



## Abstracts

### Joint Annual Meeting of the Virginia & Virginia Tech Chapters American Fisheries Society February 5-7, 2008 Fralin Hall, Virginia Tech Blacksburg, VA

**Tuesday February 5<sup>th</sup>**

#### **Contributed Paper Session 1:00 – 4:00 PM**

**1:10 – 1:30 A Multi-Model Approach to the Determination of Individual Growth Using Tag-Recapture Data: A Case Study Using Red Abalone, *Haliotis rufescens*, in California. Robert Leaf\*.**

An understanding of the age-at-length relationship is important for managers and biologists for describing temporal and spatial dynamics of individual growth. The precision of an age-at-length estimate is subject to the natural variability in growth (process error) and the model used to describe the observed growth (measurement error). Measurement error is a source of variation that arises when a growth model does not contain all relevant biological criteria necessary to describe the dynamics of growth. The recognition that a single model may introduce an unacceptable level of measurement error has spurred the use of multi-model approaches to estimate growth model parameters. In this work I present three growth models (Gompertz, Logistic, and Chapman-Richards) that I parameterize following Fabens' (1965) method. Fabens' (1965) parameterization of the Von Bertalanffy growth function (VBGF) enables the non-linear estimation of the asymptotic length parameter common to each model,  $L_{\infty}$ , using tag-recapture data. I analyze tag-recapture data collected from fishery-independent surveys of the recreationally harvested mollusk, red abalone (*Haliotis rufescens*), from six sites in California using four growth models (VBGF, Gompertz, Logistic, and Chapman-Richards). I describe temporal and spatial differences in  $L_{\infty}$  among these populations, evaluate the performance of each model to describe individual growth, and determine model-specific and model-averaged values of  $L_{\infty}$ . I found that the estimate of  $L_{\infty}$  varied temporally and spatially and that the fit of each of the candidate models was variable. Because of the observed variability of model fit I conclude that a multi-model approach is appropriate for  $L_{\infty}$  estimation of this species and that the methods proposed here can be used for other shellfish and finfish populations.

**1:30 – 1:50 A Comparison of Scale and Otolith Aging Methods for Various Centrarchid Species in Virginia. Margaret A. Peirce\*, Bradley A. Ray, and Brian R. Murphy.**

The ability to accurately determine fish age is a valuable skill in fisheries science. This study was done to determine how precisely scales and otoliths could determine age. 243 individuals of four Centrarchid species including Largemouth Bass (*Micropterus salmoides*), Bluegill (*Lepomis macrochirus*), Redear Sunfish (*Lepomis microlophus*), and Black Crappie (*Pomoxis nigromaculatus*) were collected from two reservoirs in Central Virginia. A paired t-test was used to determine significant differences in scale and otolith ages for all of these species. Combined, this test showed a significant difference, however, when this test was applied to each species individually, p-values showed no significant difference for all species except Bluegill. Other findings included that scales often accurately matched otolith readings from zero to two years of growth for each species. Thus, using scales to age these species in the first few years of life seems to be an adequate method for aging Black Crappie, Largemouth Bass, and Redear. However, Bluegill seemed to show more significant differences between the two methods.

**1:50 – 2:10 Improvements From Multi-Model Estimation: A Shark Length-Growth Case Study. James Thorson\*.**

In many research circumstances, multiple models may be used to explain and interpret experimental data. In these cases, model selection introduces process error that may decrease the precision or accuracy of estimates derived from data. While researchers may compensate by exploring multiple models and their effect on estimates, it may be necessary to provide a single, most-plausible metric. In these cases, multi-model estimation can be used to aggregate results from many models. Akaike Information Criterion (AIC) weighing is one such method, and can be interpreted as a likelihood-weighted estimate which compensates for biases in model complexity. Through comparison with known generating values, simulation modeling can demonstrate the benefits of AIC-based multi-model estimation. A simulation model was developed to investigate the effects of length-selective bias in sampling gear on estimates of length and growth of marine sharks. This study used multiple growth models and multi-model inference to explore the interaction of process error and sampling bias. Multi-model estimation was shown to decrease error by as much as 50%, both in cases of process error or sampling bias. AIC-based multi-model estimation is recommended in experimental studies where either process error or sampling bias is suspected.

