lawrence Dorsey, NC AFS President

8:40 – 9:00 Techniques for aging and population characteristics for grass carp from Lake Gaston. Cory Kovacs, Catherine Lim, Mike Isel and Victor DiCenzo, *VA Department of Game and Inland Fisheries*

9:00 - 9:20 Intensive grass carp stocking effects on reservoir invasive plants and native fish populations. Alan Garner and Thomas Kwak*, NCSU,* Hugh Barwick and Kenneth Manuel, *Duke Energy*

9:20 – 9:40 Survey of Lake Gaston walleye anglers identified through tag returns. Kirk Rundle, *NC Wildlife Resources Commission*

9:40 – 10:00 Zooplankton assemblages as key indicators of larval fish predation in Claytor Lake Virginia. Thomas Shahady, *Lynchburg College*, and John Copeland, *VA Department of Game and Inland Fisheries*

10:00 – 10:20 Evaluating property owner willingness to implement shoreline habitat improvement techniques. Robert Barwick, *NC Wildlife Resources Commission*, and W. Gregory Cope, *NCSU*

10:20 – 10:40 BREAK

10:40 – 11:00 Integrating gear bias and selectivity into development of a standardized fish sampling protocol for Puerto Rico streams. Christin Brown, Thomas Kwak, Patrick Cooney, and Kenneth Pollock, *NCSU*

11:00 – 11:20 Temporal and spatial patterns of anadromous fish passage at Bosher's Dam vertical slot fishway on the James River, Richmond, Virginia. Matt Fisher, *VA Department of Game and Inland Fisheries*

11:20 – 11:40 Comparison of prepositioned areal electrofishing grids and two-way resistance board weirs for assessing migrating stream fish populations. Scott Favrot and Thomas Kwak, *NCSU*

11:40 – 12:00 Comparison of split-beam and DIDSON hydroacoustic gears for conducting sturgeon surveys. Kevin Magowan and Joseph Hightower, *NCSU*, Lori Brown and Dewayne Fox, *Delaware State University*

12:00 – 1:20 LUNCH

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1:20 – 1:40	Smallmouth bass management in the New River, Virginia: a case study of population trends with lessons learned. John Copeland and George Palmer, *VA Department of Game and Inland Fisheries*, and Donald Orth, *VA Tech*
1:40 – 2:00	Shenandoah River fish kills: effects of water temperature and discharge during spawning periods. Nick Brown, Daniel Downey and Thomas Benzing, *James Madison University*
2:00 – 2:20	One out of three ain't bad – or – the nonindigenous fishes of the Yadkin – Pee Dee river basin. Bryn Tracy, *NC Division of Water Quality*
2:20 – 2:40	Hickory shad spawning habitat in the Roanoke River, North Carolina. Julianne Harris and Joseph Hightower, *NCSU*
2:40 – 3:00	Genetic marker-assisted restoration of the presumptive native walleye stock in the New River, Virginia. George Palmer and Joe Williams, *VA Department of Game and Inland Fisheries*, Mark Scott, *WV Department of Natural Resources,* Kathy Finne, Nathan Johnson, Daniel Dutton, Brian Murphy and Eric Hallerman, *VA Tech*
3:00 – 3:20	BREAK
3:20 – 3:40	Trophic relations of introduced flathead catfish in a North Carolina Piedmont river. Jessica Brewster and Thomas Kwak, *NCSU*
3:40 – 4:00	The effects of stream resources on fish and macroinvertebrate nutrient composition and nutrient excretion. Ryan McManamay and Jackson Webster, *Virginia Tech*
4:00 – 4:20	Effects of small flood control dams on upstream and downstream water chemistry and fish populations. Springli Payeur and Daniel Downey, *James Madison University*
4:30 – 6:00	NC AFS Business Meeting
7:30 – 10:00	Social

Wednesday, February 28, 2007

8:40 – 9:00	Evaluation of largemouth bass populations in three water supply reservoirs near Greensboro, North Carolina. Corey Oakley, *NC Wildlife Resources Commission*
9:00 – 9:20	Food and floods: understanding factors that influence stream trout movement. Morgan Hyatt and Charles Gowan, *Randolph-Macon College*, D. Brad Fink, Jeremy Shiflet, and Mark Hudy, *US Forest Service*
9:20 – 9:40	Otolith microchemistry determination for heavy metals pollution assessment. Philip Janney and Daniel Downey, *James Madison University*
9:40 – 10:00	BREAK
10:00 – 10:20	Black crappie (*Pomoxis nigromaculatus*) performance in a Virginia small impoundment following the implementation of a 229-mm minimum size limit. Steve Owens, *VA Department of Game and Inland Fisheries*
10:20 – 10:40	"I'm from VA-DEQ, and I am here to help": implementing Virginia's local and regional Water Supply Planning Program. Adrienne Averett, *VA Department of Environmental Quality*
10:40 – 11:00	After the storm: SDAFS disaster relief actions and recommendations. Robert Curry, *NC Wildlife Resources Commission* and Danielle Pender

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11:00 – 11:20 Preliminary impacts of the Three Gorges Dam on fisheries of the Yangtze River, China: the problems are only beginning. Brian Murphy, *VA Tech*, and Xie Songguang, *Chinese Academy of Sciences*

ADJOURN

POSTER Smith River tailwater: opportunities for enhancement of habitat ofr native and introduced fishes. M. Anderson, G. Buhyoff, P. Diplas, C. Dolloff, A. Hunter, C. Krause, T. Newcomb, D. Novinger, and D. Orth, *VA Tech*

POSTER Water chemistry of Smith Creek: effects on land use and riparian zone protection to date. Ania Austin and Daniel Downey, *James Madison University*

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Abstracts

VIRGINIA CHAPTER *of the*
AMERICAN FISHERIES SOCIETY

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After the Storm: SDAFS Disaster Relief Actions and Recommendations.

