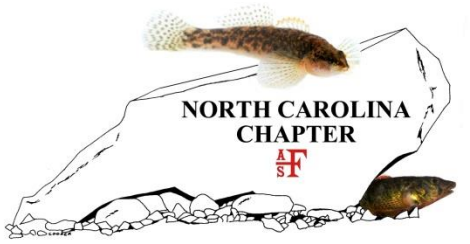
Abstracts

Sorted by presenting author



2016 Meeting of the Virginia and North Carolina Chapters of the American Fisheries Society

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The Southeast Atlantic Slope and Virginia Atlantic Slope Mollusk Groups

Monday, March 14th - Thursday, March 17th, 2016

Institute for Advanced Learning and Research
150 Slayton Avenue
Danville, VA 24540

2016 Meeting of the Virginia and North Carolina Chapters of the American Fisheries Society &
The Southeast Atlantic Slope and Virginia Atlantic Slope Mollusk Groups
Danville, VA March 14 – 17, 2016

Assessing the toxicity of the Clinch River Basin sediment load to the endangered freshwater mussel *Epioblasma brevidens* (Cumberlandian combshell)

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*Presenting

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The Clinch River in Virginia and Tennessee is well known for its diverse native freshwater mussel assemblages; however, notable declines in mussel populations in recent decades have prompted much concern and subsequent research. Habitat suitability, water quality, and bed sediment parameters have been studied, but this is the first study to examine potential stressors introduced in the sediment load. We examined the toxicity of recently-deposited sediments on juveniles of the freshwater mussel *Epioblasma brevidens* (Unionidae), by collecting time-integrated sediment samples from the water column with sediment traps from 11 sites in the Clinch River Basin, including 7 sites within an 88-km reach deemed a 'mussel zone of decline'. Sediment samples were analyzed to identify presence and concentration of metals and organic contaminants. Mussels were exposed to the riverine sediments and to three control sediments for 28 d; survival, shell length, and biomass were then assessed. Sediment treatment (i.e., river location) had a significant effect on mussel survival ($p < 0.01$) and biomass ($p = 0.02$), but did not affect length ($p = 0.37$), and sediments from two tributaries with rather different watershed land uses were the most toxic (Guest River and Copper Creek). Metals and polycyclic aromatic hydrocarbons were prevalent in sediment samples collected from all sites. Manganese was significantly correlated with mussel survival and biomass, as was ammonia with survival, and total organic carbon with biomass. Quantitative models explaining mussel responses to these contaminants were developed. Landscape analysis of potential contaminant sources indicate fossil fuel mining and agriculture likely contributed to elevated manganese and ammonia, respectively. The sediment load is an important source of contaminant stressors that should not be ignored; our findings can be applied to watershed management and faunal conservation in the Clinch River and other similar river systems in context with whole-system contaminant fate, transport, and cycling.

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Professional, Oral Presentation

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Treating Hydrilla with Fluridone in a Lotic System: Responses of Target and Non-target Species

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Hydrilla (*Hydrilla verticillata*) is an invasive aquatic weed that has been spreading throughout North Carolina's lakes and reservoirs since it was first discovered in 1980. It is now invading increasingly dynamic and high biodiversity systems such as rivers and natural lakes. One recent site of invasion is the Eno River system in the Piedmont region of the state. The Eno is is a tributary of the Neuse River, and is home to several rare species including the panhandle pebblesnail (*Somatogyrus virginicus*). It also serves as a significant source water for Falls Lake, the drinking water reservoir for the City of Raleigh, NC and several surrounding areas. In 2015, an aquatic herbicide treatment with fluridone (Sonar Genesis) was conducted in the Eno River, marking the first metered herbicide treatment of hydrilla within a riverine system in the state. We evaluated the herbicide treatment impacts to selected target and non-target aquatic species. Efforts included quantitative sampling of *H. verticillata*, *S. virginicus*, and *Podostemum ceratophyllum* (the native vegetation and habitat of *S. virginicus*) at seven spatially separated sites along the Eno River. Biweekly vegetation monitoring and monthly snail sampling began in late May, two weeks before treatment, and continued through December. *H. verticillata* shoot lengths were significantly reduced during treatment from an average of 23.4 cm to 10.6 cm. Average density of *S. virginicus* was significantly different among sites, ranging from 5,537 snails/m^2 to 1,782.4 snails/m^2. Monthly snail density averaged among all sites differed over the course of the sampling season, with lower densities found in October and December. Average monthly snail densities during treatment months did not differ significantly. *P. ceratophyllum* densities differed between treated and untreated sites with means of 13,736 and 10,682 stems/m^2, respectively. Overall, fluridone effectively reduced hydrilla density within the treated area with no apparent negative impact to the studied non-target species.

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Student, Oral Presentation

Determining the Survivability of Tiger Muskie in mid-Atlantic Small Impoundments

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Though not often thought of in small water bodies, tiger muskies offer a unique fishing experience rarely found in ponds and small lakes in the mid-Atlantic. Many questions pertaining to their health and survival remain unanswered and undescribed in primary literature. In an attempt to monitor growth and survival, small populations were established in several small impoundments in Virginia. Six month old fish averaging 269 mm (10.6 inches) were stocked in eight small impoundments in central Virginia in the fall of 2013, and additional fish were stocked again in the fall of 2015. Preliminary results show the initial stocking was a success, with growth rates averaging 290 mm (11.4 inches) in the first year post stocking.

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Professional, Lightning Talk

Field-based measurement of thermal tolerance limits for Brook Trout in Ramsey's Draft and other Virginia trout waters

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Stream temperature has long been identified as an important limiting factor in the distribution of brook trout. Throughout the southeast, stream warming is expected to decrease trout habitat based on model forecasts using thermal limits established in controlled laboratory studies or through analysis of field data collected for other purposes.

The purpose of this study was to investigate whether brook trout in Virginia streams are able to withstand higher temperatures than previously documented or commonly believed to be limiting. Programmable temperature data loggers were deployed in Ramsey's Draft, a small brook trout stream in Augusta County, Virginia, during July – September 2015. Monitoring locations were selected in pools that become isolated during the summer. As such, these pools represent refuges for brook trout where they congregate to survive periods of low flow and higher temperatures. When isolated, these pools become ideal experimental vessels where thermal tolerance can be evaluated in the field without migration as a confounding factor.

In Ramsey's Draft, brook trout experienced and survived stream temperatures above 70 degrees (21 C) on 10 days during late July and mid-August 2015. Field observations confirm that the data loggers remained underwater during the entire period and that brook trout movement was restricted to isolated pools when the highest temperatures were recorded. Compared with stream temperatures from past years (provided by VDGIF), summer 2015 was not unusually warm in recent history. These results suggest thermal tolerance limits for brook trout in Virginia may be higher than previously thought.

Similarly, stream temperatures were monitored and analyzed for other Virginia trout waters including the Jackson River in Highland County, and Crooked Creek, Snake Creek, and Dry Run in southwest Virginia. Stream temperatures paired with population surveys in transitional reaches also support the idea of using higher thermal tolerance limits for trout in modeling and management.

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Professional, Oral Presentation

News Flash! Bridle Shiners still extant in North Carolina

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The Bridle Shiner (*Notropis bifrenatus*) historically inhabited Atlantic coastal waterways from the St. Lawrence drainage to the Santee River in South Carolina, but contemporary surveys suggest that this small, rare fish is declining across most of its range. Within North Carolina, the Bridle Shiner is a state Endangered species and was previously known to only occur in the lower Neuse River Basin. In 2012, a second population was discovered in the Chowan River basin, which launched additional survey effort in the river basin and an update of historical localities in the Neuse River basin. From 2012 to 2014 we conducted 14 and 34 boat electrofishing surveys in the Chowan and Neuse river basins, respectively. Fifty-seven specimens were collected and at least two year-classes were observed within both river basins. Bridle Shiners were only collected from the original discovery locality in the Chowan River basin and six localities in the Neuse River basin. Bridle Shiners still appear to be rare in North Carolina; however, additional surveys are needed to fully delineate the distribution within North Carolina and exploratory surveys are also needed for adjacent river basins.

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Professional, Lightning Talk

Mark-recapture and artificial stream channel experiments inform burrowing patterns of the endangered James Spinymussel (*Pleurobema collina*) in response to floods

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Freshwater mussels are keystone species in their ecosystems, yet over 70% of freshwater mussel species are endangered. Freshwater mussel research can be limited by the difficulty in finding the rare and cryptic organisms. The endangered James Spinymussel (*Pleurobema collina*) now has only a few populations existing in headwater streams of the James River. This study looks at the burrowing patterns of James Spinymussels and other freshwater mussels in the field and after floods simulated in experimental stream channels. In the summer of 2014, a mark-recapture study was initiated using Passive Integrated Transponder (PIT) tags at Swift Run in Earlysville, VA. Mussels were recaptured approximately every month and their substrate, location along an x,y coordinate system, and whether they are surfaced or burrowed was recorded. More tagged mussels were seen on the surface after higher flows, and the odds of visually detecting a mussel increased by 5.4% with a 1cm increase in water depth. To study the pattern of surfacing in response to floods, artificial stream channels at James Madison University ran simulated floods on a common co-occurring species (*Villosa constricta*) also present at the field site. Preliminary experimental results indicate an overall decrease in the amount of mussels surfaced immediately after a flood followed by a rebound. Within two days, the number of mussels surfaced had come near to, if not reached, pre-flood counts. There was no difference in the number of mussels surfaced during the day and night. An understanding of mussels' burrowing behavior in response to floods may help researchers time their population surveys so that they are more accurate.

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Student, Oral Presentation

Identifying Sampling Efficiencies in Fisheries Monitoring: Examples from Virginia

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Monitoring studies aimed at assessing status and trends are imperative for addressing fisheries management goals and objectives because of the dynamic nature of fish populations. However, routine surveys often overlook sample size considerations needed for statistical validity in making fisheries management decisions. We evaluated five datasets using bootstrap techniques to determine how coefficient of variation (CV) of catch per unit effort (CPUE; fish/hr) estimates respond to sample size (e.g., total number of sites, or sample days depending on survey type). Datasets were obtained from a variety of monitoring studies across Virginia, which included electrofishing and creel surveys from lakes, rivers, and small streams. Typically, CV curves will show a negative relationship (i.e., exponential decay trend) as sample size increases. We found this to be true with the number of sites needed to accurately estimate Largemouth Bass *Micropterus salmoides* CPUE in a large impoundment. However, the opposite trend occurred with angler CPUE for Largemouth Bass and Blue Catfish *Ictalurus furcatus* from James River creel surveys. In this case, despite high and increasing trend in CV, there was still a point of diminishing returns for added sampling effort above eight creel days for estimating CPUE of those target species. When determining adequate sample size biologists should consider overall study objectives, time and budget constraints, and the distribution of the experimental unit in question. Lastly, periodic evaluation to determine sampling efficiencies is essential for maintaining data integrity and standardization, and should become standard practice.

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Professional, Oral Presentation

Why is the Stream Drying Up? A Spreadsheet to Calculate Lake Evaporation and Tailwater Discharge

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Abstract
Water enters lakes and reservoirs through influent streams, direct rainfall and springs then exits by discharge, evaporation and absorption into the underlying geology. Loss of water by evaporation has the potential to substantially reduce downstream discharge. In this presentation we describe a model published by Fennessy and Vogel (1996) that quantifies the amount of water loss due to evaporation from a lake/reservoir system for the eastern United States. We have created an excel spreadsheet program for use by lake and fisheries managers based on this paper. The calculated evaporation rate is based upon readily available data including lake elevation, longitude, average monthly temperature, and average daily temperature without the need for onsite data collection associated with other models. We have tailored this program to fit most manmade water bodies in Virginia and neighboring states. Climate data were obtained from the National Ocean and Atmospheric Administration (NOAA) First Order weather observatories online. The spreadsheet also calculates reduction in downstream discharge from watershed size, yield, and average annual rainfall in conjunction with the evaporation rate. Elevation, longitude, watershed size, lake surface area, and other information were available from the National Inventory of Dams Online. This spreadsheet can be used to demonstrate the effect of impoundments on historically free flowing streams in downstream dewatering particularly during periods of high temperatures and low rainfall and is available without charge.

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Student, Poster

2015 REVISED WILDLIFE ACTION PLAN – SPECIES, HABITATS, AND SO MUCH MORE

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The State Wildlife Grants (SWG) program was established by the US Congress to provide funding for nongame species not traditionally covered under most previous federal funding programs. To qualify for SWG funds, each state is mandated to develop conservation strategies with a focus on Species of Greatest Conservation Need (SGCN) and to publish this information in a state Wildlife Action Plan (WAP). During the 2015 WAP revision process, new ranking criteria metrics were developed and used by taxa teams comprised of species experts to determine amphibian, bird, crayfish, freshwater fish, freshwater mussel, mammal, reptile, and snail SGCN priorities in the state. The revised WAP includes 40 natural community descriptions, including expanded aquatic habitat descriptions, and identifies aquatic priority areas for conservation. Several threat categories likely to affect wildlife and habitats over the next 10 years are described as well. Taxa team evaluation results, habitat associations, and 12-digit HUC priorities that support the revised WAP are available in Excel format. Comprehensive information about statewide conservation efforts and monitoring programs that can be used to identify information resources and potential conservation partnerships are also outlined in the new Plan. The revised WAP serves as a practical and essential resource for future fish and wildlife conservation planning in North Carolina.