**2:10 – 2:30 Distribution and Movement of Triploid Grass Carp in a Virginia Reservoir. Ben Eberline\*, Mike Duncan, and Brian Murphy.**

Lake Gaston, a 26,000 acre reservoir located in the piedmont region along the Virginia-North Carolina border, has become inundated with hydrilla. The Lake Gaston Weed Council (LGWC) has taken efforts to reduce the affects of hydrilla though chemical and biological means. In the absence of herbicides, the invasive macrophyte covers much of the shoreline inhibiting access to open water. The LGWC has introduced triploid grass carp to the reservoir in recent years to help decrease hydrilla coverage. Nearly 7,500 grass carp were released at two sites during the spring of 2007. We tagged 28 of those fish using internal radio tags prior to release. We determined immediate and overall as well as mortality throughout the summer and fall. We found quick but limited dispersal of tagged fish following release. We could not estimate reliable mortality rates due to the inability to locate nearly 30% of the tagged fish. If the LGWC elects to continue

stocking grass carp, we suggest increasing the number of release sites to help ensure adequate distribution of carp throughout the lake during the first year after release.

**2:50 – 3:10 First Observation of a Northern Snakehead (*Channa argus*) Nest in North America. Nick LaPointe\*.**

Schools of northern snakehead juveniles have been reported from: Little Hunting Creek, VA; FDR Park, PA; and, Crofton Pond, MD. However, no observations of circular nests in macrophyte beds (as described from their native range) have been recorded. In August 2007, we observed a mass of floating eggs in Little Hunting Creek, VA, guarded by two adult northern snakehead, including one fish that had been implanted with a radio tag. The nest was located at the side of a tidal canal, in a patch of *Hydrilla verticillata*. The adults had cleared a circular area of macrophytes 1.8 m in diameter. Clipped macrophytes had floated to the surface and were held in place by the surrounding *H. verticillata* beds. The mass of floating yellow eggs, approximately 25 cm across and 1-3 layers deep, was held in place by the floating, clipped macrophytes. Water depth ranged from 50 to 150 cm, depending on tide. Eggs hatched two days after they were first observed, and mosquitofish (*Gambusia affinis*) began to prey on the fry. Dissected mosquitofish, captured near the nest, had more than 50 northern snakehead fry in their gut. Three days after hatching, the fry had moved away from the nest and remained in a tight school. Aerial respiration began 10 days after hatching, when the school had moved 100 m from the nest and was still guarded by both adults. Fry grew 1-2 mm per day, with growth rate increasing over time. We observed six other schools of juvenile northern snakehead in the Potomac River Catchment in 2007, ranging from 10 to 80 mm. Adults were observed guarding juveniles up to 50 mm, but may have guarded larger juveniles as well. All schools were associated with dense beds of *H. verticillata*.

**3:10 – 3:30 Understanding Why Stream Trout Move During Summer. Shannon White\*, Arba Williamson\*, and Charles Gowan.**

Stream salmonids feed by positioning themselves in the current, capturing prey as it drifts downstream. Trout choose 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 fish movement. We manipulated prey abundance in seven study pools in a 220-m study reach using automatic feeders that delivered prey items at a known rate. 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 as feeding locations were moved among pools during a 32-day observation period in July and August, 2007. Fish did not move to find the feeders, and, in fact, very little movement occurred at all in the study reach. No fish were observed to move from one study pool to another, and in only four instances did we observe a new fish to move into a pool or a prior resident to permanently exit a pool during the 32 days of observation. We conclude that fish were not monitoring food resources throughout the study reach, but only within a single pool. Current mathematical models used to manage stream trout assume that fish monitor conditions in a stream reach and will move among pools as conditions change. Our results

indicate that these important models may be based on faulty assumptions for streams such as Fridley Run.

**3:30 – 3:50 Update on Efforts to Implement Virginia's Wildlife Action Plan. Chris Burkett.**

Virginia's Wildlife Action Plan was completed in the Summer of 2005, and was designed to help wildlife species from declining to the point where Federal Endangered Species Act protections become necessary. In July 2007, the DGIF hired an action plan coordinator to revitalize the action plan's implementation and efforts by Virginia's Teaming With Wildlife Coalition. This presentation will focus on the action plan's contents, circumstances affecting the action plan's implementation, the role of Virginia's Teaming With Wildlife Coalition, and a vision for future implementation efforts.