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On 29 August 2005, Hurricanes Katrina and Rita devastated large portions of Louisiana and Mississippi and caused significant impacts to Alabama, Florida, and Texas. Shortly thereafter, AFS President Chris Kohler established the AFS Hurricane Relief Task Force, and the AFS Disaster Relief Program, administered primarily through the Southern Division of the AFS (SDAFS), assumed full responsibility for hurricane relief in June 2006. The Parent Society allocated $30,000 to the SDAFS to address disaster relief operations for 2006. Funds were used to provide complementary, temporary, AFS memberships, electronic journal subscriptions, and travel awards to attend AFS meetings for affected members and to staff the Disaster Relief Distribution Center. Financial and material donations were received from over 30 individuals, Sections, Chapters, and Divisions and have been distributed to those in need. Aid will continue to be provided to affected members in the form of travel assistance and the coordination of donated material items through 31 December 2007. Guidelines will be formed for AFS to assist members for future natural disasters.

Black Crappie (*Pomoxis nigromaculatus*) Performance in a Virginia Small Impoundment following the implementation of a 229-mm Minimum Size Limit

Steve Owens, Virginia Department of Game & Inland Fisheries, 1320 Belman Road Fredericksburg, VA 22401 Steve.Owens@dgif.virginia.gov

Black crappie (*Pomoxis nigromaculatus*) population dynamics were evaluated in spring 2002 in four northern Virginia public fishing lakes to determine candidates for size structure enhancement. Based on FAST models, Lake Orange (50-ha) was deemed to have acceptable population parameters that could benefit from restrictive harvest (growth was fast to age-3, but total annual mortality was estimated at 56%). In March 2003, 735 crappies were Floy tagged at Lake Orange to estimate exploitation. Between March and October 2003, 182 tagged fish were reported for an unadjusted 25% fishing mortality rate. An access point creel survey has been conducted since 2003. Black crappie harvest in 2003 was 2,681 fish (mean TL 214-mm, mean WT 0.13 kg) and an overall yield of 333 kg. In order to reduce angler exploitation and to allow crappie to maximize growth potential, a 229-mm minimum size limit was implemented January 1, 2004. Since implementation of the minimum size restriction, mean TL of harvested fish increased from 214-mm (2003) to 245-mm (2006). Similarly, yield increased from 333 kg to 677 kg. Mean WT also increased from 2003 to 2006 (0.13-0.21 kg). In spring 2005, 541black crappie were tagged to re-evaluate angler exploitation during 2005. By fall, 124 tagged fish had been creeled for an un-adjusted exploitation rate of 22%. During 2005, anglers harvested 2,388 fish followed by an increased harvest during the 2006 fishing season of 3,244 fish. The minimum size restriction may have allowed the size distribution of black crappie to improve at Lake Orange. Number of fish harvested decreased from the pre-regulation period for two years before surpassing pre-regulation harvest figures. Mean TL, mean WT, and overall yield increased post-regulation. Future analysis will evaluate year class effects and monitor changes to population dynamics following the regulation change.

Comparison of Prepositioned Areal Electrofishing Grids and Two-Way Resistance Board Weirs for Assessing Migrating Stream Fish Populations

Scott D. Favrot and Thomas J. Kwak, U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit Box 7617, North Carolina State University
Raleigh, NC 27695

Many species of freshwater stream fish are known to migrate seasonally for reproduction or other ecological functions. Quantifying lotic fish communities and their movement patterns provides critical information for management of streams and rivers. We compared catch efficiency and composition of stream fishes during the spring spawning period using two different techniques: (1) prepositioned areal electrofishing grids (PAEDs) and (2) two-way resistance board weirs. We deployed both gears concurrently at two sites in Valley River, a North Carolina mountain stream in the Hiwassee drainage, from April through June 2006. Total PAED catch (815 fish) was much higher than total weir catch (285 fish) and was dominated by cyprinids and catostomids for both techniques. However, biomass of the PAED catch (127.5 kg) was much lower than that of the weir catch (209.2 kg), indicating fewer, but larger fish captured in weirs. Community measures were higher for species richness in PAED catch relative to weir catch, but diversity, evenness, and species dominance were similar between the two techniques. Fish catch in weirs was greatly reduced after a peak in fish spawning. PAEDs provided occupancy data of the community, while weirs described migration chronology for highly migratory redhorses (*Moxostoma* spp.). We conclude that both sampling techniques are valid approaches to quantify fish communities, but weirs should be employed when objectives focus on migration.