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Professional, Oral Presenation

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Floodplain deforestation effects on fisheries

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Floodplains are among the most threatened ecosystems on the planet, with 90% of them in Europe and North America being functionally extinct. Floodplains dominate fish production rates among freshwater ecosystems largely because their vegetated habitats provide fish populations with important nursery and feeding opportunities. Yet, the extent to which escalating changes on floodplain land-cover affect fisheries productivity is unknown. We evaluated the effects of floodplain land-cover change on fisheries productivity in a region of the Amazon Basin where 56% of the forests have been converted into agricultural and cattle ranching lands. We used linear regression methods to model multispecies fish capture per unit effort (CPUE) in 107 floodplain lakes as a function of the amount of herbaceous, shrub, aquatic macrophyte, and forest habitats surrounding them. The floodplain lakes were distributed along a gradient of surrounding habitat conditions, from forested to highly-deforested. We tested the degree to which each floodplain habitat type influenced CPUE. We found that forest and herbaceous habitats affected multispecies CPUE. Forest amount directly affected multispecies CPUE at a significance of $p = 0.000005$, and herbaceous amount inversely affected multispecies CPUE at a significance of $p = 0.01$. The coefficients of both these parameters indicate that a one-unit change in forest or herbaceous percent causes a five-unit change in untransformed multispecies CPUE. These results indicate that removal of floodplain forests causes decreases in fish biomass available for harvesting and associated productivity of multispecies fisheries. The herbaceous habitats that usually develop in deforested areas exacerbate deforestation effects by decreasing multispecies fisheries productivity even further. These results constitute the first empirical evidence concerning floodplain deforestation effects on fisheries, and they illustrate the fishery potential that is being lost as floodplains worldwide continue to be degraded.

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Professional, Poster

Do Resource Agency Reviews of Road Projects Translate to Better Fish and Wildlife Crossings?

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The North Carolina Wildlife Resources Commission (NCWRC) and other state and federal resource agencies participate in the review of proposed road construction and bridge replacement projects, and provide recommendations to the North Carolina Department of Transportation (NCDOT) to minimize impacts to fish and wildlife resources. Our comments are considered in decisions regarding the types of crossing structures and specific design elements where roads and waterways meet. Examination of project sites during planning, after construction and after some time has passed, reveals how well our recommendations were implemented and if following our advice led to successful fish and wildlife crossings.

Our standard comments indicate our general preference for spanning structures, instead of culverts (pipes and box culverts). Our comments also include specific design elements to ensure fish and wildlife passage when culverts are constructed. To achieve the desired goal of a stable continuum of water depth, channel width and flow velocity through the culvert, imbedding the bottom of the base-flow barrel below the stream bed and using alternating baffles, as needed to maintain the stream channel, are recommended.

Evaluation of stream crossings constructed in recent years help resource and transportation agencies to determine the successful aspects of their efforts and areas where improvements can be made. Views of various crossing structures and post-construction analysis are presented, focusing on resource agency recommendations. Working together and evaluating post-construction results are key to the future success of fish and wildlife passage through our network of roads.

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Professional, Poster

Status, Trends, and Ecology of the Endemic Carolina Madtom

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Nongame fishes contribute to diversity and important ecological functions in freshwater ecosystems. However, many nongame species are imperiled and their status and ecology are poorly understood. One such species is the Carolina Madtom, *Noturus furiosus*, a nongame catfish endemic to the Tar and Neuse river basins of North Carolina. Systematic surveying of Carolina Madtom populations first began in 1962, and subsequent surveys in 1989 and 2007 have shown declining occurrence and abundance in the Neuse River basin, with stable populations in the Tar basin. The 2007 survey showed a 92% occurrence decrease throughout historically inhabited sites in the Neuse River basin. Habitat suitability analyses and comparative habitat surveys between river basins suggest that suitable physical habitat for Carolina Madtom occupancy and reproduction is widely available in the Neuse basin, and habitat limitation does not readily explain the decline in population numbers in these areas. Alternative causes, such as poor water quality or predation by nonnative species may be adversely affecting Neuse basin Carolina Madtom populations. We plan to visually snorkel survey a minimum of 30 sites consisting of both historical and new locations in both river basins to document current distribution and abundance of the Carolina Madtom. Additional instream gear calibration research and basinwide occupancy modeling will add relevance to survey results. Fin clips taken from field collected specimens will be used to define the genetic structure of the two allopatric populations in the Neuse and Tar River basins. New findings from the surveys and genetic analyses will be used to inform conservation planning and management actions to ensure the viability of this imperiled, endemic species.

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Student, Lightning Talk

NCDWR's Monitoring of Heavy Metals in Dan River Fish Tissues following the February 2014 Coal Ash Spill; a 15-month Synopsis after Four Rounds of Fish Sampling in North Carolina

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*Presenting

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Assessing the potential bioaccumulation of coal-ash-related heavy metals in Dan River fish tissues continues to be a priority for the NC Division of Water Resources in support of North Carolina's risk-assessment process for fish consumers. In the 15 months following the coal ash spill at Eden, NC, the Division of Water Resources has conducted four separate monitoring assessments of 16 heavy metals in Dan River fish tissues, resulting in over 5,500 discrete data points for 23 Dan River fish species. Significantly increasing trends and or exceedances of North Carolina's fish consumption advisory action levels and screening values are extremely limited and indicate a lack of bioaccumulation of heavy metals in Dan River fish tissues collected downstream of the coal ash spill. A fifth and possibly final round of monitoring is planned for the spring of 2016 characterizing fish-metals in the North Carolina portions of the Dan River at approximately 27 months following the spill.

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Professional, Oral Presentation

Movement of Triploid Grass Carp in the Regulated Pee Dee River, North Carolina

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Hydrilla (*Hydrilla verticillata*) was discovered in the Pee Dee River, North Carolina just below the Lake Tillery Dam in 2010. Triploid grass carp (*Ctenopharyngodon idella*) were selected as the most effective treatment method for this system. However, the North Carolina Wildlife Resources Commission (Commission) has not previously permitted triploid grass carp stockings in riverine environments. The Pee Dee River between Lake Tillery Dam and Blewett Falls Dam is regulated by releases from the Lake Tillery Dam but also receives flow from several tributaries including the Rocky River and the Little River. In order to determine the movements of triploid grass carp in a partially regulated river, Commission staff deployed ten VR-2 acoustic receivers in the section between the two dams, and two receivers below Blewett Falls Dam to monitor for escapement. Triploid grass carp (n = 24) were implanted with sonic tags that allowed one year of operational battery life and released in June of 2014 at the Red Hill Boating Access Area approximately 20 km downstream of the Lake Tillery Dam. Movement data was captured by the acoustic receivers from the stocking date until June 1, 2015. No grass carp were detected below the Blewett Falls Dam even though there were at least 68 days during the study period where water spilled over the dam increasing the potential for downstream movement. However, only three fish passed the upstream receivers where the majority of the hydrilla in this system occurred. These three fish moved back downstream within 48 hours after their upstream migration. Only seven fish were detected after two weeks post-stocking suggesting that either short-term mortality was high and / or that there were not enough receivers present to document these fish in all portions of the study area.

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Professional, Oral Presentation

Can They Play Nicely? Creating and Managing a Two-Predator System

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The management of fisheries that include multiple predatory, sport fish species can be difficult, from both the perspectives of ecological balance and competing angler interests. Such complications certainly exist for the Muskellunge *Esox masquinongy* and Smallmouth Bass *Micropterus dolomieu* fisheries of the New River, Virginia. The Virginia Department of Game and Inland Fisheries (VDGIF) introduced Muskellunge in the 1960s, and the population has since developed into a premier, state-renowned fishery. Circa 2006, the VDGIF changed Muskellunge management to spur this development and promote a self-sustaining, trophy fishery. Concurrently, Smallmouth Bass anglers voiced concern over possible increases in predatory interaction between Muskellunge and Smallmouth Bass and the effects their interaction might have on the quality of the bass fishery. We evaluated the population demographics and food habits of the current Muskellunge population. We found several ontogenetic shifts in Muskellunge diet, but consumption of Smallmouth Bass overall and within size classes was very little. We also found an increase in the CPUE, biomass/ha, and size structure of Muskellunge, since the VDGIF changed Muskellunge management. Using this information, we simulated interactions between the populations under different management regimes. Our study indicates the New River can support premier fisheries for both Smallmouth Bass and Muskellunge. Similar results are emerging from studies conducted on other Virginia Rivers, and we feel intensive Muskellunge management can successfully add new fishing opportunities in Virginia while preserving other popular fisheries.

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Student, Oral Presentation

Stock Structure of Spotted Seatrout: Assessing Movement and Genetic Connectivity at Northern Latitudinal Limits

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Understanding population structure is essential to accurately delineating stock boundaries and to developing and implementing effective fisheries management strategies. Spotted seatrout (*Cynoscion nebulosus*) are one of the most economically important marine recreational fish species in the United States, yet data on the connectivity of populations in the species' northern range (North Carolina latitudes and north) are limited. In North Carolina's 2015 age-structured assessment, spotted seatrout in both North Carolina and Virginia were considered one unit stock based in part on recent multiyear tag-return data collected by North Carolina State University. From 2008 to 2013, 9.4% (47 of 499 tag recoveries) of spotted seatrout tagged in North Carolina were recaptured in Chesapeake Bay. Clear and consistent seasonal migration patterns between North Carolina and Chesapeake Bay were observed and are likely associated with known overwintering and spawning periods for spotted seatrout in North Carolina. Therefore, tag-return data do not unequivocally imply homogeneity, as it is not known whether or not it is only the Chesapeake Bay-produced spotted seatrout overwintering in North Carolina that then return to Chesapeake Bay during summer for spawning. In this study, we conducted a genetic analysis of the spatial and seasonal demographic independence of North Carolina's spotted seatrout. Specifically, we used microsatellite loci to determine spotted seatrout connectivity among estuaries in North Carolina and between North Carolina and Chesapeake Bay during both the 2014 spawning (May-September) and overwintering (December-February) periods. Our results will be invaluable in determining if the current spotted seatrout assessment is using an appropriately defined unit stock.

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Professional, Oral Presentation

Hybridization and Replacement of Roanoke bass (*Ambloplites cavifrons*) with invasive rock bass (*A. rupestris*) in Virginia: How big is the problem?

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*Presenting

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The Roanoke bass (*Ambloplites cavifrons*) is a sport fish endemic to the Roanoke, Chowan, Tar, and Neuse drainages in Virginia and North Carolina. Virginia populations of this species are threatened by competition and hybridization with rock bass (*A. rupestris*), an invasive congener introduced from the Gulf slope throughout the early 20th century. Displacement and hybridization were reported as early as the 1950's, but the current status of this invasion and its impacts on *A. cavifrons* populations are unknown. Eleven nuclear DNA microsatellite markers were developed to discriminate between *A. cavifrons*, *A. rupestris*, and their hybrids, and in doing so to assess the current distribution of *A. cavifrons* in Virginia. The panel of markers provided a high degree of resolution among these groups, further allowing us to separate F1 hybrids from backcrossed individuals. Our results suggest a complex mosaic of invasion, displacement, and introgression patterns across the range of *A. cavifrons* in Virginia. *A. cavifrons* persists in only 4 of the 8 watersheds we examined, but has been mostly to completely replaced by *A. rupestris* in 3 others. In the Pigg watershed, an ongoing invasion is apparent: *A. rupestris* and hybrids were distributed throughout this system. Most extant *A. cavifrons* populations are geographically small, and all are vulnerable to invasion. This highlights the importance of educational campaigns that discourage anglers from transplanting "redeyes" to new waterways and potentially the need to establish new refuge populations of *A. cavifrons*.

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Student, Oral Presentation

Grafting of the tree of broken dreams: A phylogenetic analysis of *Elliptio*

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Elliptio is currently the most speciose genus of freshwater pearly mussels in North America. More than 40 species are currently recognized however morphological characteristics are nondescript and phenotypic plasticity confounds field identifications. Previous genetic analyses have found little evidence for monophyly and poor separation of seemingly morphologically divergent taxa. We are using a large dataset and multiple loci to identify evolutionary significant units within *Elliptio*. We compiled mitochondrial cytochrome oxidase subunit I (COI) and NADH dehydrogenase subunit 1 (NAD1) gene sequence data from 1000+ individuals and representatives of 25 *Elliptio* species. Although much of the dataset was generated in our lab, we supplemented alignments using sequences from GenBank. Sequences were trimmed to an appropriate length; questionable sequences and abnormally short sequences were discarded. Haplotype networks were estimated using POPart. Maximum likelihood and Bayesian inference phylogenetic trees were reconstructed using Geneious and MRBayes, respectively. Haplotype network results indicate extensive haplotype sharing across species, possibly representing multiple introgression events. Phylogenetic reconstructions suggest *Elliptio* is polyphyletic and we found curiously weak evidence of phylogeographic structuring within and among taxa. Addition of more slowly-evolving nuclear markers and additional species to our data set may help resolve basal nodes and clarify relationships of major groups within *Elliptio*. Our preliminary results seem to indicate that *Elliptio* appears to either be presently undergoing a radiation event or there has been substantial introgression of mitochondrial lineages. It is also possible that both processes are occurring simultaneously as hybridization is believed to be an important driver of speciation. The conservation implications for *Elliptio* are unclear but it seems that an extensive reevaluation of species boundaries and taxonomy may be needed.