## **Wednesday February 6<sup>th</sup>**

### **Contributed Paper Session 1:30 – 4:30**

**1:30 – 1:50 Population Genetic Characterization of Southwestern Virginia Brook Trout (*Salvelinus fontinalis*) Populations. Joanne Davis\* and Eric M. Hallerman.**

Brook trout, *Salvelinus fontinalis*, was once abundant throughout its range, but environmental disturbances and introductions of nonnative trout species have drastically reduced the number and sizes of wild populations. Genetic evidence suggests a division at the subspecies level between southern- and northern-derived brook trout populations, with the zone of contact roughly at the New River watershed. Before the subspecies structure was recognized, brook trout of northern origin had already been stocked extensively in southern waters. The objective of this study was to determine the phylogenetic origin of brook trout populations in 56 streams in southwestern Virginia using established isozyme markers. Fish were collected by electroshocking, and muscle tissue samples were collected using a non-lethal biopsy technique. The samples were analyzed by cellulose acetate gel electrophoresis for variation at five polymorphic loci. Allele frequencies indicated that 19 of the populations were of southern Appalachian origin, 5 of northern origin, and 32 of mixed genetic origin. There was no apparent pattern regarding where populations characterized as southern, northern, or mixed were located geographically. Limitations posed by allozyme markers and incomplete stocking records compromised the ability to ascertain the phylogenetic origins of New River watershed populations. Screenings of microsatellite DNA markers may be helpful in this regard. Findings were shared with the Virginia Department of Game and Inland Fisheries to support conservation and management planning.

**1:50 – 2:10 Bioelectrical Impedance Analysis: A Novel Approach to Fisheries Management. Mike Duncan\* and Brian Murphy.**

The need to measure growth and condition is vital to fisheries management. While there are many methods to accurately measure growth, a method to quickly and accurately evaluate body composition is lacking. Biologists commonly use condition indices (e.g., relative weight) to evaluate the general health of fish populations. Research has shown that bioelectrical impedance analysis (BIA) is an effective method for estimating proximate composition in some fish. The

technique is quick, inexpensive and, most importantly, nonlethal. We used BIA and relative weight to monitor changes in the condition of bluegill and redear sunfish throughout the summer in several Virginia reservoirs. While BIA showed increasing lipid stores throughout much of the summer in all systems, relative weight indicated decreasing condition for most populations during the same time period. These contradictory results indicate the potential for misinterpretation of condition indices. Direct estimates of lipid can better inform biologists and increase the reliability and success of management programs.

**2:10 – 2:30 Trypsin Levels in Age-0 Largemouth Bass From Briery Creek and Sandy River Reservoirs. Bradley A. Ray\* and Brian R. Murphey.**

Largemouth bass are typically self-sustaining through natural reproduction; however loss of age-0 fish to biotic and abiotic factors can negatively affect recruitment. Prolonged reduced recruitment can diminish future angler effort, satisfaction, and the economic benefits associated with sport fishing. In Virginia, Briery Creek Reservoir continually produces trophy largemouth bass (>3.6 kg), however, recent electrofishing assessments of age-0 largemouth bass exhibited low catch per unit effort. A potential recruitment bottleneck appears to be occurring shortly after the age-0 largemouth bass leave the nest. Therefore, the dietary enzyme important for digesting protein, trypsin, was examined. Trypsin activity is related to food intake and stomach fullness; therefore, starvation or reduced food intake decreases the activity. Model selection showed significantly lower trypsin levels in Briery Creek Reservoir than in Sandy River Reservoir, a nearby reservoir that have exhibited high age-0 largemouth bass catch per unit effort. Further, length explained differences in trypsin levels throughout the first summer of age-0 largemouth bass. This lower trypsin activity may indicate that poor diet quality is a possible cause of low age-0 abundance in Briery Creek Reservoir. This question of diet quality will be further investigated.