Comparison of Split-Beam and Didson Hydroacoustic Gears for Conducting Sturgeon Surveys

Kevin J. Magowan, NC Cooperative Fish and Wildlife Research Unit, NC State University, Box 7617, Raleigh, NC Lori Brown, Delaware State University, College of Agriculture and Natural Resources, 1200 N. Dupont Highway, Dover, DE
Dewayne A. Fox, Delaware State University, College of Agriculture and Natural Resources, 1200 N. Dupont Highway, Dover, DE Joseph E. Hightower, U.S. Geological Survey, NC Cooperative Fish and Wildlife Research Unit, NC State University, Box 7617, Raleigh, NC

Population estimates are valuable for managing fisheries and assessing the status of rare species. In large rivers, one common approach for estimating population size of anadromous fish is to count upstream-migrating fish at a fixed site, using split-beam hydroacoustic equipment. Echoes produced as a fish passes through the beam can be used to estimate fish size, range, position in the water column, speed and direction of movement. One disadvantage of split-beam transducers is that they provide no information about species identification. A newer technology that can be used to count upstream migrants is the DIDSON, a high-definition imaging sonar that provides near-video quality images. When used at a range of 5-10 m, video files clearly show body shape including fin placement, size, and swimming behavior of individual fish. In hatchery pond experiments, two size classes of Atlantic sturgeon were differentiated with a high degree of certainty using split-beam and DIDSON technologies. Split-beam gear provides more precise information about fish position, but DIDSON data are much easier to interpret, can be used to identify sturgeon to genus, and allow for on-screen measuring of fish lengths. Initial field trials showed potential for utilizing these technologies to determine habitat, identify sturgeon, and estimate densities.

Effects of Small Flood Control Dams on Upstream and Downstream Water Chemistry and Fish Populations

Springli M. Payeur and Daniel M. Downey, Department of Chemistry, MSC 4501, James Madison University, Harrisonburg, Virginia 22807

Chemical and physical parameters of three first order headwater trout streams in western Rockingham County, Virginia were investigated. The watersheds of all three streams were similar in topography, geology, elevation and forest timber stands. Two of these streams, Skidmore Fork and Dry Run, have small flood control dams and reservoirs while the third stream, Gum Run had a proposed dam that was not constructed. Sampling sites were established upstream and downstream of the reservoirs and at equivalent locations on the free flowing stream to assess the effects on aquatic chemistry. Temperature, pH, turbidity, conductivity, total organic carbon, biochemical oxygen demand, silica, ammonium, calcium, magnesium, potassium, sodium, chloride, nitrate, sulfate, and alkalinity were determined for each sampling site. Discharge, fish populations and pool stratification were also measured. The construction characteristics of the dams and risers were evaluated. Statistically significant differences were found for temperature, turbidity, ammonium, calcium, magnesium, potassium, sodium, chloride, nitrate, sulfate, and alkalinity ($p < 0.05$). All other chemical parameters showed no statistically significant differences. Fish populations differed in numbers, species and biomass upstream and downstream. Dry Run Dam may exert detrimental effects on fish populations, fish diversity and aquatic chemistry due to surface release of warm water. Switzer Dam on Skidmore Fork could provide beneficial effects for coldwater fish populations as there is the potential for metalimnionic water release.

The Effect of Stream Resources on Fish and Macroinvertebrate Nutrient Composition and Nutrient Excretion

Ryan A. McManamay, M.S. Candidate, and Jackson R. Webster, Professor Department of Biological Sciences, Virginia Tech

Stream resource nutrient availability can influence fish and macroinvertebrate consumers by two mechanisms: 1) altering body nutrient composition or 2) altering nutrient excretion by consumers. In turn, nutrient excretion by consumers can influence nutrient availability to primary producers and microbial organisms. Due to stoichiometric laws of chemical equations, reactants must equal products. Stoichiometry also applies to ecological interactions such as consumer/resource nutrient dynamics. Several studies have evaluated the effect of nutrient concentrations on consumer nutrient levels and indicate that consumer body nutrient levels are relatively stable. Therefore, our prediction is that if resource nutrient levels change, consumer nutrient excretion must change. This study was conducted to determine whether riparian canopy cover affected resource nutrient levels and if that, in turn, influenced macroinvertebrate and fish nutrient excretion. The study was conducted on two streams at Coweeta Hydrologic Laboratory in western North Carolina, two sites on one stream in Floyd Co., VA, and at two streams located within Grayson Highlands State Park, VA. Streams were selected differing in the amount of riparian cover and background water nitrogen and phosphorus concentrations. Forested streams ranged from 89 – 99% canopy cover while open streams ranged from 1 – 24%. Streams ranged in elevation from 2200 ft to 4500 ft. Seven different fish taxa and eleven different macroinvertebrate taxa were collected and nutrient excretion was quantified. Macroinvertebrates of fish gut contents were identified to order. Brook trout diet was composed of 73% terrestrial drift in open streams as compared to a 49% terrestrial diet in the forested stream. Across all sites rainbow trout had a 48-49% terrestrial diet, while mottled sculpin and dace had a 85-100% aquatic diet. Fish and macroinvertebrate excretion varied with taxa. Mottled sculpin had the lowest PO_4^{-3} excretion rate (5 µg $PO_4^{-3} \cdot hr^{-1} \cdot g^{-1}$), while longnose dace and redbelly dace had the

highest (33 µg $PO_4^{-3} \cdot hr^{-1} \cdot g^{-1}$). Central stoneroller had the lowest NH_4^+ excretion rate (45 µg $NH_4^+ \cdot hr^{-1} \cdot g^{-1}$), while brook trout had the highest (185 µg $NH_4^+ \cdot hr^{-1} \cdot g^{-1}$).