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Student, Lightning Talk

Maury River Restoration Project Update

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In September 2014, VDGIF completed a large stream-restoration project on the Maury River in Glasgow, Virginia to re-align close to 2,000 feet of channel for erosion reduction and habitat enhancement. This project was presented at the VA AFS meeting in February 2015. Since that time, there have been several discharge events that have caused channel adjustments. Those events, their effects on the project, and the actions taken as a result will be shared.

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Professional, Lightning Talk

Channel Catfish (*Ictalurus punctatus*) Stocking and Reproduction in Small Impoundments

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The Virginia Department of Game and Inland Fisheries stock channel catfish in multiple small impoundments throughout the state to increase angling opportunities. In most small impoundments these stockings are considered to be the only source of recruitment for channel catfish populations and may supplement natural populations in some small impoundments. To better understand how much these stockings contribute to the channel catfish population we chose four small impoundments and began clipping the adipose fin of stocked fish in the fall of 2014. Stocked fish will be clipped again in 2016 for a total of three marked cohorts. Night electrofishing, hoop netting and gill netting for channel catfish will take place in 2017 and 2018 to examine the percentage of stocked fish from the three cohorts. Part two of this study will begin in 2017 and involves the installation of catfish spawning boxes into these four lakes. VDGIF has observed successful spawning of channel catfish in these spawning boxes in small impoundment and hatchery settings. Three more cohorts will be clipped and stocked during the fall of 2017, 2018 and 2019. These cohorts will be sampled and analyzed in 2020 and 2021 to again determine how much the stockings are contributing to the channel catfish population or if the spawning boxes have increased the percentage of natural fish. We also plan to determine if there is a correlation between the number of spawning boxes per acre and the increase in natural recruitment. Catfish collected will have spines or otoliths removed for aging. This will also allow us to obtain growth information in these small impoundments to better adjust minimum size and creel limit regulations. The only result to report at this time is the observation of spawning boxes being utilized in impoundment and hatchery settings.

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Professional, Lightning Talk

2016 Meeting of the Virginia and North Carolina Chapters of the American Fisheries Society &
The Southeast Atlantic Slope and Virginia Atlantic Slope Mollusk Groups
Danville, VA March 14 – 17, 2016

Condition, Diet, and Trophic Relations of Stocked Trout in Southern Appalachian Mountain Streams

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Stream trout fisheries are among the most popular and valuable in the United States, but are among the most dependent on hatcheries to sustain fishing and harvest. Thus, understanding the ecology of hatchery-reared trout in natural environments is fundamental to management. We evaluated the trophic dynamics of western North Carolina Appalachian mountain streams that were stocked with Brook Trout *Salvelinus fontinalis*, Brown Trout *Salmo trutta*, and Rainbow Trout *Oncorhynchus mykiss*. Relative weights (W_r) of hatchery-reared trout were inversely associated with residence time, but were consistently higher than those of wild trout in delayed-harvest reaches. Declines in weight of harvested trout during season openers were similar among species and size at stocking, but fish stocked earlier lost more weight. Mean W_r declined from 102 (SE = 1.1) to 87 (SE = 0.8) in the North Toe River and from 104 (SE = 1.8) to 94 (SE = 1.8) in the East Prong Roaring River. Hatchery-reared and wild trout were sampled over time to compare diet composition and to evaluate temporal dynamics of trophic position using stable isotope analysis. Overall, 40% of the hatchery-reared trout stomachs collected from both streams were empty compared to 15% of wild trout stomachs. Wild trout were 18 times more likely to consume fish and 4.3 times more likely to consume gastropods relative to stocked trout. Hatchery-reared trout were isotopically similar to co-occurring wild fish for both δ13C and δ15N values, but less variable than wild individuals. Although hatchery-reared trout appeared to consume similar food items as those of wild fish, differences in consumption or altered behavior (e.g., reduced feeding) may have resulted in lower condition and overall negative growth. These findings are important to guiding trout stocking activities (e.g., timing, densities, locations) and may assist in enhancing trout fisheries in mountain streams.

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Professional, Oral Presentation

2016 Meeting of the Virginia and North Carolina Chapters of the American Fisheries Society &
The Southeast Atlantic Slope and Virginia Atlantic Slope Mollusk Groups
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Behavior and Survival of Stocked Trout in Southern Appalachian Mountain Streams

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Stocking trout to support recreational fisheries is a common practice among state and federal agencies to meet the demand for fishing and harvest. Success of stocking efforts relies upon the behavior and survival of fish to maximize availability of fish to anglers. We quantitatively described movement behavior and survival of stocked Brook Trout *Salvelinus fontinalis*, Brown Trout *Salmo trutta*, and Rainbow Trout *Oncorhynchus mykiss* in three southern Appalachian Mountain streams in western North Carolina, managed under delayed harvest regulations. Hatchery trout were tagged with a combination of passive integrated transponders (PIT tags) and radio transmitters (radio tags), stocked into the North Toe River, East Prong Roaring River, and Little River delayed harvest reaches, and monitored during the catch-and-release season from October to June. Assessed according to river and species, 19-65% of trout emigrated from the delayed harvest study reach, while 1-29% died within study reaches. Among radio-tagged fish, 71% (59-85% by river) stayed within 2 km of the point where they were stocked, but 6% migrated over 10 km from the stocking location. Few trout stocked during fall were available to anglers for harvest in June due to a combination of migration and mortality, and emigration was associated with stocking and high-flow events. Multi-state modeling detailed these observations and provided weekly estimates of migration and survival rates. River-specific differences in emigration and mortality suggest that emigration was a greater loss of trout than mortality in all rivers; no river-size pattern was apparent in emigration, but mortality was greater in small streams. Brook trout mortality rates were highest among species, and large fish of most species showed higher emigration and mortality than catchable-sized trout. Fisheries managers can apply our results to alter stocking regimes to enhance efficiency and may evaluate hatchery practices to improve acclimation of stocked trout to instream environments.

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Professional, Oral Presentation

Status of Non-indigenous Fishes in North Carolina

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Populations of non-indigenous fishes are widespread in North Carolina and include 6 exotic species from outside the USA, 13 species native to other states, as well as 59 species native to waters of NC that now occur outside their historical native range. Three species are tropical and limited to artificially warm reservoirs with little potential for impacts on native communities under present climate conditions, but most are extant in natural habitats and pose various threats to native communities and could potentially expand further. Twenty species were intentionally stocked by NCWRC and other resource managers for expanded game fishing opportunities or as forage for game fishes. Perhaps the most widespread and impacting species in this group is Flathead catfish (*Pylodictus olivaris*), now common to abundant in eight Atlantic Slope river systems. Further threats include species presently known from adjacent states that occur in waters contiguous with NC waters [e.g. Northern snakeheads (*Channa argus* and related spp.) and Asian carps (*Hypophthalmichthys* spp.)] and species with high commercial aquacultural interest. Vulnerability to and the establishment of non-indigenous species varies across river systems. The Catawba River system in western NC presently has the greatest total non-indigenous species 35 (37%) and the New River system has the highest percentage of total fish fauna (52%) made up by non-indigenous species, while the Lumber River system has the fewest (6 spp., 8%). Management and policy in NC also varies across regions and species. Historically, NC has made action to address the introduction and spread of non-native fishes a low priority, but more attention has been focused recently. Steps taken to date include the adoption of a statewide stocking permit requirement by the NCWRC, the development of a statewide Aquatic Nuisance Species Management Plan, and a move to stocking only sterile triploid trout and Grass carp (*Ctenopharyngodon idella*).

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Professional, Oral Presentation

Emergency Response Phase Sampling Results and Year-one Sampling Results of a Long-term Monitoring Plan following an Accidental Coal Ash Release into the Dan River

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Duke Energy, Raleigh, North Carolina

Duke Energy began intensive sampling of water, sediments, and the aquatic community immediately following an accidental coal ash release on February 2, 2014, from the Dan River Steam Station in Eden, NC. Initial results from sampling water and sediments indicated that chemical constituents and ash dissipated or dispersed in the Dan River basin fairly quickly. Also, during this emergency response phase, sampling of the biological community was performed to assess whether acute impacts occurred. However, the potential for long-term impacts to the system remain unknown. Duke designed an extensive long-term monitoring plan to address this concern and with the approval of the Dan River natural resources trustees, implemented the sampling plan at the beginning of 2015. Information and data from the initial emergency response phase sampling and one-year of the long-term monitoring plan will be presented.

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Professional, Oral Presentation

Spring Flow Variability Associated With Muskellunge Recruitment on the Upper James River, VA

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Muskellunge (MUE) fingerlings were stocked most years on the Upper James River from 1972 through 2010. Significant Increases in relative abundance were detected beginning in the early 2000s. Annual increases in age – 0 MUE CPUE, even during no stocking years, led biologists to cancel the stocking program in 2010. Since cancellation, total MUE CPUE has continued to increase exponentially, while age- 0 has remained variable. We analyzed long-term water quality and river discharge datasets (2000 to current) for the upper James River in an effort to explain the expanding muskellunge population. We used a combination of regression techniques to identify abiotic variables associated with year-class strength. Spring discharge fluctuation (ft3/s) (Range of mean monthly flow March –June) had a significant positive relationship with fall YOY CPUE. Further analysis of catch curve residuals vs. range in spring flows for respective year classes also showed a significant positive relationship. Slope of spring-mean-monthly flows had a significant negative relationship with Fall YOY CPUE, suggesting that a declining trend in monthly flows was more important for MUE recruitment. Conductivity also had a significant positive relationship with YOY CPUE, which suggest that productivity during cascading spring flow regimes is greater than years with stable or increasing spring flow regimes, which may further increase YOY survival. Years with flows highest in March followed by cascading declines through June produced the strongest MUE year classes on the Upper James River, VA.

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Professional, Oral Presentation

Using Angler Diaries to Provide Cost-Effective Information on an Emerging Blue Catfish Fishery in Lake Wylie, North Carolina

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Blue Catfish (*Ictalurus furcatus*) fisheries management has increased in importance for numerous natural resource agencies; however, methods to collect beneficial population information on ictalurids often have been obscured by gear selectivity, seasonal variability in catch rates, and low precision of estimates of population metrics. Additionally, effective collection methods (e.g., gill nets) often require increased staff effort and multi-day sampling approaches, and mortality of target and non-target species often is high. In 2010–2011, North Carolina Wildlife Resources Commission (NCWRC) biologists conducted electrofishing and trot line surveys in response to increasing angler interest in an emerging Blue Catfish fishery in Lake Wylie, North Carolina. Survey results were poor, as one Blue Catfish was collected using all gear types. As an alternate approach, in 2012–2014, NCWRC biologists distributed angler diaries to provide baseline Blue Catfish and Channel Catfish (*I. punctatus*) population information and bolster communication lines with stakeholders. Although numbers of angler diary participants were low, 418 Blue Catfish and 864 Channel Catfish were caught, measured, weighed, and released during the survey period, thus providing beneficial stock assessment information with minimal effort.

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Professional, Oral Presentation

North Carolina Aquatic Nuisance Species Management Plan

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In the 1990s national legislation established several aquatic nuisance species (ANS) control initiatives, including an opportunity to prepare state-specific ANS plans. The majority of states prepared such plans, but North Carolina was one of the few states without one. In 2014, after a series of ANS introductions into waters containing rare species and involving state ownership, several North Carolina agencies agreed to lead the effort in producing an ANS plan for North Carolina. Over 250 species were assessed for their status in North Carolina, of which 90 nuisance or invasive species are extant. Another 20 native species are known to exist outside their native range (i.e., moved to other river basins). The process of plan development, contents of the plan, and its current status will be discussed.