**2:30 – 2:50 The Natural Range of Variability in a Headwater Brook Trout Population: Mountain Run (1993 – 2007). Morgan Hyatt\* and Mark Hudy.**

Understanding the natural range of variability of brook trout *Salvelinus fontinalis* populations is necessary to evaluate fisheries management actions (i.e. length limits), land use practices (i.e. road density), population viability (extirpation probabilities) or large scale environmental changes (i.e. climate change). We evaluated 14 consecutive years (1993-2007) of brook trout population data from Mountain Run, a 2.5 km long headwater allopatric brook trout stream in Rockingham, County VA. During this 14-year period the total brook trout population averaged 574 (SD = 256, range 247 to 1,156; coefficient of variation = 0.45). Adult brook trout (>100 mm in July) averaged 307 (SD =126, range 55 to 524; coefficient of variation = 0.41) while young of the year (YOY) (<100 mm in July) brook trout averaged 267 (SD = 208, range 22 to 809; coefficient of variation = 0.78). YOY populations were correlated ( $r^2 = 0.72$ ; canonical correlation analysis) with a model that used average flows during (OCT 9 – NOV 5) and (DEC 27- APR 6). Populations of brook trout in headwater streams are naturally highly variable and this high variability needs to be considered in designing monitoring activities.

**3:10 – 3:30 The Use of Artificial Stream Shading to Evaluate the Feasibility of Brook Trout Restoration. D. Brad Fink\* and Mark Hudy.**

Increases in stream water temperatures from the historic and current removal of riparian vegetation are one of the major reasons for extirpation of brook trout throughout their native

range. Recent riparian plantings by the Eastern Brook Trout Joint Venture (EBTJV) are long-term restoration efforts and the success or failure may not be known for decades. Understanding and validating water temperature response can be used to evaluate a priori the feasibility of restoration projects. In our study area on Smith Creek (Rockingham County, Virginia), we evaluated the feasibility of this restoration by artificially shading 550 meters of stream to simulate water temperature responses of a full riparian canopy (90% shade). Preferred water temperatures for brook trout are not found in Smith Creek between July 15 to September 15 because of historic land use practices. Air and stream temperature were collected before, during and after (June 2006 to November 2007) the shading experiment (July 26 through October 27, 2007). In 2006, we calculated that the mean daily maximum temperature increased 0.4°C between the upstream and downstream locations. In 2007, after shading, the mean daily maximum decreased 0.8°C. In 2007, the diurnal temperature fluctuations averaged 3.2°C immediately upstream of the shade and 2.2°C immediately downstream of the shade. Based on the shade experiment and the survival of transplanted wild and stocked brook trout in the shaded area, the establishment of suitable stream water temperatures for brook trout looks promising in Smith Creek if a riparian forest buffer can be established.

**3:30 – 3:50 Response to Aquatic Chemistry in an Acid Sensitive Trout Stream From Air Pollution Control Measures. Michelle L. Bender\* and Daniel M. Downey.**

Water Chemistry data for Little Stony Creek (LSC) Northwest Virginia, have been collected since 1989 for long term studies on the effects of acid rain and of limestone (CaCO<sub>3</sub>) treatment on streams occupied by native brook trout (*Salvelinus fontinalis*). Limestone is added to the stream once every three years to neutralize acidity. Much of the anthropogenic acidity in LSC originates from regional coal fired power stations in West Virginia such as Mt. Storm power plant, a 1.6 GW station located 180 km northwest of the stream. In 1995, Mt. Storm contributed almost a quarter of WV sulfate emissions, 410,394 tons/year, into the atmosphere. Since 1995, limestone scrubbers installed at Mt. Storm have reduced sulfur dioxide emissions by 97% from about 100,000 to 3,100 tons SO<sub>2</sub>/year. Values for discharge, pH, sulfate concentration, acid neutralizing capacity (ANC) and other parameters for water samples collected monthly from LSC upstream of liming sites have been evaluated to determine whether any changes in water quality have occurred coincident with the implementation of pollution control measures. Data from the National Atmospheric Deposition Program (NADP) air quality monitoring station nearest LSC (Big Meadows, VA) have also been studied. The purpose of this study was to evaluate the data to determine whether limestone mitigation should be continued. We have found that LSC sulfate and calcium discharge have decreased while ANC and pH have increased. Although the water quality of LSC has improved, the stream remains sufficiently acidic that liming mitigation must be continued to maintain water quality acceptable for aquatic life.