Evaluating Property Owner Willingness to Implement Shoreline Habitat Improvement Techniques

Robert D. Barwick District Fisheries Biologist, North Carolina Wildlife Resources Commission, NC Chapter AFS Education and Outreach Committee, 412 Zachary Court, Winterville, NC 28590 and W. Gregory Cope, Associate Professor, Department of Environmental and Molecular Toxicology NC Chapter AFS Education and Outreach Committee Box 7633, NC State University Raleigh, NC 27695-7633

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

Evaluation of Largemouth Bass Populations in Three Water Supply Reservoirs near Greensboro, North Carolina.

Corey Oakley, NC Wildlife Resources Commission, 5600 Pine Meadow Lane Mebane, NC 27302 (919) 563-0220 coreyoakley@mebtel.net

The North Carolina Wildlife Resources Commission in partnership with the City of Greensboro Parks and Recreation Department periodically sample the largemouth bass (*Micropterus salmoides*) populations in Lake Higgins, Lake Brandt, and Lake Townsend in northern Guilford County. The three reservoirs received moderate fishing pressure between March – November 2005 with an average of 1172 visitors per month. The largemouth bass populations in each reservoir were surveyed twice between April 1997 and May 2005 using shoreline electrofishing. All three populations exhibit well balanced fisheries with catch-per-unit-effort exceeding 60 fish/h in Lake Higgins and Lake Brandt and proportional stock density exceeding 70 for all three reservoirs. Growth and body condition of largemouth bass in all three reservoirs were good with fish reaching harvestable size (356 mm) near age 4 and mean relative weight values ranging from 90 – 106 for fish greater than 300 mm. These data indicate that each population provides a quality largemouth bass fishery. There is little indication that the fisheries differ in size structure, condition, and growth. Lake Brandt differs from the other two lakes by possibly providing increased angling opportunity for larger fish (380 – 509 mm). Continued harvest of legal size fish along with good stewardship of aquatic resources

should help maintain these lakes as quality largemouth bass fisheries in the piedmont of North Carolina.

Food and Floods: Understanding Factors That Influence Stream Trout Movement

Morgan Hyatt and Charles Gowan, Randolph-Macon College D. Brad Fink, Jeremy M. Shiflet, and Mark Hudy, USDA Forest Service, Fish and Aquatic Ecology Unit, James Madison University, Harrisonburg, VA 22807

Stream salmonids feed by positioning themselves in the current, capturing prey as it drifts downstream. Trout choose feeding locations ("focal points") based on maximizing energy intake, and they live in dominance hierarchies with bigger fish having access to the most profitable positions. The quality of different focal points changes over time due to variation in stream flow, temperature, and prey abundance, but at any instant trout appear to be optimally distributed throughout the stream. This indicates that stream trout make ongoing decisions about where to forage and must periodically move to find better locations. Brook trout (*Salvelinus fontinalis*) were observed in Fridley Run, a stream near Harrisonburg, Virginia, to determine the influence of spatially-variable food availability on movement. We increased prey abundance to four study pools in a 220-m study reach using automatic feeders that delivered prey items at a known rate. Five additional pools served as controls. Our objective was to determine if fish moved among pools to locate the food. Behavior of individually-marked fish was monitored from covered viewing stations on the stream bank under natural conditions and during feeding. Under natural conditions, 1 of 23 fish moved between pools over a 4 day period. The study was interrupted by three days of rainfall that increased flows for the remainder of the study, making observations difficult but giving me the opportunity of examine the influence of an extreme flood event on fish movement and population size. Adult trout (>75 mm) populations in the reach declined from 98 (SE=4.05) prior to the flood to 77 (SE=2.37) after. Of 23 fish observed prior to the flood, 6 remained in their same pool, 2 moved upstream, 2 moved downstream, and 13 were not observed after the flood. During feeding trials after the flood, only one of four pools with feeders was found by a marked fish. In conclusion, fish movement occurred in Fridley Run, but much work remains to be done in terms of understanding why fish move.