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Professional, Oral Presentation

Subsistence Anglers and Other At-Risk Consumers of Freshwater Fish: Tools for Communicating Consumption Advisories

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Multiple factors influence whether fishermen are aware of and alter their behaviors in response to fish consumption advisory (FCA) information; these include education and belief systems, type of information communicated (e.g., qualitative or quantitative), and message tone, among others. Recent research has shown that specific language and images as well as the style of FCA communications also influence comprehension. There are multiple tools to communicate FCA information such as brochures, fishing regulation digests, websites, and signage. Although signs are commonly used to communicate waterbody-specific FCAs, limited research has explored the extent to which signs influence fishermen's decisions to follow advisories. For this reason, we conducted a study with the objective to evaluate the effectiveness of signs in communicating FCAs to subsistence anglers and other at-risk consumers of the catch (e.g., children, spouses). The target population for the study was the approximately 79,000 fishermen with valid subsistence fishing waivers in North Carolina (from 10/2014 through 9/2015). Demographic analysis of this population showed 48% were Caucasian, and 47% were African American. Roughly 47% were located in eastern NC, with the rest almost evenly divided between the Piedmont and western NC. Based on these data, we developed a regional concept for FCA signage and evaluated it with English- and Spanish-speaking fishermen. Through four focus groups with sport and subsistence fishermen, feedback was solicited on prototype signs designed to be posted along contaminated waterways to advise recreational and subsistence fishermen about fish contamination and adverse health risks. We found differing levels of baseline knowledge of FCAs and varying perceptions of personal risk between sport and subsistence fishermen. Sign prototypes were confusing, even to those familiar with FCAs. Initial results suggest that a modular campaign with multiple, complementary components could more effectively reach multiple audiences and communicate key messages to those most likely to respond

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Student, Oral Presentation

Trophy Largemouth Bass Research in the Private Sector

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Since 2013, multiple small impoundments throughout Virginia have been reset with the goal of establishing trophy bass fisheries. In the spring of 2015, these private waterbodies were stocked with three varying genetic strains of female largemouth bass. To monitor the growth rates and the success of each strain over time, an equal number of bass from three sources were weighed, measured and PIT tagged prior to being stocked. The data collected will provide great insight into the impact of genetics in our region, while also helping biologists adjust management strategies and improve growth rates of largemouth bass. Recapture data from October 2015 indicate the project s' potential to provide significant findings. In addition to the genetic component, the current projects have provided valuable information on the importance of collecting and comparing recapture data from an identical stock of fish released into various waterbodies. Early in-season growth data comparisons allow biologists to adjust management strategies early in the same growing season in order to take corrective measures on waterbodies that show subpar growth data.

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Professional, Lightning Talk

A General Assessment of a Southern Riverine Muskellunge (*Esox masquinongy*) Population

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*Presenting

Virginia Department of Game and Inland Fisheries

Biologists began stocking muskellunge in the Shenandoah River systems in the mid 1960's. Very little sampling was completed specifically targeting general muskellunge population parameters. The Shenandoah River Muskellunge Research Project began in 2009 to determine contribution of stocked muskellunge, percentage of natural reproduction, individual growth, movement, and general population data. Sampling took place in the months of February and March using three electrofishing boats in tandem. Muskellunge age three and greater were considered fully recruited to the sampling gear. Coded Wire Tags (CWT) were used to mark fingerling and advanced fingerling muskellunge stocked into the South Fork and Main Stem Shenandoah rivers. All muskellunge collected during spring sampling (2009-2015) were double marked with a passive integrated transponder tag (PIT) and visual implant alpha tag (VIA). In 2014 & 2015, pelvic fin rays were collected on all fish for age verification. Known-age (CWT) fish verified 100% reader accuracy through age four, 88% through age five using pelvic fin rays in 2014. Throughout the duration of the project, 61 CWT fish were collected. Thirty four percent of muskellunge (< 7 years old) from the 2014 sample contained CWT stocked muskellunge. Both stocked and wild fish contribute to the population. Of the 55 PIT tagged muskellunge recaptured, 9.1% showed significant movement. Catch rates (CPUE) ranged from 1.0 – 2.2 fish per hour. Current findings will direct future muskellunge management in the Shenandoah River watershed.

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Professional, Oral Presentation

Development of Environmental DNA Protocols for Detecting Occurrence of Imperiled Daces (Genus *Chrosomus*) in Virginia

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Management and recovery of imperiled *Chrosomus* species in Virginia relies upon accurate knowledge of species' distributions and distribution changes over time. Surveying efforts would benefit from use of tools that identify streams with high probabilities of occupancy, as well as sampling methodologies that are rapid, non-invasive, cost-effective, and exhibit high detection probability. We developed and tested protocols for indirectly detecting the occurrence of *Chrosomus* species based on the presence of their DNA within water samples collected from streams of interest in Southwest Virginia. DNA primer pairs targeting the mitochondrial cytochrome *b* and cytochrome oxidase I genes were developed for Clinch Dace *C.* sp. cf. *saylori* and Tennessee Dace *C. tennesseensis* and utilized in quantitative polymerase chain reaction assays to amplify the species' DNA in streamwater samples. In a subset of samples exhibiting amplification success, amplified DNA was sequenced to confirm and identify *Chrosomus* species present in the stream of interest. Our primers and eDNA protocols showed sensitivity of detection to 7.9×10^{-4} ng/μL in laboratory serial dilution studies. Assays of water samples from Southwest Virginia streams showed true-positive detection in 73% of cases for Clinch dace and 33% for Tennessee Dace. Despite low frequencies of false-positive results (0-2% and 5% for the two species, respectively), high frequencies of false-negative results (27% and 67%, respectively) indicate that application of eDNA must be regarded as a partial success for detection of *Chrosomus* daces. A slight increase in sensitivity might make eDNA more time-efficient than minnow trapping for detecting Clinch Dace, although a moderate increase in sensitivity would be needed to make eDNA as effective as electrofishing for detecting dace when present. We conclude with a list of recommendations based on our experiences and published literature to improve detection probabilities in the future.

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Professional, Poster

Stocking Grass Carp, is the Reward worth the Risk? An Examination of Virginia's Grass Carp Program

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Grass carp are illegal to possess in Virginia except under a permit administered by The Virginia Department of Game and Inland Fisheries. Triploid (sterile) grass carp are permitted as a vegetation management tool in Virginia only in closed systems and can only be obtained from suppliers certified by the U.S. Fish and Wildlife Service National Triploid Grass Carp Inspection and Certification Program that agree to random ploidy blood test of carp on their shipments (ploidy determined by flow cytometry). The use of triploid grass carp is extensive in Virginia with over 300 permits issued on an average year and managers have had great success with the control of certain aquatic vegetation. In the 1,766-hectare Claytor Lake, Virginia, managers observed greater than an 80% reduction in hydrilla after two years of grass carp stocking. The successes with triploid grass carp have not come without risk. Since the grass carp program started in 1985, Virginia's independent blood testing has identified numerous diploid carp on certified triploid deliveries. The instances of diploid carp peaked between 2008 and 2012 with multiple shipments into the Commonwealth containing up to 30% diploid fish. Additionally, the collection of feral carp in rivers like the James has increased considerably since 2012; e.g., in 2014, 28% of feral carp collected from James River tested diploid. The high percentage of diploid fish in Virginia waters increases the potential for development of a resident spawning population in Virginia's river systems. Increased vendor testing and greater enforcement are warranted to reduce the risks associated with grass carp stockings.

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Professional, Poster

Long-term freshwater mussel monitoring in the Pee Dee River, North Carolina

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From 2009 to 2015, the Wildlife Resources Commission and its partners conducted biennial mussel surveys in the Pee Dee River downstream from Falls, Tillery, and Blewett Falls dams. The Pee Dee River contains four Wildlife Action Plan Species of Greatest Conservation Need (SGCN) and the results of these quantitative surveys will help inform the status of these mussels as well as document potential changes in mussel diversity and abundance due to improvements in water quality (dissolved oxygen) and quantity (minimum flows). Since 2010, there have been incremental improvements in water quantity and/or quality released from the hydropower dams. We documented the lowest species richness (8 species) at Falls Dam and the highest (14 species) at Tillery Dam. The mean density of all mussel species ranged from 5.1 mussels/m^2 at Falls Dam to 24.1 mussels/m^2 below Blewett Falls Dam. The density of mussels at Falls and Tillery Dams have remained stable over time and there was an increasing trend in density downstream of Blewett Falls Dam then a decline to initial densities in 2015. We will continue our long-term monitoring surveys to ensure that SGCN populations remain viable and to help refine our management strategies.

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Professional, Lightning Talk

~~An Economic Analysis of the Striped Bass (*Morone saxatilis*) Fishery of the Neuse River~~
WITHDRAWN

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Fish stocking programs are a common management tool used to restore depleted fish populations. The striped bass fishery of the Neuse River is an example of one such fishery that has been stocked with the goal of rebuilding the population. This study sought to investigate whether the current stocking activities are worth keeping by comparing costs of the striped bass stocking program with the economic returns generated through recreational and commercial fishing. Using information collected from the NCDMF, the consumer surplus for the striped bass fishery was estimated to measure recreational benefits. The total recreational benefit to anglers for 2014 was $126,947.37 or $17.54 per angler. The total commercial benefit to commercial fishermen for 2014 was $14,450. A benefit-cost analysis determined that the net benefits of the striped bass stocking program are negative, although our results were found to be statistically insignificant. It was estimated that for the stocking program to break even, the number of recreational fishing trips would have to increase by 24%. Further studies should continue to assess the economic impact of the striped bass fishery to analyze the effectiveness of stocking as a restoration tool.

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Student, Poster

Emergency Response Actions and Natural Resource Damage Assessment and Restoration following an Accidental Coal Ash Release into the Dan River: An Example of Public/Private Collaboration

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On February 2, 2014, a stormwater pipe underneath the primary ash basin at the Dan River Steam Station in Eden, NC collapsed, releasing water and ash into the Dan River. In the immediate aftermath of the incident, dozens of company and agency personnel worked together to implement emergency response actions and recover ash accumulations. An inter-agency team was formed to facilitate communication and sharing of data as multiple parties conducted water sampling, biological surveys and observations of ash movement in the river. These cooperative efforts resulted in better understanding of each agency's interests and needs and collaborative decision-making regarding studies to be performed and action levels to be used for ash recovery. In June 2014, the federal and state Natural Resource Trustees and Duke Energy entered into a cooperative agreement to complete the Natural Resource Damage Assessment and Restoration (NRDAR) process under CERCLA. Information about natural resource damage assessment efforts and current status of early restoration projects will be presented.

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Professional, Oral Presentation

Individual Blue Catfish Growth Variation during Introduction and Expansion in Virginia Tidal Rivers: Observations and Modeling

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Blue Catfish were introduced in the James, Rappahannock and York Rivers of the Chesapeake Bay watershed in the 1970s and 1980s to promote new fisheries. Since introduction, Blue Catfish have expanded into all Virginia tributaries of the Chesapeake Bay with astounding abundances reported. As the species expands in distribution and abundance, uncertainty exists surrounding how life history parameters have changed spatially and temporally as Blue Catfish adapt to this novel environment. Understanding variability in life history across time and space is paramount to formulation of population dynamics models. Our objective was to quantify variability in somatic growth of Blue Catfish within three tidal river systems of the Virginia portion of the Chesapeake Bay catchment. We analyzed growth data from 8,393 Blue Catfish collected by Virginia Division of Game and Inland Fisheries from 1995–1996, 2002–2011 and 2014 from the James, Rappahannock and York River Systems. We extended the von Bertalanffy growth function to nonlinear mixed-effect models with random effects of river system, sampling year and year class. Using an information theoretic approach, we recommend the best model describing spatial and temporal variability in von Bertalanffy growth parameters featured cohort and river system as random effects. The results of this study support differences in individual growth across river systems and a decline in growth over time, providing crucial information for formulation of population dynamics models considering spatial and temporal variability in Blue Catfish biomass.

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Student, Oral Presentation

The Effects of a Largescale Drawdown and Dam Replacement on Largemouth Bass in Salem Lake, North Carolina

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Salem Lake is a 148-ha impoundment built in 1919 by the town of Winston-Salem, located in the northern Piedmont of North Carolina. Between 1986 and 2010, North Carolina Wildlife Resources Commission staff conducted frequent spring electrofishing surveys (N=15) at Salem Lake. These surveys revealed a quality Largemouth Bass fishery, with an average CPUE of 60 fish/h and average PSD and PSD-P values of 84 and 61, respectively. During fall 2010, repairs to the Salem Lake dam were initiated as a result of structural issues. This required an 80% drawdown of the lake for approximately 1.5 years, with lake levels returning to normal pool in summer 2012. As a result of angler concerns regarding the effects of the drawdown on the Largemouth Bass fishery and the likelihood of similar issues on nearby lakes with aging dams, annual spring electrofishing surveys were initiated during 2013. Stock assessment values for Largemouth Bass in 2013 suggested a decline in the fishery. However, improvements were observed in 2014 and by spring 2015 the Largemouth Bass size structure, size indices (PSD = 91, PSD-P = 57), and CPUE (59 fish/h) had recovered to pre-drawdown conditions. While additional surveys are planned, the results suggest the impact of the drawdown was short lived. The information obtained may help predict the effects of similar dam replacement projects on Largemouth Bass populations in other small Piedmont impoundments.
Keywords: Largemouth Bass, electrofishing, dam repair, fish monitoring

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Professional, Oral Presentation

2016 Update on Freshwater Mussel Propagation at the North Carolina Wildlife Resources Commission's Conservation Aquaculture Center

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Recent improvements to habitat in North Carolina, including the Cheoah and Pigeon rivers, have provided opportunities for reintroductions and augmentations of rare freshwater mussels. Since 2008, the North Carolina Wildlife Resources Commission (NCWRC) has devoted resources to captive propagation of rare aquatic species with the development of an internal propagation facility, the Conservation Aquaculture Center (CAC) in Marion NC, and through partnerships with NC State University and the US Fish and Wildlife Service. In 2015, the CAC focused on restoration activities for four federally listed species, and seven state priority species. Propagation efforts at the CAC in 2016 resulted in the production of over 28,000 freshwater mussels to 9 months of age. Notable releases include ~2,500 *Alasmidonta raveneliana* into the Cheoah River in Graham County, NC, ~8,000 *Elliptio steinstansana* into Little Fishing and Fishing creeks Halifax Co., NC, and 133 Lasmigona decorata into Waxhaw Creek, Union Co., NC. Additional state priority species releases include ~4,000 *Lampsilis fasciola* and ~4,000 *Villosa iris* into the Cheoah River, ~11,000 *L. fasciola* into the Pigeon River, and ~1,500 *Alasmidonta viridis* into the Cheoah River. Propagation techniques at the CAC include the use of flow through and recirculating systems using fine substrate and upwellers. Future work at the CAC will continue to address survivorship, growth, and tagging.