**3:50 – 4:10 Freshwater Mussels (Bivalva:Unionidae) of the South Fork Holston River, Virginia: Declines, Causes, and Recovery. Michael J. Pinder and Joe J. Ferraro.**

The Holston River originates in southwestern Virginia from three tributaries, the South, Middle, and North Forks. The South Fork differs from the Middle and North Forks by having low calcium-bearing geologies and reduced mussel diversity. In the South Fork Holston River (SFHR), baseline mussel data from two limited surveys in the early 1900's found 13 species including the federally endangered *Epioblasma walkeri* (Wilson and Clark, 1914). Over the

proceeding 40 years, logging, industry, and mining caused drastic alterations in the watershed. As many activities ended, the Tennessee Valley Authority (TVA) completed construction of the South Fork Holston Reservoir near the Virginia/Tennessee border. Its impounded waters extended into the South Fork's confluence with the Middle Fork, blocking a potential source of mussel recolonization. Throughout the 1960's and 1970's, the TVA and the U.S. Forest Service restored abandoned mine lands in the upper watershed. By the time Stansbery and Clench (1977) conducted the first comprehensive mussel survey in 1968, most impacts were abated and water quality improved. Even so, their survey found a degraded fauna containing 60 individuals of 9 species. One species, the federally endangered *Pegias fabula*, was a new record for the drainage. We resurveyed the same sites in 2001 finding 7 species totaling 66 specimens. Little recruitment was present in the mainly senescent mussel community. To restore the fauna, the Aquatic Wildlife Conservation Center (AWCC), located along the banks of the SFHR near Marion, Virginia, has begun augmenting mussels through release of propagated juveniles and translocating adults. Since 2005 we have released 275 adults of 5 species and over 11,000 juveniles of one species at a suitable SFHR site. Beginning in 2008, we will start monitoring to assess our freshwater mussel recovery efforts in this drainage.

**4:10 – 4:30 The Age and Growth of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the James River, a 400 Year Study. Matthew Thomas Balazik\*.**

The James River once supported an abundant Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) population, but due to commercial over-harvesting in the late 19<sup>th</sup> century and environmental degradation, their numbers are now considered severally depleted. This study is unique in that it not only looks at the current population, but allows comparison to itself, 400 years ago, before negative anthropogenic effects. Pectoral spines and sample information for present day Atlantic sturgeon were collected by agencies in close relation with commercial waterman for length at age evaluation; Jamestown pectoral spines were made available via the Association for the Preservation of Virginia Antiquities (APVA). Various measurements were made of pectoral spines to find possible isometric correlations with fork lengths. The present day spines were read blind by two experienced readers, CV 1.84%, the oldest sample being 19 years old. Pectoral spines from the Jamestown settlement were also read twice, by the same reader, CV 4.02%, the oldest sample was 42 years old. Correlations were observed ( $r^2$  between 0.883 and 0.942) portraying isometric growth between pectoral spines and fork length for Atlantic sturgeon so sizes could be attributed to Jamestown samples. The population's length at age data shows the power regression trend typical of Atlantic sturgeon found by researchers along the Atlantic sturgeon's distribution. The Von Bertalanffy growth curve fitted to the James River population and proportional back-calculations showed similar growth trends compared to the power regression of the length at age data for the current population. The present day James River population appears to be growing faster now compared to the Jamestown population, this could be due to rising temperatures, better foraging conditions, compensatory growth, or combination of the three. The population shows signs of rebounding but population hindering effects by man must be restricted. The current collections are based primarily on seasonal bycatch data, more robust sampling is needed to get a better view on recovery.

## **Poster Session Wednesday 5:00 – 6:00**

### **Environmental Conditions and the Shenandoah River Fish Kills: Part II (2007 Update).**

Stuart W. Cannaday\* and Thomas R. Benzing.