Genetic Marker-Assisted Restoration of the Presumptive Native Walleye Stock in the New River, Virginia

George C. Palmer, Virginia Department of Game and Inland Fisheries, 1796 Highway 16 Marion, VA 24354, Joe Williams, Virginia Department of Game and Inland Fisheries, 2206 South Main Street Blacksburg, VA 24060, Mark Scott West Virginia Division of Natural Resources, 2006 Robert C. Byrd Drive, Beckley, WV 25801, USA
Kathy Finne, Nathan Johnson, Daniel Dutton, Brian Murphy, Eric M. Hallerman**,** Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061-0321, USA

The increasing importance of the walleye (*Sander vitreus*) fishery in the New River, Virginia and recent research findings showing persistence of a presumptive native stock motivated a six-year program of hatchery-based restoration of the native stock. Candidate spawners were collected from spawning areas, and DNA from fin clips was genotyped at two microsatellite loci. Candidates exhibiting alleles at the Svi17 and Svi33 loci characterizing the presumptive native walleye stock were spawned. Their young were reared at one of three fish hatcheries and then approximately 414,000 fingerlings were stocked in riverine sections of the New River in Virginia. Catch rates from spring sampling have increased from an average of 1 fish per hour in 2002 to 17

fish per hour in 2006 throughout the stocked area. This restoration project utilizing genetic marker-assisted selection of native broodstock is the first of its type for walleye.

Hickory Shad Spawning Habitat in the Roanoke River, North Carolina

By Julianne E. Harris and Joseph E. Hightower Presenter: Julianne Harris, Graduate Student, North Carolina State University

Hickory shad (*Alosa mediocris*) is an anadromous clupeid that spawns in coastal rivers from Maryland to Florida. Although it is the dominant clupeid in some systems, relatively little is known about its life history and habitat preferences. Spawning pads and plankton tows were used to collect hickory shad eggs in the Roanoke River, North Carolina, during the springs of 2005 and 2006. Objectives were to evaluate efficiency of the two gears, timing of the spawning run and specific habitat requirements for spawning. Environmental parameters including dissolved oxygen, water temperature, sediment type and water velocity were measured at each spawning pad on each sampling date. Plankton tows more efficiently collected hickory shad eggs, but spawning pads were more useful for examining habitat characteristics. Hickory shad spawned in the Roanoke River from mid-March to mid-April at water temperatures between 10.2 and 18.7 °C. Water velocity and sediment type appeared to be the most important factors affecting the location of spawning. Spawning areas were characterized by shallow to moderate depths, moderate to high water velocities and substrates of gravel, cobble and boulder, but lacking silt. Information from this study and others were used to create a preliminary habitat suitability model for spawning hickory shad.

"**I'm from VA-DEQ, and I am Here to Help": Implementing Virginia's Local and Regional Water Supply Planning Program**

Adrienne W. Averett, Senior Water Supply Planner Virginia Department of Environmental Quality

The Local and Regional Water Supply Planning Regulation (9 VAC 25-780), effective November 2005, requires all Virginia localities to develop water supply plans describing how water will be supplied to existing users and foreseen development over a 30 to 50 year period. Inherent in this process is the need to balance environmental protection and future growth. This presentation will briefly review the goals of the water supply planning program and outline the criteria all local governments must follow to develop local or regional water supply plans. Successful implementation requires effective partnerships at the state and local levels. Improved coordination with our fellow agencies will facilitate meaningful dialogue and a value-added water supply plan review process. Together, we are all working to ensure the management and protections of Virginia's water resources meet the long-term needs of her citizens, in an environmentally sound manner.

Intensive Grass Carp Stocking Effects on Reservoir Invasive Plants and Native Fish Populations

Alan B. Garner, Thomas J. Kwak, U.S Geological Survey North Carolina Cooperative Fish and Wildlife Research Unit Box 7617, North Carolina State University, Raleigh, NC 27695 D. Hugh Barwick, Duke Energy Carolinas, 526 South Church Street, P.O. Box 1006 Charlotte, NC 28201-1006 Kenneth L. Manuel, Duke Energy Environmental Center, 13339 Hagers Ferry Road, Huntersville, NC 28078

Grass carp are a common biological control agent for invasive aquatic vegetation. Effective control depends on the stocking rate and the fish's preference for consuming the target vegetation. Our research evaluates the efficacy of using high grass carp stocking rates to control non-preferred vegetation and effects on native fishes. Lookout Shoals Lake, North Carolina, was stocked with triploid grass carp (*Ctenopharyngodon idella*) at a rate of 100 fish per vegetated hectare to assess control of Parrot-feather (*Myriophyllum aquaticum*). Analysis of parrot-feather abundance using in-situ exclosures indicated significant reduction four months after grass carp were stocked. We evaluated fish population distributions in the lake using seasonal shoreline electrofishing prior to, and after, grass carp stocking. Total catch for all fish species at shoreline transects during spring was significantly different after grass carp stocking by number, but we found no significant difference in biomass. Catch rates of largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redbreast sunfish (*Lepomis auritus*), and yellow perch (*Perca flavescens*) were not significantly different after grass carp stocking, with the exception of reduced yellow perch catch during fall. Our initial results demonstrate that intensive grass carp stocking can control an invasive, non-preferred plant and suggest associated changes in fish distributions. The biological significance of the fish distribution changes and long-term effects on lake biota remain undetermined.