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Professional, Lightning Talk

Examining fine-scale movement of estuarine southern flounder (*Paralichthys lethostigma*) using a combination of active and passive acoustic techniques

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Identifying areas of essential fish habitat are necessary for implementing novel spatial approaches to fisheries management. However, habitat use can be difficult to quantify in cryptic environments especially for highly mobile estuarine fish species. This study applied a combination of three different telemetry approaches to examine fine-scale habitat use of southern flounder (*Paralichthys lethostigma*) in a tributary (Northeast Creek) within the New River estuary, North Carolina. Twenty flounder (mean TL ± sd = 347±37mm) were implanted with acoustic transmitters (VEMCO V9) from June-August 2013. First, passive acoustic monitoring was accomplished through an array of eight stationary acoustic receivers (VEMCO VR2W) which enabled calculation of the duration of residence within and migration from the creek by each individual. Second, weekly active tracking was completed by transecting the creek using a manual hydrophone (VEMCO VR100) along predetermined listening stations to examine habitat use patterns at a broad scale. Finally, continuous active tracking for a period of 36-48 hours, during which fish position was recorded every ten minutes, was conducted on a fine spatial scale for a subset of individuals, including a flounder tagged and followed in May 2015.

Residency analysis results from passive monitoring and weekly transects indicated average creek residency of approximately four months (mean ± sd = 135±88days). During the study, 30% of tagged flounder were harvested by fishers while residing within the creek. Tributary migration occurred mostly in the fall (8/27/2013-12/21/2013) for observed emigrating flounder (N=5). Focal follow results (N=7) indicated small daily activity spaces that ranged between 1600-7000m2 95% minimum convex polygon and 1500-3000m2 95% kernel density estimates. Rate of movements during the tracks ranged from 0.018-0.034 meters/second. There was no detected diel difference in either activity space (t-test: df=6, t-stat=1.43, P-value=0.2) or observed rate of movement (t-test: df=6, t-stat=0.29, P-value=0.8).

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Student, Oral Presentation

Detecting Predation Impact of an Introduced Fish Using Next-Generation Sequencing

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Non-native species introductions have been implicated as a cause of decline in native biodiversity and a major threat to the conservation of imperiled species. Blueback Herring *Alosa aestivalis*, an anadromous fish native to the Atlantic Ocean and coastal rivers, was introduced to the Hiwassee River system of the Interior Basin and became established in Hiwassee Lake, North Carolina, by 1999. The Hiwassee River supports six species of native redhorses (*Moxostoma*) of the sucker family (*Catostomidae*), which are vulnerable to effects of introduced species and habitat degradation. One of these, the Sicklefin Redhorse *Moxostoma* sp., is imperiled with a restricted distribution and is of high conservation concern. To evaluate possible predatory interactions of Blueback Herring with native sucker species, Blueback Herring were sampled from the Hiwassee River and a major tributary, Valley River, using electrofishing during April-June, 2014 and 2015. Stomach contents of 232 Blueback Herring were examined visually and via DNA barcoding coupled with next-generation sequencing (NGS). Visual diet examinations detected 12 orders of aquatic invertebrates, as well as fish ova, fins, and larvae. Limitations on visual analyses included an inability to precisely identify prey items, especially fish tissue, and a large proportion of diets examined (34%) were completely unidentifiable. Barcoding PCR was successful for ~67% of samples allowing identification of five species of redhorses and the Northern Hog Sucker *Hypentelium nigricans* in the Blueback Herring diet, but Sicklefin Redhorse was not detected. NGS DNA barcoding enabled species-level identification for 25 of 26 visually observed larval fish and for 5 samples with ova. Predation on larval suckers was detected in May (mean frequency of occurrence: 21%) and June (8%) and was related to predator size. Our findings enhance understanding of trophic dynamics between introduced and native fishes and demonstrate the utility of an innovative method for investigating predatory interactions.

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Student, Oral Presentation

Swamp Tales: A Status Update for the Carolina Pygmy Sunfish *Elassoma boehlkei*

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The Carolina Pygmy Sunfish (*Elassoma boehlkei*) is one of 374 species under review by the US Fish & Wildlife Service. These small inhabitants of blackwater ditches, streams, and swamps are endemic to small portions of the Lumber and Santee river drainages in North and South Carolina. No recent focused surveys had been conducted for this species across its known range and there were only a handful of opportunistic records scattered across several decades indicating persistence. Beginning with a pilot survey to investigate detection probability in 2014, 81 survey sites were visited over two years, 49 within the Juniper Creek drainage in the Waccamaw River system and 32 in adjacent watersheds. While the Carolina Pygmy Sunfish was detected at only 15 of these localities, over half were previously unrecorded locations. Local densities remain high in available habitats, and two extremely high water years have demonstrated the species' ability to migrate with flow to take advantage of ephemeral conditions. In addition, new localities were discovered for several other priority species. With most of the riparian land in the Juniper Creek watershed now state-owned, as well as protected areas both upstream and downstream and very low development pressure, the Carolina Pygmy Sunfish appears to face a relatively stable future.

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Professional, Oral Presentation

Maximum Daily Consumption of Blue Catfish *Ictalurus furcatus*

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Daily maximum consumption of Blue Catfish (*Ictalurus furcatus*) will be determined in the laboratory over the temperature ranges of 5-25 °C. Introduced to Virginia's tidal rivers during the 1970's, these fish have quickly established themselves as a top predator. Predation on threatened species such as American Shad (*Alosa sapidissima*) and blue crabs (*Callinectes sapidus*) has been observed in these fish. To quantify the maximum daily consumption, fish will be fed Gizzard Shad (*Dorosoma cepedianum*) and blue crabs (*Callinectes sapidus*) ad libitum over a period of 24 hours. From this experiment, it is possible to extrapolate the data into abundance models to quantify the absolute maximum consumption of the catfish.

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Student, Poster

Freshwater mussel detection: a research synthesis aimed at filling knowledge gaps on mussels

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The longevity of native freshwater mussel species is threatened due to anthropogenic pollution, habitat destruction, and competition by invasive species. Complicating conservation efforts is the lack of life history information for imperiled species. Additionally, mussels are difficult to locate because they are cryptic by nature; mussels spend the majority of their lives burrowed in the streambed, and when surfaced, their shells are camouflaged against the substrate. The result is that surveying for mussel populations can be time consuming, of limited accuracy, and potentially inefficient due to surveyors lacking sufficient life history information.

In hopes of improving surveying efficiencies by examining current limitations, we investigated differences in visual detection of mussels by substrate, the depth to which mussels can burrow, and the time need to re-surface after a disturbance. Results from an experiment involving novices surveying for mussels in an artificial stream channel suggest there is no bias in visual detection of mussels in sand versus rock-dominated substrates. Preliminary trials on mussel burrowing depth found juvenile mussels were capable of re-surfacing after being buried to depths up to 25 cm in artificial stream channels. Mussels were found to stay subsurface for ~48 hours after burial, with at least 50% synchronously surfacing on the second day, regardless of burial depth. The maximum cumulative percent of surfaced mussels reached a plateau after the third day since burial. This finding supports the idea that a disturbance could prompt a synchronous rebound of sub-surfaced mussels.

Based on our initial findings, we suggest that those surveying streams for mussel populations assume no sampling bias between substrates when surveying, to dig at least 25 cm into the substrate, and to survey shortly after a disturbance event such as high flows, to find the greatest amount of mussels present at the surface.

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Student, Poster

CATT Tracks – A summary of stream inventory projects in VA and NC, 1995 to present

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The USDA Forest Service Southern Research Station Center for Aquatic Technology Transfer (CATT) is a science delivery program serving aquatic resource managers in the southeastern U.S. The CATT has provided assistance with a wide variety of projects in Virginia and North Carolina since 1995. A full listing of CATT projects is available on the CATT website at: http://www.srs.fs.usda.gov/catt/reports.html. Here we provide a brief overview of the information available in our reports, contacts for obtaining project data, and services available to resource managers through the CATT program.

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Professional, Poster

Sleeping Giants: the Ecology and Impacts of Domestic Invasive Large Catfish

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Large North American ictalurid catfishes (channel catfish, blue catfish, flathead catfish) have been widely introduced in the United States beyond their native ranges. These domestic invasive species receive less scientific and media attention relative to exotic fish introductions, but their ecological impacts may be equally or more severe. They have been implicated for the decline of sport fishes, imperiled fishes, and amphibians. Introduced flathead catfish are of special concern, because they are an aggressive obligate carnivore with great potential to alter native fish assemblages. Since the 1950s, they have been introduced into southeastern U.S. Atlantic Slope rivers from Florida to Pennsylvania, established by releases of few individuals. The flathead catfish has been considered easily collected by electrofishing, of low densities, with sedentary behavior, restricted to freshwater, and feasible to manage in restricted river units, but recent research suggests that electrofishing is an inefficient gear, it occurs in dense populations, individuals migrate throughout a drainage, it tolerates brackish waters, and populations must be managed at the basin scale. Management of introduced catfish focuses on limiting dispersal among basins, public education, and encouraging harvest. Additional research is needed to elucidate the effects on native fishes and develop and assess alternative population control measures.

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Professional, Oral Presentation

Max Patch Pond
Angler Access Improvement and Habitat Enhancement, Madison County, NC

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Max Patch Pond is located in Madison County, NC within the Pisgah National Forest. The Max Patch Pond angler access improvement and habitat enhancement project was a joint effort between the US Forest Service (USFS), the NC Wildlife Resources Commission (NCWRC) and Trout Unlimited (TU). Since 1989, the NCWRC has managed the pond for sport fishing by stocking 1,700 catchable-sized trout annually (March-May). This high elevation (4,243 ft.) 1.5-acre pond provides a unique trout angling opportunity adjacent to the Appalachian Trail. In 1993, the NCWRC and USFS jointly constructed a Sport Fish Restoration funded boardwalk structure and fishing platform to provide universal angling access to the pond. After more than 20 years of angler use and weathering, the original access structures were in need of repair or replacement. Moreover, the pond was receiving sediment inputs from an adjacent gravel road and hiking trail storm run-off. Thermal impacts from an open canopy around the pond limited the duration of trout stockings due to elevated summertime pond temperatures. In 2015, TU, the NCWRC and the USFS partnered to address the angler access needs and also target sedimentation issues and thermal impacts. Angler access improvement objectives were to construct a universally accessible floating fishing pier and associated parking location, refurbish the existing stationary fishing platform and increase the total number of parking spaces. Habitat enhancement objectives were to reduce the volume of storm water run-off entering the pond and rehabilitate the riparian buffer surrounding the pond. Funding for the project was provided through the NCWRC, the Sport Fish Restoration Program and the USFS's Master Stewardship Agreement. Stewardship Agreement funding covered the habitat enhancements and Sport Fish Restoration funding covered the access improvements.

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Professional, Oral Presentation

Population Estimation of the Imperiled Clinch Dace (*Chrosomus* sp. cf. *saylori*)

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Clinch Dace (*Chrosomus* sp. cf. *saylori*), a newly discovered species of minnow, is listed as a Tier 1 species of conservation concern in Virginia. Estimates of Clinch Dace abundance and density are needed to prioritize populations for specific conservation action. I generated estimates of population extent based 206 site visits from four independent fish surveys within the Clinch Dace's putative range since 2007. I used Royle-Nichols occupancy models to test hypotheses on factors that influence Clinch Dace abundance while accounting for spatial autocorrelation among sites. Next, I used mark-recapture techniques to estimate densities in five occupied streams. A linear regression model generated from these data allowed me to transform all single-pass electrofishing data into population estimates for Clinch Dace in occupied streams where single pass electrofishing has occurred. Estimates of total census and genetic population size were combined for an estimate of total abundance in Virginia. Clinch Dace occur at low densities in 31.2 km out of the approximately 351 km of 2nd and 3rd order streams in Russell and Tazewell Counties in Virginia. Individual population census size estimates ranged from 11 to 1699 individuals. Estimates of combined census population size for 10 of 16 populations was just 6,046 adult individuals. Clinch Dace populations are small, isolated, and likely lacking in genetic diversity. No estimates of population trends are available, but these estimates provide a baseline for future monitoring programs. Swift conservation action is needed to protect most Clinch Dace populations in Virginia.