The Shenandoah River system experienced widespread mortality and poor health of many surviving fish primarily of the Centrarchidae family in the years 2004, 2005, 2006, and 2007. In 2005 DEQ and DGIF assembled an interdisciplinary task force of scientists and stakeholders to research the fish kills. It was determined from dead and dying fish collected in 2005 that many of the fish exhibited lesions and infections containing common parasites, fungi, and bacteria. Bacteria and parasites were not thought to be the primary cause of mortality, but were taking advantage of already stressed fish, which had been subjected to unknown chemical, biological or physical stressors. This study was performed to evaluate possible physical habitat related stressors, such as current and historic temperature and flow. Long-term discharge data were available from the six United States Geological Survey (USGS) gauging stations located on the two forks of the Shenandoah River. Six municipal water treatment plants also provided reliable daily water temperatures from Broadway, Front Royal, Strasburg, Winchester, and Woodstock as well as Moorefield, WV along the South Branch Potomac River. In addition, data were also collected from HOBO temperature sensors that were placed along the North Fork Shenandoah River (NFSR) at Broadway, Woodstock, and Strasburg and the South Fork Shenandoah River (SFSR) at Lynnwood, Luray, and Front Royal between January and June of 2007. The HOBO data were used to compare the actual stream temperatures and treatment plant water temperatures which showed a close similarity between the two data types. Water treatment plant temperature values increased at Front Royal, Strasburg, and Woodstock by 2 – 4 °C in the past 16 years. Also, Moorefield and Winchester plants did not show a significant increase in temperature and Broadway did not experience an increase. Analysis using USGS flow data, water treatment plant temperature, and VDEQ fish kill report data suggests that the fish kills are happening around the spawning period of smallmouth bass (*Micropterus dolomieu*) and red breast sunfish (*Lepomis auritus*) which mostly occurs during April and May between 16 and 25 degrees Celsius. The highest flow regimes in the Shenandoah are also seen during this spawning period. Therefore, it is hypothesized that the fish kills may be caused by some stressor that causes the fish to become susceptible to illnesses during the time of the spawn. It is also hypothesized from this data that the spawning time may be occurring earlier in the year as a result of the increasing water temperatures.

### **Photo Documentation of a Natural Fish Host Infestation by the Federally Endangered Oyster Mussel (*Epioblasma capsaeformis*). Nicholas A. King\* and Richard J. Neves.**

The United States has the largest diversity of freshwater mussels (families: Unionidae and Margaritiferidae) in the world. Of the approximately 300 taxa, 68% are at risk and 12% are extinct, with little known of their biology and behavior. Most freshwater mussels must infest a fish host to complete their life cycle. Additionally, this relationship is a primary mechanism of dispersal. Based on field observations and anatomical studies, biologists have suggested several strategies by which mussels attract and infest fish hosts. However, only a few natural infestations have been documented. Laboratory experiments have demonstrated that the snuffbox (*Epioblasma triquetra*) captures its host fish to ensure successful glochidial (larval) infestation. It was hypothesized that the congener oyster mussel (*Epioblasma capsaeformis*) employed a similar strategy. In May 2007, I photographed two individuals of *E. capsaeformis* capturing and infesting darters (family: Percidae) in the Clinch River. This is the first known

photo-documentation of mussels capturing fish in the wild. These photographs support the hypothesis of host fish capture by members of the genus *Epioblasma*. These observations have implications for freshwater mollusk biology and conservation.

**Results of Water Quality Monitoring in Three Coastal Plain, VA Streams. Mitchell D. Norman.**

**Analytical Results for Trace Elements Using ICP-MS for Fish Otoliths, Tissue and Livers Collected in the Shenandoah River System. Wesley L. Storm\* and Daniel M. Downey.**

Anthropogenically introduced trace elements and other pollutants in the Shenandoah River watershed may be contributing to stress and fish mortality. To assess the extent of biological contamination, archived otoliths (ear bones) of 336 smallmouth bass (*Micropterus dolomieu*) and redbreast sunfish (*Lepomis auritus*) collected from multiple locations in the Shenandoah River and its tributaries in 2004-2006 were analyzed. Following cleaning to remove biological fluids and tissue, the otoliths were dissolved in nitric acid solution with heat and ultrasonication and analyzed for eighteen trace elements by inductively coupled plasma mass spectrometry (ICP-MS). As only the archived otoliths were available, twenty-five additional smallmouth bass were collected at a single location in the South Fork Shenandoah River near Front Royal, Va. and livers, tissue, and otoliths removed from these fish for analysis and comparison. Tissue and liver samples were analyzed by ICP-MS after microwave assisted digestion using nitric acid / hydrogen peroxide mixture. To date, fourteen trace elements have been found in varying amounts including aluminum, antimony, arsenic, cadmium, cobalt, copper, chromium, lead, manganese, molybdenum, nickel, selenium, vanadium and zinc. In some cases the elements are found only in the tissue and livers, while other elements have been found in the otoliths and not in the tissue. This presentation will discuss the concentrations found for the trace elements and possible significance in contributing to stress in the Shenandoah River fish kills.