Integrating Gear Bias and Selectivity into Development of a Standardized Fish Sampling Protocol for Puerto Rico Streams

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North Carolina State University, Raleigh, NC 27695-7617

Few studies have been conducted on riverine fishes of Puerto Rico, making management difficult. Proper management requires both appropriate gear selection and sampling methods. We evaluated estimating stream fish populations by removal and mark-recapture methods using electrofishing in two Puerto Rico drainages that varied in rainfall and morphology. We conducted a bias assessment and found that a three-pass removal method had less estimated bias than a two-pass removal or a Peterson mark-recapture. To understand how changes in capture probabilities are affected by season, site, habitat, and water quality, we used program MARK to determine the model that best estimated these populations. The model selected, using AIC model selection, estimated the capture probabilities. We found among seasons (spring, summer, and fall), capture probabilities in the spring were statistically greater. Among 12 sites sampled, only one was statistically different in capture probability from the others. Among 18 instream habitat and water quality parameters, only stream width and velocity explained variation in capture probability. We conclude that a three-pass removal is the best method for estimating populations, and that these estimates are affected seasonally, occasionally by site, and by variation in stream width and velocity. These results may be used to define a standardized stream fish sampling protocol for research and biomonitoring in Puerto Rico, and provide insight into sampling small streams elsewhere.

One Out of Three Ain't Bad – or – The Nonindigenous Fishes of the Yadkin-Pee Dee River Basin

Bryn H. Tracy (NC Division of Water Quality, 4401 Reedy Creek Road, Raleigh, NC 919/733-6946; bryn.tracy@ncmail.net)

As part of the North Carolina Division of Water Quality's basinwide water quality monitoring program, more than 250 fish community samples from wadeable streams have been collected

from the Yadkin River basin since 1996. Integrated with fish occurrences in Menhinick's 1991 book, *The Freshwater Fishes of North Carolina*, historical publications dating back to the 1860s, and recent collection efforts by the North Carolina Wildlife Resources Commission, Progress Energy, and the North Carolina State Museum of Natural Sciences, an up-to-date description of the indigenous *vs.* nonindigenous fish fauna has emerged. Currently, 110 freshwater fishes are known from the basin; 33 of these species are believed to be have been introduced, many within the last 50 years, as bait fish, sport fish, or forage fish, through aquarium releases, for aquatic plant management, and for species conservation. More than 80 percent of the sites had at least one nonindigenous species present; at some sites almost 40 percent of the species and 50 percent of the fish by number were nonindigenous. Examples of the historical and recent geographical distributions of select species such as the central stoneroller, red shiner, warpaint shiner, northern hog sucker, and striped jumprock will be presented. General mechanisms aiding and thwarting future introductions and ramifications of introduced species on the native fauna will also be discussed. A better understanding of riverine fish communities may facilitate improved management and conservation of these systems and their faunas.

Otolith Microchemistry Determination for Heavy Metals Pollution Assessment

Philip K. Janney and Daniel M. Downey, Department of Chemistry, MSC 4501, James Madison University, Harrisonburg, VA 22807

The elemental microchemistry of fish otoliths (ear bones) can be used to determine the uptake of heavy metals, and other pollutants in the aquatic environment. An otolith is an aragonitic calcium carbonate ($CaCO_3$) structure that grows continually throughout the life of a fish. The continual deposition of new $CaCO_3$ layers produces growth annuli, similar to those found in trees, which may be biologically inert records of the water chemistry surrounding the fish. Currently, inductively coupled plasma mass spectrometry (ICP-MS) is one of the most sensitive means of conducting trace elemental analysis. Previous studies have determined the bulk contaminant concentrations in otoliths with solution based ICP-MS following an acid digestion of the otolith. The acid digestion leads to a further dilution of trace analytes as well as a failure to utilize the temporal nature of the otolith. Coupling ICP-MS with a laser ablation (LA) sample introduction system, it is possible to directly analyze solid samples with little preparation. Utilizing LA-ICP-MS, it is possible to analyze the individual growth annuli within the otolith in an attempt to develop a temporal record of contaminant uptake throughout the lifetime of a fish. In order to quantitatively report the concentrations of metals within the growth annuli, standards were first produced. To match the otolith matrix, pressed $CaCO_3$ pellets spiked with Hg, Pb, Cu, Zn, and Cr were produced by coprecipitation of the analytes in the $CaCO_3$ matrix. Four standards were produced with concentration levels of 50, 100, 150, and 200 ppb. The analyte concentration within the $CaCO_3$ standards was verified by solution mode ICP-MS. LA-ICP-MS will be used to examine microchemistry of smallmouth bass (*Micropterus dolomieu)* otoliths to develop a temporal record of exposure to heavy metal pollutants Hg, Pb, Cu, Zn, and Cr. The effects of abalation rate, as well as the depth and length of ablation patterns have been studied in order to obtain the most accurate metals analysis of the otoliths.