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Student, Oral Presentation

Assessing Smallmouth Bass (*Micropterus dolomieu*) Trophic Position in a Hierarchical River Network Using Stable Isotope Methods

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Smallmouth bass (*Micropterus dolomieu*) is an introduced, coolwater species abundant in the rivers and reservoirs of Virginia. In response to climate change, the range of smallmouth bass is expected to expand higher into river watersheds where increasing sympatry with coldwater assemblages is anticipated. An understanding of smallmouth bass trophic ecology in these smaller stream communities is important to quantify their potential impact on native brook trout (*Salvelinus fontinalis*) populations and overall community structure. As prey assemblages in streams differ predictably with stream order, we hypothesized that smallmouth bass prey selection would likewise change systematically. Specifically, we predicted a decline in trophic position of smallmouth bass in smaller streams due to a decline in piscivory and increased feeding on invertebrate prey. To test this hypothesis we analyzed gut contents and employed stable isotope methods to assess smallmouth bass prey selection and trophic position across stream order in a hierarchical river network (James River Basin, VA). Findings show that trophic position does not change as a function of stream order based on stable isotope estimates from white muscle tissue. Across sites, numerical abundance of prey items in gut contents was dominated by omnivorous crayfish, a high-to-intermediate trophic level invertebrate that could potentially obscure stable isotope results. These results illustrate that stable isotopes methods are best applied in combination with gut content data to compare smallmouth bass trophic ecology between systems.

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Student, Oral Presentation

Trends in Abundance of Northern Snakehead in Virginia Potomac River Tributaries

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A Northern Snakehead *Channa argus* population was documented in the Potomac River system in 2004. We estimated relative abundance (electrofishing fish/hour) for 12 years for a series of core creeks within the original area of colonization and for nine years for Aquia Creek – colonized about three years later. Population estimates were also calculated for adult Northern Snakehead in Little Hunting Creek. Relative abundance of Northern Snakehead ceased to increase, and ANOVA was unable to discern any significant differences in relative abundance in recent years suggesting population growth slowed or perhaps stabilized. Population estimates (12-21 fish/ha) declined each year 2013-2015 supporting the assertion that Northern Snakehead density stabilized and possibly declined.

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Professional, Oral Presentation

EFFECTS OF LAND USE AND STREAM HABIAT CHANGES ON APPALACHIAN ELKTOE (*ALASMIDONTA RAVENELIANA*) POPULATIONS IN THE NOLIHCUKCY RIVER DRAINAGE, NC

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The Appalachian elktoe (*Alasmidonta raveneliana*) is endemic to the Upper Tennessee River Drainage in the Blue Ridge Physiographic Province in North Carolina and Tennessee. This federally endangered mussel has recently undergone declines in abundance and distribution across portions of its range. However, the mechanisms responsible for this trend are not entirely known. We surveyed 25 sites in the Upper Nolichucky Drainage in 2015 to quantify the spatial effects of land use alteration and stream habitat conditions on Appalachian elktoe distribution. We characterized substrate using pebble counts, measured stream depth and current velocity and conducted timed visual-tactile mussel surveys. Additionally, we analyzed changes in land use/land cover (LULC) among sites using ArcGIS. Appalachian elktoe abundance in the Nolichucky Drainage is significantly correlated with current (2011) and past (1992) forest cover at both the 100-m riparian zone and watershed levels. Additionally, sites occupied by Appalachian elktoe had significantly lower concentrations of silt compared to unoccupied sites ($p=0.02$, $n=25$). These results indicate that Appalachian elktoe distribution in the Nolichucky River is potentially affected by primary forest cover removal and subsequent degradation of benthic habitat by siltation. Moreover, they illustrate that ongoing development and other anthropogenic activities across the Blue Ridge are likely to be major stressors on Appalachian elktoe populations. Future research is aimed at quantifying stream hydrologic variables including stream gradient, bank-full height and shear stress via a combination of field measurements and Light Detection and Ranging (LiDAR) sourced elevation data.

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Student, Oral Presentation

Population Assessment of the Federally Endangered James Spinymussel (*Pleurobema collina*) in North Carolina

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North Carolina Wildlife Resources Commission

The James spinymussel (*Pleurobema collina*) is a federally endangered mussel endemic to the James and Roanoke River basins of VA and NC. In NC, this species is known only from the Dan and Mayo River basins, where it is historically rare. In 2015, we conducted standard visual-tactile monitoring surveys to assess the current status of James spinymussel populations in NC. We surveyed 30 sites in the Dan and Mayo Rivers with 84.25 phr total effort and observed live James spinymussels (n=21; CPUE=0.25) at 8 sites. We did not detect James spinymussel from the Mayo River or the Dan River downstream of Buck Island Creek. Ongoing surveys in 2016 will work to further delineate the current range and status of James spinymussel in NC.

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Professional, Lightning Talk

Assessing the Influence of Propagation and Culture Methods on Juvenile Mussel Chemical Sensitivity: Implications for Conservation

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Freshwater mussels (Family Unionidae) are ecologically important and globally imperiled, thus work is needed to identify and manage stressors. Assessing mussel sensitivity to pollutants is necessary in identifying tolerance thresholds and setting protective water quality criteria and standards. Newly transformed juveniles are a sensitive life stage and are often used in toxicity testing. Thus, there is a need to transform mussel larvae into juveniles within a laboratory setting. Substantial resources have been invested into the propagation of unionid mussels over the past several decades. These efforts have produced great advances in propagation techniques and long-term growth and maintenance of propagated mussels. Improving standard host-fish (*in vivo*) infection techniques has been a significant contributor to this success, but recently, *in vitro* culture methods have made it more efficient and cost-effective to transform juvenile mussels in the laboratory. However, the relative chemical sensitivities of juveniles raised using both culture methods is not well examined. Consequently, *in vitro* cultured juveniles are not currently recommended by the American Society for Testing and Materials for use in toxicity testing. The objective of this study was to evaluate the relative sensitivity of *in vitro* and *in vivo* produced juvenile mussels to certain chemical toxicants. We conducted standard 96-hour acute toxicity tests with selected species (*Lampsilis cardium*, *L. abrupta*, and *Utterbackia imbecillis*) and chemicals: chloride, nickel, ammonia, copper, and two aquatic herbicides. We calculated the median lethal concentration (LC50) for each species-chemical combination and compared the LC50s of the *in vitro* and *in vivo* juveniles. Of the 12 tests completed, five resulted in statistically significant differences in LC50 between *in vitro* and *in vivo* propagated juveniles. While statistically different, four of the five tests were within a two-fold difference, which has been demonstrated by others to be within normal variation for intra-laboratory toxicity testing with juvenile mussels.

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Student, Oral Presentation

Stream Acid Mitigation Plan for Two Jefferson National Forest Streams

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North Fork Potts Creek and North Fork Stony Creek are two Appalachian Mountain streams in the Jefferson National Forest of West Virginia and Virginia. Both streams flow from the same mountain on opposite sides of the ridge. Both have acceptable cold water and thermal habitat for brook trout (*Salvelinus fontinalis*) but originate within watershed geology of little natural carbonate bearing minerals. The combination of the near absence of natural buffer and acid precipitation have created conditions of relatively low pH (pH < 5) and other water quality values which result in poor trout biomass and recruitment. In the present study water chemistry has been evaluated for the purpose of designing a mitigation strategy by the single point, single application method of introducing base material ("liming") near the headwaters. Physical size, watershed geology and discharge values have been evaluated for the two streams. Water samples have been collected and analyzed for pH, acid neutralizing capacity (ANC), base cations (Ca^{+2}, Mg^{+2}, K^{+}, and Na^{+}), strong acid anions (Cl^{-}, SO_4^{-2}, and NO_3^{-}), and aluminum. These physical and chemical parameters have been used along with results of previous liming studies to propose single point, single applications of 50 and 100 tonnes for the two streams, respectively, for a 4 to 5 year treatment period.

Project conducted with assistance provided by NSF-REU Grant CHE-1461175; United States Forest Service - George Washington and Jefferson National Forests; Dawn Kirk and Jesse Overcash, USFS staff scientists; Kelsey Berrier, Lindsay House and Chris Cabino, JMU student researchers.

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Student, Poster

Neuse River Catfish: Dynamic Assemblage and Establishment of a Trophy Fishery

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The Neuse River catfish community has undergone significant change since management surveys were initiated in the 1960s. Historically dominated by Channel Catfish (*Ictalurus punctatus*) and White Catfish (*Ameiurus catus*), the establishment of Blue Catfish (*I. furcatus*) in the 1960s and Flathead Catfish (*Pylodictis olivaris*) in the early 1990s have led to increased catfish angling effort and interest in a trophy fishery. In response to angler concerns of high exploitation, a survey was conducted in summer 2014 to assess the catfish community in the Neuse River from Smithfield to New Bern, NC. Low (15 Hz) and high (120 Hz) frequency boat-mounted electrofishing collected 299 Flathead Catfish, 263 Blue Catfish, and 124 Channel Catfish. Total annual mortality rates for Flathead Catfish (A = 16%) and Channel Catfish (A = 35%) indicate overexploitation is unlikely. Additionally, Flathead Catfish PSD-M (16) and PSD-T (10) suggest ample opportunity for anglers seeking large fish. Blue Catfish exhibited a bimodal size-distribution with few fish collected 350–500 mm total length. Given the mortality rates and size-structure, restrictive regulations for catfish are not necessary at this time. However, the absence of White Catfish is a management concern, and the cause for the Blue Catfish bimodal size-distribution remains to be elucidated. Future research will include an updated assessment of the catfish community in 2017 as well as a recreational angler creel survey.

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Professional, Oral Presentation

Gill Lice and Whirling Disease within North Carolina Trout Populations: Past, Current, and Future Efforts to Understand These Recently Discovered Threats

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Within its Public Mountain Trout Waters Program, the North Carolina Wildlife Resources Commission (NCWRC) manages approximately 8000 km and 800 ha of lotic and lentic resources, respectively. Brook Trout *Salvelinus fontinalis*, Rainbow Trout *Oncorhynchus mykiss*, and Brown Trout *Salmo trutta* populations comprise the majority of these resources, which are distributed across 26 counties of western North Carolina. In addition, a single population of self-sustaining Kokanee Salmon Oncorhynchus nerka exists within Nantahala Reservoir, Macon County. Since September 2014, NCWRC biologists have documented new biological threats to salmonids within the State. Gill lice (Copepoda: Lernaeopodidae: Salmincola) have been found on Brook Trout and Rainbow Trout populations. Further taxonomic evaluations of copepod collections are ongoing; however, elsewhere within the United States, *S. edwardsii* and *S. californiensis* are known to parasitize salmonids of the genera of *Salvelinus* and *Oncorhynchus*, respectively. Additionally, whirling disease was confirmed in Rainbow Trout collected from Watauga River, Watauga County, in July 2015. Confirmation of each of these threats marked their initial discovery in North Carolina. Sampling for copepods and *Myxobolus cerebralis* (the parasite responsible for whirling disease) has continued since these initial observations. Furthermore, the NCWRC has worked to inform and engage the public regarding whirling disease and gill lice as biologist seek to learn more about the invasive organisms' distribution and effects to the State's salmonids. By increasing understanding within the State, the NCWRC can continue to work with other regional managers to trout health issues on a larger spatial scale.

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Professional, Oral Presentation

A Brief Discussion of Recent Socioeconomic Data Concerning North Carolina's Public Mountain Trout Waters

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The North Carolina Wildlife Resources Commission (NCWRC) recently completed three studies to obtain socioeconomic data regarding its Public Mountain Trout Waters program. The purposes of these studies were to describe the fisheries management expectations, fishing preferences, and characteristics of North Carolina resident and nonresident trout anglers, estimate the economic contributions of mountain trout fishing to North Carolina's economy, and determine western North Carolina landowners' views toward angler access to trout waters. In 2006 and 2008, the Commission conducted a survey of anglers' views of mountain trout fisheries in North Carolina and estimated the economic contributions of mountain trout fisheries to the State's economy, respectively. Information generated from those two studies helped inform trout management; however, recent data were needed to understand trends, address management questions, and support the NCWRC's newly completed Trout Management Plan. In addition to collection of contemporary human dimension data, this effort was the first study to determine western North Carolina landowners' views toward trout angler access. The estimated number of anglers who fished for trout in North Carolina during 2014 was 148,991. Anglers indicated that finding access located on public land, knowing that they will likely catch a trout, and having regulations posted on site were very important factors when deciding where to go trout fishing. The vast majority of landowners have not experienced problems with anglers. Landowners indicated that having maps showing private lands listed as open for the public and dissemination of water access law information would be effective in reducing problems on their lands. Wake, Mecklenburg, and Buncombe counties are the top counties of residence for trout anglers. Estimated economic effects of the NCWRC's Public Mountain Trout Waters program to North Carolina's economy in 2014 was $383.3 million.

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Professional, Lightning Talk

Virginia Stocked Trout Management Plan

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Due to the importance of stocked trout fishing in Virginia, and the significant investment required to operate and maintain hatcheries to produce catchable-sized trout, the Virginia Department of Game and Inland Fisheries (VDGIF) developed the Virginia Stocked Trout Management Plan to ensure effective and efficient management of stocked trout fisheries. The planning process focused on balancing stakeholder values and sound biological information provided by VDGIF to produce a plan that is technically sound and publicly supported. The Plan contains two major sections: the technical section and the goals, objectives and strategies for management of stocked trout. The technical section describes the history of trout management in Virginia, how VDGIF approaches management of stocked trout, including production, facilities, species produced, and challenges faced in raising trout. The second section of the Plan lists the values and goals for management of stocked trout within five major issue areas (what stakeholders want to achieve and why) and the objectives and strategies for management of stocked trout (specific accomplishments that will allow VDGIF to measure success in achieving goals and how to approach achieving goals and objectives). The five major issue areas identified include: Announcement of stockings, angler recruitment and retention, funding and administration, ecosystem effects, and recreational opportunities. The Plan is designed to provide a blueprint for future direction of stocked trout management rather than specific details of day-to-day operations.