**Increased Survival of the Endangered Freshwater Oyster Mussel, *Epioblasma capsaeformis* (I. Lea, 1834), Following Feeding With Bacterial Floes. Meghann E. Vincie\*, Steven R. Craig, Ewen McLean, and Richard J. Neves.**

The southeastern United States possesses the most biodiverse freshwater (FW) mussel fauna in the world. Of the over 270 native species of FW mussels, 60% of described species are considered endangered or threatened, and 12% are presumed extinct. Reasons for declines in FW mussel populations include anthropogenic impacts such as impoundments, pollution and channelization, as well as the recent invasion of the zebra mussel (*Dreissena polymorpha*). In order to safeguard vulnerable populations from unpredictable events, including droughts, while providing the means to conserve endangered populations and isolated gene pools, it is vital that we optimize cultivation technologies for FW mussels. Already, several hatcheries have recorded noteworthy success, but one area that remains problematic is the captive feeding of juvenile animals. Accordingly, in efforts to develop artificial feeds for FW mussels, several feeding strategies were evaluated for the endangered FW oyster mussel based on growth and survival data. Forty-two juvenile mussels were placed in each of 24 separate culture vessels in a recirculating aquaculture system at the Freshwater Mollusk Conservation Center (FMCC) under standardized laboratory protocol and randomly assigned a dietary treatment. Dietary treatments included a bacterial floc, a probiotic, water from a pond source, and a triple concentration of the standard algal diet utilized at the FMCC. Each diet was fed three times daily for a period of 51 d. A sample of mussels was individually measured from each dish every ten days for shell length,

and survival was measured at the end of the experiment. Largest final length was obtained when mussels were fed the triple concentration algae treatment, followed by pond water and bacterial floc treatments, respectively. The probiotic treatment produced the smallest animals at the completion of the trial. Survival was highest in the bacterial floc treatment, followed by pond water, triple concentration algae and probiotic treatments, respectively. This preliminary trial provides evidence that inclusion of bacterial flocs in diets for juvenile mussels could enhance survival of this and other endangered FW mussel species.

## **Thursday February 7<sup>th</sup>**

### **Contributed Paper Session 8:30 – 11:20**

**8:30 – 8:50**    **Volunteers at DGIF; A Force for the Future. Thomas Wilcox.**

**8:50 – 9:10**    **Tracking the Black Crappie Population Dynamics of Chickahominy Lake. Scott Herrmann.**

The objective of this study was to document the population strength and dynamics of black crappie fisheries in drinking water supply reservoirs of eastern Virginia (Region 1, District 1). Several Newport News reservoirs were sampled through the use of trap net surveys. Surveys were conducted during the spring seasons of 2005 - 2007. The majority of targeted efforts went to analyzing the black crappie fishery of Chickahominy Lake. Chickahominy Lake is a 1,230 acres reservoir that supplies drinking water to the City of Newport News. The construction of Walker's Dam in 1943 on the Chickahominy River created Chickahominy Lake. Chickahominy Lake has a wide assemblage of fish species present. Black crappie, *Pomoxis nigromaculatus*, is one of the more popular species sought after by anglers. Typical shoreline electrofishing surveys of the past showed great variability in the collection of black crappies. Trap net surveys were used during each spring from 2005 to 2007 to further analyze the black crappie fishery. Chickahominy Lake was divided into two halves with each section receiving 10 net nights worth of effort. A total of 20 net nights of trap netting were conducted during each of the three years. Catch rates, population dynamics and size structure distributions were analyzed for each sample year. Otoliths were collected during the 2005 and 2007 survey years to allow for an initial comparison of growth rates and mean length at age values.