Preliminary Impacts of the Three Gorges Dam on Fisheries of the Yangtze River, China: the Problems are only Beginning

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The Three Gorges Dam (TGD) is the largest hydroelectric project in the world, and will eventually create a reservoir hundreds of kilometers in length. Work on the structure was completed in spring of 2006, although the dam has been impounding water for two years. Preliminary survey results indicate that the recruitment of important commercial carps (grass carp, bighead carp, silver carp, and black carp) has already declined to a tiny fraction of pre-dam levels, due to disruption of both annual temperature and flow cycles in the river. TGD impacts both below and above the dam are being studied by the Chinese Academy of Sciences, which will lead to design-change recommendations for future hydroelectric projects. Construction of two dams even larger than the TGD has already been initiated in upstream sections of the Yangtze (at Xiangjiaba and Xiluodu). These new dams are the first of more than 20 additional hydropower dams planned for the Yangtze basin. Lessons learned at the TGD offer important considerations for all river impoundment projects.

Shenandoah River Fish Kills: Effects of Water Temperature and Discharge During Spawning Periods

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1. The Shenandoah River system experienced widespread mortality and poor health of many surviving fish primarily of the Centrarchidae family in the years 2004, 2005 and 2006. In 2005 Virginia Department of Environmental Quality and Virginia Department of Game and Inland Fisheries assembled an interdisciplinary task force of scientists and stakeholders to research the fish kills. Although the causes of the fish kills remain a mystery; bacterial lesions, spawning stress and other yet to be established stressors are being evaluated. For the study described in this presentation current and historic temperature and flow regimes have been collected and analyzed. Long term discharge data were available from six USGS gaging stations. Several municipal water treatment plants provided more than twelve years of daily water temperatures. Data was acquired for the South Fork Shenandoah from Front Royal and for the North Fork Shenandoah from three locations: Broadway, Strasburg, and Woodstock. Water temperature significantly increased at three of the four sites by up to 3^{O}C. In addition, seasonal low temperature values are recently warmer. Air temperature data and summaries were obtained from Virginia State Climatology Office and National Climate Data Center; their data indicated variability in air temperature but no identifiable trends coincident with the stream temperature increase. Analysis of discharge data indicated that greater flows with more dramatic fluctuation occurred in April than in May for most years. Smallmouth bass (*Micropterus dolomieu*), the main species affected by the fish kill, spawn when water temperatures exceed 16^{O}C. A working hypothesis is that smallmouth bass are spawning earlier in the year by two to four weeks due to stream warming. It is possible that the greater discharge that typically occurs in April of most years stress fish that have historically spawned in mid-May, exacerbating their already weakened condition.

Smallmouth Bass Management in the New River, Virginia: A Case Study of Population Trends with Lessons Learned

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Smallmouth bass (*Micropterus dolomieu*) have been the preferred species of New River anglers since the early 1960's. Since the early 1960's, shifts in New River smallmouth bass population conditions have occurred. Some of these shifts are due to changed size limits, which altered angler behavior. However, a number of unexplained changes prevent definitive analysis of causative factors. The New River smallmouth bass fishery of 1982 and 1983 was characterized by high numbers of sublegal fish (< 305 mm), slow growth, poor survival, and low relative weights. These characteristics shifted to conditions indicative of a more healthy population subsequent to the implementation of a 279 to 356 mm protected slot limit in 1987. The New River smallmouth bass fishery is currently managed with a 356 to 508 mm protected slot limit, reflecting current management emphases on producing trophy bass, while continuing harvest of numerous bass < 356 mm. Future management of the New River smallmouth bass fishery will incorporate population monitoring, attention to changing angler behavior, and keeping a close watch on environmental factors affecting the fishery.

Smith River Tailwater: Opportunities for Enhancement of Habitat for Native and Introduced Fishes

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Operations of Philpott dam for flood control and peak power generation since 1953 have substantially altered downstream ecosystem conditions in the Smith River from the dam to Martinsville. A diverse assemblage of native fishes were replaced by depauparate populations of natives fishes and wild brown trout (*Salmo trutta*) and stocked rainbow trout (*Oncorhynchus mykiss*). Average peak flow and duration of generating flows significantly depressed abundance of native fishes and recruitment of brown trout. Low productivity of insects, crayfish, and fish has resulted in slow growth and poor condition of brown trout and average angling success. Although there are no "silver bullet" solutions, the most successful path toward improving the tailwater will reflect tradeoffs to balance environmental, economic, and recreational goals. We recommend mitigating the effects of fluctuating releases from Philpott Dam through a combination of flow management (e.g. characteristics of dam operations during baseflow and peak flow periods) and habitat improvement (e.g. channel restoration, temperature management, enhanced biological productivity). In addition, removal or modification of Martinsville Dam to enhance flow, habitat, and fish and sediment passage would benefit fish populations and environmental conditions in the lower tailwater. Management actions for improving flow and

habitat also should be assessed in light of the presence of the Federally Endangered Roanoke logperch (*Percina rex*) that also appear to be limited by degraded environmental conditions in the tailwater.

Survey of Lake Gaston Walleye Anglers Identified Through Tag Returns

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A tagging study was used to determine the general magnitude, timing, and location of the walleye catch and harvest in Lake Gaston. A total of 500 walleye were collected by electrofishing and tagged. A monetary reward, ranging from US$1 to $100, was offered for the return of each tag along with a completed survey on angling effort, catch, and harvest. A total of 46 (9.2%) walleye tags were returned. Most of the tags were returned within 5 months of the initial tagging. The majority of walleye anglers fished during the day and harvested their catch. We recommend further analysis of angler exploitation and natural reproduction before curtailing the walleye stocking program entirely at Lake Gaston.