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Professional, Lightning Talk

Movement Ecology of Blue Catfish in Virginia's Tidal Rivers: Preliminary Findings

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Over several decades, the non-native Blue Catfish *Ictalurus furcatus* has spread to many waterways within the Chesapeake Bay watershed. Natural dispersal from mobile individuals contributed to population expansion. Evaluating movement patterns of Blue Catfish specific to tidal rivers will help managers and researchers understand home range size, seasonality of movements, and environmental variables that may cue fish to move. Our objective was to tag and track Blue Catfish in the Pamunkey and Rappahannock rivers in order to evaluate movement patterns. Acoustic tags were surgically implanted into Blue Catfish (size range = 356–1152 mm total length; n = 30 per river). To track tagged fish we used a combination of active and passive tracking techniques. We supplemented existing stationary receiver arrays with additional strategically placed VR2W receivers. The receiver arrays provided continuous detection throughout the time period. Active tracking was conducted each month with a VR100 mobile receiver. Preliminary data suggests that a large portion of tagged fish showed high site fidelity, but large movements occurred in others, especially in a downstream direction. Exploring what factors influence spatiotemporal movement patterns (i.e., tide cycles, salinity, flow, and seasonality) will be an important next step in this study.

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Professional, Lightning Talk

~~Human and environmental factors affecting the distribution of arapaima in Amazon River floodplain lakes~~ WITHDRAWN

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Understanding habitat selection across the life span of fishes is a critical component of sustainable fisheries management strategies. However, few studies have characterized the relationship between fine-scale environmental influences (microhabitat) and tropical floodplain fish distributions. The goals of this study were to (1) examine the effects of microhabitat variability (i.e., water quality, habitat structure, lake morphology) on the presence of arapaima *Arapaima* spp. in floodplain lakes, (2) determine the extent to which these relationships differ across life stages, and (3) compare the relative influence of human and environmental factors affecting arapaima distribution. Dry season arapaima microhabitat measurements were collected from 13 floodplain lake environments in six fishing communities of the lower Amazon River near the municipality of Santarém, Pará, Brazil. Arapaima expressed distinct and significant relationships between microhabitat variables and predicted probability of presence. The general pattern observed was that arapaima selected deeper ($p<0.001$), more turbid ($p=0.028$) habitats within floodplain lakes, and smaller arapaima selected habitats nearly twice as close to floating macrophyte beds than larger, older arapaima. Predicted probability of arapaima presence differed strongly and significantly between fishing communities, indicating that community-based management strategies play an important role in sustaining arapaima populations. This study reveals that microhabitat factors can govern population distributions for large-bodied fish in river floodplains and suggests that incorporation of environmental data into current community-based management models could enhance sustainability and restoration efforts for critical fisheries populations through identification of key habitats.

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Student, Oral Presentation

Characteristics of a Native Ictalurid Community in the White Oak River, North Carolina

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Early inland fisheries management practices primarily focused on the propagation and distribution of “desirable” fish species, resulting in the introduction of Channel Catfish (*Ictalurus punctatus*), Blue Catfish (*I. furcatus*), and Flathead Catfish (*Pylodictis olivaris*) to rivers of the southeastern Atlantic Slope. These introductions have produced significant changes to the ictalurid community and the trophic dynamics of many waterbodies. Lotic waterbodies with native catfish populations are becoming increasingly rare and biologically significant. Surveys of North Carolina’s coastal rivers have indicated very few ictalurid communities that are unaffected by non-native catfish introductions. White Oak River surveys have resulted in the collection of four Channel Catfish since 1964, and in 2009, the collection of two Flathead Catfish. Intensive surveys conducted since 2009 have failed to collect any non-native ictalurids. However in 2015; 120 White Catfish (*Ameiurus catus*) were collected and no non-native catfish were observed. Fish kills associated with Hurricane Irene in 2011 may have limited the introduction of non-native catfish in the White Oak River. Future surveys will be conducted regularly to monitor the status of the ictalurid community, which may be one of the few remaining in the southeastern Atlantic Slope devoid of an established non-native catfish population.

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Professional, Lightning Talk

Population Assessment in North Carolina of the Federally Endangered Roanoke Logperch (*Percina rex*), 2015

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The federally endangered Roanoke Logperch is a large darter (<165 mm total length) and was originally known only from Virginia portions of the Chowan and Roanoke River Basins. In 2007 Duke Power Biologists captured a single juvenile specimen in the Dan River downstream of the Smith River confluence in North Carolina. In subsequent surveys from 2007-2012, 22 individuals were captured in NC, from five additional water bodies. In 2015, 23 individuals were collected from the Smith, Mayo and Dan Rivers, one fish was captured twice in the Mayo River. In NC the current population could occupy up to ~40 RM: 35.5 RM in the Dan River, 2.3 in the Mayo River, and 2.5 RM in the Smith River. The most abundant population exists in the Mayo River downstream of Washington Mill Dam in Mayodan, NC. In all three rivers upstream migration is prevented by dams: Lindsey Bridge Dam in the Dan; Washington Mill dam in the Mayo; and Cotton Spray Dam in the Smith River. In 2015 no logperch were collected upstream of these dams and none were collected in previously known localities in Cascade Creek nor Wolf Island Creek. These streams and more sites on the Dan River will be assessed in 2016.

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Professional, Lightning Talk

Estimating mortality for southern flounder using a combined telemetry and conventional tagging approach

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The southern flounder (*Paralichthys lethostigma*) is a valuable marine fishery resource in North Carolina. The most recent (2009) stock assessment concluded that southern flounder were overfished with overfishing still occurring, necessitating updated estimates of fishing (F) and natural (M) mortality. Using a combined approach, southern flounder have been tracked with acoustic transmitters in a single estuary to provide fine-scale estimates of F and M, while fish with conventional tags have been deployed statewide to provide information about F and M on a larger spatial scale. During 2014 and 2015, 94 and 96 southern flounder were fitted with acoustic transmitters, respectively, and released throughout the New River estuary between May and December. Additional external tags contained contact information and a high monetary reward to meet the assumption of 100% reporting of recaptures. Fish were detected continuously via a passive array of acoustic receivers, with supplemental manual tracking that occurred bi-weekly or monthly. To date, 33 fishing mortalities have been reported among the 2014 cohort while 19 fishing mortalities have been reported among the 2015 cohort. Combining the 2014 and 2015 cohorts, commercial harvest was responsible for over 70% of reported fishing mortalities, which occurred throughout the estuary and included multiple gears (10 recreational hook and line, 5 recreational gig, 11 commercial gig, and 28 commercial gill net). For harvested fish, time at large was highly variable ranging between 1 and 214 days with an average ± SD of 54 ± 44 days. Emigration removed ~ 24% of individuals from the system for each annual cohort (23 emigrations each year). Currently 49 individuals from the 2015 cohort are assumed to be still at large in the estuary with 1 confirmed natural mortality, and 4 individuals that have not been detected since tagging. Active and passive tracking is ongoing to determine the fates of fish from the 2015 cohort still at large in the estuary.

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Student, Poster

Predation of Alosa species by non-native catfish in an Atlantic slope drainage

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Native to the Midwest, blue catfish *Ictalurus furcatus* and flathead catfish *Pylodictis olivaris* have been widely introduced into many Atlantic slope rivers, and are now found in several drainages of the Chesapeake Bay. As large, long-lived species, fisheries managers are concerned that these catfish are preying upon depleted anadromous species such as American shad, blueback herring, and alewife. We assessed spatiotemporal variability and selectivity in the diets of both blue and flathead catfish during the upriver spawning migration of Alosa species. Diets were extracted from 2,495 catfish, which included hundreds of specimens > 600 mm TL (N=947). Blue catfish had broad, omnivorous diets while flathead catfish fed solely on other fish. Alosa species were found in less than 5% of blue catfish stomachs while they occurred in nearly 17% of flathead catfish stomachs. Flathead catfish selected heavily for American shad and river herring, while blue catfish only slightly selected for American shad (Chesson's selectivity index). Alosa species were consumed more frequently in tidal fresh areas, particularly in the tailwaters of Bosher Dam, and predation of Alosa species peaked in April (logistic regression; $P<0.01$). Given this information, flathead catfish are likely to have a greater per capita impact on depleted anadromous species. Furthermore, dams still act as major obstacles to Alosa passage and may increase their vulnerability to predation.

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Student, Oral Presentation

Modelling Sediment Transport in the Roanoke River Basin to Protect Sediment-Sensitive Freshwater Fish Species

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Many freshwater fish and mussel species are negatively impacted by embeddedness driven by land use practices that increase sediment loading to streams (e.g. development, agriculture). The Roanoke Logperch (*Percina rex*,), found in the Roanoke River throughout Virginia and North Carolina, is federally endangered due, in part to embeddedness. Excess sediment coats streambed substrate, impeding Roanoke Logperch feeding tactics, and limiting available habitat. While riparian restoration efforts are expected reestablish vegetative buffers and natural sediment filters, resources (time and money) are limited. Therefore, a greater understanding of erosion, sediment transport, and deposition into the Roanoke River is needed to efficiently allocate resources for stream management. We developed a statistical model to predict reach-level embeddedness in the Roanoke River Basin integrating three spatial scales (watershed, HUC-12, and stream reach) of explanatory variables, including: annual upland soil erosion estimated using a spatially explicit GIS model, riparian filtration capacity, and additional landscape factors. The model has been used to estimate potential reduction in silt embeddedness and silt cover under riparian restoration scenarios for each watershed. Our results can be used to aid sediment-sensitive fish species by prioritizing watersheds for restoration efforts and improving stream management efficiency.

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Student, Oral Presentation

Behavioral mechanisms brook trout use to establish linear dominance hierarchies

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Brook trout in streams compete for access to preferred foraging locations, a process that leads to formation of linear dominance hierarchies within a patch of suitable habitat. The contests involved are energetically costly and can result in serious injury, and so fish have evolved behaviors to avoid contests that they are unlikely to win, including individual recognition of conspecifics and transitive inference. But, fish also move upstream and downstream to new habitats, and so an individual often encounters situations where it must enter an already-established hierarchy. No research has been done to evaluate the behavioral mechanisms fish use to determine their position in these established hierarchies, but it seems probable that behavioral syndromes ('personalities') play a role. For example, one axis of personality observed across many taxa is exploration/avoidance that measures the tendency to explore novel environments. The objective of this study was to determine if fish with different personalities display different behaviors when encountering a novel dominance hierarchy. Subject fish were evaluated in an open field test to quantify their personality on the exploration/avoidance spectrum, and then each subject was introduced to a testing arena containing an existing three-fish linear hierarchy. The behaviors of all four fish were quantified continuously for a period of six hours. We noticed that the number of agonistic interactions demonstrated towards the subject decreased over the trail time. The subject demonstrated more interactions with the two subordinate rivals and significantly less with the alpha rival. We successfully completed trials for 14 subjects, and data analysis is ongoing.

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Student, Lightning Talk

Estimation of persistence within the North Carolina red drum juvenile abundance index: performance of fixed versus partial replacement survey design

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Population monitoring efforts for red drum (*Sciaenops ocellatus*) include a survey designed to generate an annual juvenile abundance index (JAI). Since its inception in 1991, the JAI has estimated catch per unit effort of young of the year red drum during the fall using beach seines pulled at a set of fixed stations (n ~ 20) throughout the state. In an effort to evaluate the potential for bias in the index due to the fixed-station design, we quantified the spatial and temporal persistence among stations and across sample years. We calculated persistence among stations from year to year (i.e., did differences in catch among stations remain consistent through time?), and also among years from station to station (i.e., were differences in catch among years evident at all stations?). We also examined graphically the temporal pattern in ranked CPUE at each station and the spatial patterns in ranked CPUE across years. Lastly, a pilot study was conducted in 2014 and 2015 in two regions of the state to evaluate the potential for the addition of randomly selected stations to the fixed-station design. Analysis of the historical data demonstrated that as time between surveys increased, spatial persistence (i.e., consistency of station performance) gradually declined. Also, more recent years displayed higher persistence, with > 72% of pairwise comparisons of years yielding good levels of persistence ($\tilde{\omega} < 0.5$), while only about half of comparisons yielded a similar level of persistence prior to 2001. We also observed some temporal trends in the ranked catches that indicated instability in performance of certain stations. In one region of the state, the random stations revealed higher levels of CPUE in the mid and upper estuarine regions, while two fixed stations in close proximity to these random stations failed to catch significant numbers of fish in the past two survey years. The goal of this project is to evaluate the potential for a partial replacement survey design to improve accuracy in the North Carolina JAI.