**9:10 – 9:30**    **Developing Attractive Fish Habitat in Southwest Virginia Impoundments. Tom Hampton, George Palmer and Clifford Kirk.**

We constructed and installed fish attractors in four small impoundments and two large impoundments in Southwest Virginia. A variety of strategies and materials were employed. Some fish attractor projects were completed with support from other organizations and others were accomplished independently. Some of the materials utilized include: Christmas trees, hardwood brush, sawmill slabs, recycled concrete, hardwood and softwood trees and drift wood. Tree seedlings and grains were also planted. Some materials and techniques produced results that were more attractive (to fish) and less expensive in terms of time and money. No increases in population abundance or spawning success could be attributed to the fish habitat enhancements. However, it was apparent that several types of structures successfully attracted both fish and anglers.

**9:50 – 10:10 Bowfin! A New Spin on an Old Fish. Eric M. Brittle.**

The bowfin is a living relic native to the Coastal Plain and lower Piedmont, Atlantic-slope drainages in Virginia. Although considered one of the gamest fish when hooked, it is loathed by many recreational fishermen. Commercial fishermen, however, have discovered a new market for bowfin caviar. The sale of caviar has risen in recent years as a replacement for dwindling sturgeon caviar stocks. Adult bowfin were collected using boat mounted electrofishing gear from the Blackwater River (N = 54) and Nottoway River (N= 60) bowfin in the summer of 2007. Annuli were verified using whole view otoliths (sagittae). Mean total length at age of capture (TL, mm), sex ratio, and length-weight relationships were calculated. Bowfin ages ranged from 3 – 9 years. Blackwater bowfin TL was significantly ( $P \leq 0.05$ ) smaller than Nottoway bowfin. Female TL was significantly ( $P \leq 0.05$ ) larger than males. Very little is known about age and growth of Commonwealth bowfin populations including commercial harvest data. Currently there are no bowfin regulations in Virginia and there are very few regulations in place across the country. More research and data needs to be collected before harvest of these fish increases.

**10:10 – 10:30 Recruitment Exchange of Smallmouth Bass Between the James and Maury Rivers: Inference From Otolith Chemistry Analyses. Robert Humston, Brant Priest, Brett Carpenter, and Paul Bugas.**

Recruitment dynamics of smallmouth bass (*Micropterus dolomieu*) in river fisheries are highly variable. Despite being well-studied as a species, comparatively little research has been dedicated to understanding the population dynamics of smallmouth bass in strictly lotic systems. More generally, patterns of dispersal and connectivity among subpopulations of aquatic fauna in a main stem river and its tributaries have been poorly characterized. In our research, we have attempted to use otolith chemistry as a natural tag to track natal dispersal of smallmouth bass between the James River and its tributary Maury River. Initial results tracking the 2005 year class suggest an asymmetric pattern of exchange in the first year, with more fish emigrating to the James River than into the Maury River. The timing and mechanisms of this exchange are yet unknown, however, such asymmetry could have important implications for population dynamics and stability in tributaries. This presentation will review these results as well as other preliminary data assessing the utility of otolith chemistry for characterizing recruitment exchange basin-wide.

**10:30 – 10:50 Looks Like it Worked! So, Now What? Bob Greenlee.**

During a period stretching from the mid-1990's through 2003, largemouth bass (*Micropterus salmoides*) populations in many of Virginia's tidal river systems experienced recurrent poor recruitment. The efficacy of supplemental stocking over existing largemouth populations in large, complex open systems has not been determined. If supplemental stocking were found to be viable in tidal rivers, fisheries managers would have a mechanism for augmenting weak year-classes during future periods of poor natural recruitment – resulting in more stable bass fisheries in these dynamic systems. To assess the viability of supplemental stocking in Virginia's tidal river systems, oxytetracycline (OTC) marked F<sub>1</sub> hybrid (Florida X northern) fingerling largemouth bass were stocked at a rate of 62 fish/ha in the tidal Chickahominy system (1,856 ha) each year from 2005 - 2007. Assessments of relative abundance and percent contribution to year-class were to occur at roughly 5, 11, 17, and 29 months post-stocking. Issues with fish condition, stocking methodology, and environmental conditions likely lead to the poor survival experienced by fingerlings stocked in 2005. However, results to-date from the 2006 and 2007

stocking have been impressive. At 17 months post-stocking OTC-marked fish constituted 73.7% of the 2006 year-class, and at 5 months post-stocking, OTC-marked fish accounted for 65.8% of the 2007 YOY sampled.