Techniques for Aging and Population Characteristics for Grass Carp From Lake Gaston

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Hydrilla (*Hydrilla verticillata*) management in Lake Gaston, North Carolina-Virginia, has centered on the use of aquatic herbicides and triploid grass carp (C*tenopharyngodon idella*). Grass carp have been stocked at varying rates since 1995, but evaluations of the efficiency of grass carp have been hampered by the lack of basic population data. The objectives of this study were to learn how to dissect, prepare, and age lapilli otoliths and to evaluate population characteristics. Through local residents and marinas, we set up the opportunity for voluntary bow-fishers to harvest grass carp for this study. From June through September 2006, 10 bow-fishers harvested 38 fish ranging from 1 kg to 29.6 kg. In order to study the changes in population size and effectiveness of the grass carp, we learned the methods to correctly remove and prepare otoliths for aging. Otolith dissection required a shallow cut to the gill plate to expose the brain cavity where the 2 lapilli otoliths were located. After removal we transversely cut the otoliths, polished with 600-grit wet sandpaper, and used a dissecting scope to count the annuli to determine their ages. Age-specific lengths for age 1 – 4 fish ranged from 417 mm to 845 mm and age 9 – 12 fish ranged from 804 mm to 1261 mm. Future work and adjustments to the continuing project will include obtaining more fish and getting more accurate and precise ages.

Temporal and Spatial Patterns of Anadromous Fish Passage at Boshers Dam Vertical Slot Fish Fishway on the James River, Richmond, Virginia

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Boshers dam vertical slot fishway, James River, Virginia, U.S.A., opened in 1999 and restored connectivity to 543.3 km of spawning habitat for anadromous fish. The fishway also allowed local movement of resident species. Video observation from 2001-2005 was used to evaluate environmental predictors of American shad (*Alosa sapidissima*) and sea lamprey (*Petromyzon marinus*) passage. The ecological effects of restoring connectivity to upstream habitat for gizzard shad (*Dorosoma cepedianum*) and blue catfish (*Ictalurus furcatus*) are also discussed. Regression analysis determined that the best predictor of increased daytime American

shad passage is increasing water temperature and for increased daytime sea lamprey passage, an increasing water temperature trend. Sea lamprey and American shad peak passage rates were dissimilar when comparing preferred water temperature ranges. Sea lamprey peaked (5.30/hr) at 16-17.99 ºC, while American shad peaked (1.05/hr) at 20-21.99 ºC. Discharge, and indirectly, barometric pressure also played a role in passage. The diel pattern of passage for American shad indicated a strong diurnal tendency. All passage occurred during daytime hours, peaking from 1100 to 1900 hours. Diel patterns of sea lamprey indicated a strong nocturnal tendency (66% of passage occurring at night), with peak passage between 0300 and 0700 hours. More complete nightly passage data and passage data from periods when the water is too turbid for video observation would improve the accuracy of determining environmental predictors of passage.

Trophic Relations of Introduced Flathead Catfish in a North Carolina Piedmont River

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

Water Chemistry of Smith Creek: Effects of Land Use and Riparian Zone Protection to Date

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Smith Creek in Rockingham County, Virginia, begins as a headwater trout stream (Mountain Run) on forested federal property then enters open private land and drains an intensively agricultural area. Stream water samples were collected monthly from 20 sites encompassing 12 km in Smith Creek from June 2005 to December 2006. The samples were analyzed for pH, temperature, nutrient concentration (phosphorus, nitrate nitrogen, ammonia nitrogen, and potassium), ion concentrations (chloride, sodium, magnesium, and calcium), turbidity, and conductivity. Until 2006, cattle had free access to the private reach of the stream and its banks were denuded of vegetation. Fencing and riparian buffer areas were installed in April 2006 on one farm surrounding Smith Creek with funding provided by the Conservation Reserve Enhancement Program (C.R.E.P.). Trees indigenous to the area were planted and livestock were

fenced out of the riparian area to provide a buffer strip between the stream and surrounding farmland. Data collected upstream and downstream of the agricultural area and before and following the creation of the riparian buffer were used to evaluate nonpoint source (NPS) pollution resultant from agricultural practices.

Zooplankton Assemblages as Key Indicators of Larval Fish Predation in Claytor Lake Virginia.

Thomas Shahady Associate Professor Lynchburg College and John Copeland Fisheries Biologist VDGIF

We analyzed zooplankton populations in Claytor Lake over a four year period to correlate availability of key zooplankton species to introductions of larval striped bass (*Morone saxatilis*), hybrid striped bass (*Morone saxatilis x Morone chrysops*), and invasive white perch (*Morone americana*). We found that *Daphnia* and *Leptodora* are key species in this reservoir and were influenced by these introductions. This suggests the importance of these zooplankton species during stocking events and potential dietary overlap with white perch. We suggest stocking scenarios based on seasonal patterns of abundance in zooplankton.