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Student, Poster

Long-term Population Declines of the Mussel Assemblage in the Little Tennessee River, North Carolina: It's Even Worse than We Thought

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The Little Tennessee River from Franklin Dam to Fontana Reservoir contains the only extant freshwater mussel fauna in the mainstem river and two federally endangered species, *Alasmidonta raveneliana* (Appalachian elktoe) and *Pegias fabula* (Littlewing pearlymussel). Due to the Little Tennessee's aquatic biodiversity, it was designated the first Native Fish Conservation Area in the Southeast. Three long-term monitoring sites were established in 2004 to determine population trends of the endangered species and the mussel community. These sites were monitored using quantitative (quadrats) and semi-quantitative (timed-search) survey methods. Three additional timed-search sites were monitored between 2009 and 2015. Since 2006, we have documented severe declines in Appalachian elktoe populations, and by 2012, this species was not detected at two of the six monitoring sites. In 2012, we observed low numbers of the Appalachian elktoe at 3 sites (Franklin, Mason, Needmore) and slight increases in CPUE at Sawmill Creek site (furthest from the dam), but was not observed at any site in 2015. Significant population declines of the remaining mussel assemblage (averaging -40% CPUE) followed this trend at 5 of 6 sites with only Sawmill Creek reporting stable or increasing mussel populations. A significant negative correlation between Asian clam and native mussel densities was exhibited at the Franklin Dam site between 2004 and 2015 ($r= -0.47$, $p<0.05$), but this was not observed at the other sites. Surprisingly, even Asian clam populations have steadily decreased across the three quantitative sites, since high densities of 2009. Changes in native mussel abundance (CPUE) were positively correlated with distance from the dam in 2009 ($r= 0.58$), 2012 ($r=0.57$) and 2015 ($r=0.3$), but these were not significant ($p>0.05$). Specific reasons for mussel population declines are being investigated by other researchers, but there has been no definitive explanation that can be viewed as a 'smoking gun'.

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Professional, Oral Presentation

~~Examining Breathing Behavior of Arapaima for Improved Fishery Management in the Amazon~~ WITHDRAWN

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Arapaima (*Arapaima* spp.) are obligate air-breathing fish endemic to the Amazon basin, and one of the world's most overexploited fish species. Arapaima conservation and management depend on census counts that use air-breathing frequency to estimate fish abundance and set harvest limits. However, these counts depend on breathing rate assumptions, which have never previously been tested. This study examines relationships between breathing frequency and environmental parameters (i.e. temperature, depth, dissolved oxygen) for radio-tagged arapaima (n=13) in an upland river and its floodplain (Lake Ayapuá, Amazonas, Brazil). Multiple linear regression was used to evaluate environmental correlates of breathing frequency. Results show a significant negative relationship between breathing rate and water temperature (p-value = 0.014) and a positive relationship with fish size (p-value = 0.083). We observe average breathing frequency of 16 minutes for adult arapaima (T_L>1 m) and 14.5 minutes for juvenile arapaima (T_L=<1 m). Current management uses assumptions of a 20-minute breathing rate; therefore this study suggests revisions be made to fisheries management protocols to account for area-specific temperatures and size of fish counted. Our results will be used to inform better practices for censuses and improved management, thus helping to conserve populations of arapaima in the Amazon.

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Student, Oral Presentation

Multitrophic Effects of a Diatom on River Food Webs

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How increases in biomass of primary producers affect higher trophic levels is fundamental for understanding natural and managed ecosystems. Recently, the enormous increase in biomass of the stalk-producing diatom, *Didymosphenia geminata*, in many rivers worldwide has generated concern because of the potential negative impacts on these rivers and the salmonid fishes that they often support. Here, I used observations and experiments to show how the high biomass that results from *D. geminata* blooms has strong direct and indirect effects on river food webs, propagating through five trophic levels to reduce growth and increase disease prevalence of an economically important salmonid fish. The worldwide increase in blooms caused by this and other stalk producing diatoms and the potential links to climate-induced environmental changes and species introductions suggest that blooms of stalk-producing diatoms on river bottoms may be a common fisheries management and conservation concern in the future.

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Professional, Poster

The Effects of Nitrogen Gas Saturation on the Survival of Brook Trout (*Salvelinus fontinalis*) Eggs and Fry in Aquaculture and Deep Springs in South River, Waynesboro

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The restoration of brook trout in Virginia's streams is of significant importance and aquaculture may play a major role in restoring brook trout fisheries. A series of experiments were performed to evaluate the potential for hatching brook trout at the Montebello Fish Culture Station (MFCS) as well as in deep springs along the South River in Waynesboro. "Green" brook trout eggs were hatched in three deep springs in South River, Waynesboro, MFCS spring, and Paint Bank Fish Hatchery (PBFH) hatch house. The results were total mortality in all treatments except for PBFH hatch house (81% "eye-up"). To test whether nitrogen gas saturation affected mortality, "eyed" brook trout eggs were tested for 28 days at the same three springs in South River with eggs also hatched in ponds 1-6 at MFCS to determine whether as nitrogen gas saturation decreased due to aeration from water falling from pond to pond, the mortality would decrease as well. The results indicated that although the South River springs have optimal temperature, hardness and alkalinity for the hatching of brook trout eggs, the nitrogen gas saturation was detrimental to egg hatch (average morality of 30.5%, average nitrogen saturation 108.8%). The lowest mortality was found to be in the MFCS downstream ponds 3-6 (average mortality 5.5%) where average nitrogen gas saturation is 103.1%. Upstream MFCS ponds 1 and 2 had mortality of 20.6% and 11.1% with nitrogen levels of 105.5% and 104.9% respectively. For all treatments, there was a positive linear regression between nitrogen gas saturation and mortality ($R2 = 0.59$, $p < 0.01$). South River deep springs and MFCS may be more effective in hatching of brook trout eggs if the water could be degassed to remove nitrogen gas saturation.

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Student, Lightning

Duke Energy Activities Regarding the USEPA §316(b) Rule, Entrainment and Impingement at Cooling Water Intakes

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The U. S. Environmental Protection Agency's regulations for implementing § 316(b) of the Clean Water Act became effective on October 14, 2014. The § 316(b) rule establishes requirements for determining the Best Technology Available (BTA) for reducing the impingement and entrainment of aquatic organisms at cooling water intake structures. The rule applies to existing facilities with a cooling water design flow > 2 MGD, greater than 25% of water withdrawn is used for cooling purposes, and withdraw water from waters of the U.S. Seventeen Duke Energy Stations in North and South Carolina are subject to the rule. Seven options are prescribed for the minimization of fish impinged at cooling water intake structures. The state permitting agency must make a site-specific determination of BTA for entrainment for facilities that withdraw > 125 MGD actual intake flow. Requirements may include, no further action, closed-cycle cooling, fine-mesh screens, or seasonal flow reductions or other technology. All facilities, including both closed cycle and once-through cooling stations, must submit basic information concerning the source water, station operational parameters, historical studies, and chosen method of compliance with the impingement mortality standard. Facilities subject to the entrainment standard must conduct entrainment characterization studies (requires 2-years of entrainment monitoring) followed up with technical feasibility and cost studies, benefits valuation studies, non-water quality and other environmental impacts studies. Follow-up studies will be subjected to external peer review. Entrainment sampling is scheduled to begin during March 2016 at all facilities subject to the entrainment standard. Entrainment sampling will be conducted at each station's intake structure using pumped sampling methods designed to sample surface, mid, and bottom water depths. Final submittals will be due to the State during 2019 to 2022 depending on the station's permit renewal cycle.

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Professional, Oral Presentation

North Carolina's Experience with Clean Water Act §316 (a) Variances and Demonstrations

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Section 316(a) of the Clean Water Act (CWA) states: "whenever the owner or operator of any such source . . . can demonstrate . . . that any effluent limitation proposed for the control of the thermal component of any discharge . . . will require effluent limitations more stringent than necessary to assure the projection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made, the Administrator may impose an effluent limitation . . . that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water". The Division of Water Resources (DWR) has been delegated by the U.S. EPA to issue §316 (a) thermal variances to eight power generating facilities and one paper mill upon successful completion and defense of Balanced and Indigenous Communities (BIC) demonstrations. A majority of these facilities are situated on multi-purpose reservoirs where the fish assemblages have been intentionally manipulated and unintentionally altered over a period of many decades and where it is not always possible to conduct upstream-downstream impact studies. Every five years, permitees and DWR reviewers of the demonstrations (including permit writers and staff biologists) have been challenged to determine what constitutes a BIC. A balanced, indigenous community(synonymous with a balanced, indigenous population) means a biotic community typically characterized by diversity, the capacity to sustain itself through cyclic seasonal changes, presence of necessary food chain species, and by a lack of domination by pollution tolerant species. Closer scrutiny of the demonstrations by the U.S. EPA and litigants have resulted in increased guidance provided to the permitees and more careful review of the BIC and thermal modeling documents by DWR staff. Examples of some of the protracted contentious and relatively "uncontentious" demonstrations and permit renewals will be given along with more recent guidance recommendations.

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Professional, Oral Presentation

Change in Fish Toxic Element Body Burdens Over the Year Following a Catastrophic Release of Coal Fly Ash

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December 22nd, 2008 the sixty-foot earthen dike securing a retention pond at the Tennessee Valley Authority's Kingston Fossil Plant holding coal fly ash gave way. Most of an estimated 4.1 million cubic meters of saturated coal fly ash fluidized and flowed catastrophically from the pond covering a total land and aquatic area of 300 acres. The sheer volume of the spill and the fact that it has impacted both lentic and lotic systems makes this situation unique. ICP-OES analyses of water, sediments, and fish tissues (≥5 tissues sampled from shad, channel catfish, redear sunfish, and largemouth bass) collected in Jan '09, March '09, July '09, Jan '10 and May '10 from ≥5 river sites over the first 12 months following the dike failure have shown the following: 1) dissolved and/or total available toxic metals in water have not exceeded protective aquatic life criteria levels since the weeks immediately following the spill, even during extensive dredging operations beginning in March of 2009; 2) fish gills collected in March '09 from ash impacted sites showed several adverse histological alterations indicative of heavy metal exposure; 3) initially, fish body burdens of selenium (Se) were determined to be well above published regional background levels; 4) specifically for populations of redear sunfish at CRM 3.3, muscle burdens (dry weight basis) of arsenic (As - 0.824ppm in Jan '09 to 3.356ppm in Jan '10), cadmium (Cd – 0.032ppm in Jan'09 to 0.138 ppm in Jan '10) and Se (5.177ppm in Jan '09 to a high of 8.427ppm in July '09) have slowly and steadily increased; 5) a marked increase in popeye fish was noted over this period; and 6) sediment concentrations of toxic elements (especially As) at the spill site have stabilized or diminished while concurrently increasing at the site furthest downstream (TRM 567).

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Professional, Poster

Catfish Passage at Boshers Dam Vertical Slot Fishway in the James River Piedmont/Coastal Fall Zone

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The vertical slot fishway at Boshers Dam on the James River near Richmond was built in 1999. Last in the fall zone, this 3.1 m high dam is 182.3 km from Chesapeake Bay. Built primarily to provide American Shad access to over 500 km of historical spawning habitat, the fishway also provides passage for at least 22 additional species including Channel Catfish, Blue Catfish and Flathead Catfish. Fish are attracted into the entrance by a 6.3 cms (max) attraction flow system. Fish ascend 13 pools (3.1 m x 3.7 m) gaining 0.23 m at each slot (0.41 m) between pools. Fish are counted at a viewing window in the exit channel. Methods evolved from live counts, to time lapse vhs, to digital video. Review evolved from 6 hrs/day live counts, to 100% video, to 15 minutes/hour subsampling. Most review is of diurnal hours (0600-2100) with nocturnal (2100-0600) subsampling, especially to capture catfish passage. Fishway counts play a vital role in assessing the progress of American Shad restoration efforts on the James River while at the same time provide a unique opportunity to monitor movement of three catfish species from the Fall Zone at Richmond into the Piedmont. In an average season approximately 4,800 catfish traverse the fishway and the long-term trend for all three species is steady with the exception of a large spike in Blue Catfish passage in 2004. For seasons with catfish data, overall catfish passage was 52.4% Blue Catfish, 40.5% Channel Catfish, and 7.1% Flathead Catfish. All three species pass both diurnally and nocturnally, but the rate of nocturnal passage is considerably higher than the diurnal rate. Increasing nocturnal video review may enhance catfish passage estimates in future seasons. Additional analysis will include comparing fishway passage to Fall Zone and Middle (Piedmont) James River boat electrofishing CPUE.

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Professional, Oral Presentation

Spatial and temporal heterogeneity in life history trends of Atlantic Weakfish (*Cynoscion regalis*) and implications to fisheries management

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The biological characteristics of fisheries stocks which are assessed for management considerations are rarely homogeneous throughout the stocks' geographic distribution. Spatial variances in life history characteristics, productivity, and abundance of stocks are strongly influenced by heterogeneous environmental conditions. As environmental conditions vary over time as well as space, these biological characteristics also exhibit temporal variation. With ocean conditions changing at a faster pace due to global climate change, there is increasing concern for the resulting effect on fish distribution and abundance. In addition to environmental conditions, the spatial structure of fish stocks is affected by anthropogenic interactions. Fishing pressure varies greatly by location. This is likely due to fishermen taking advantage of local knowledge of fish abundance to increase their catch. However, stock assessment scientists largely ignore spatial heterogeneity in their models. This mismatch of knowledge between the resource users and managers is likely to have negative effects on fish stocks. This study addresses the incorporation of spatial heterogeneity into stock assessment models using the Atlantic Weakfish (*Cynoscion regalis*) population as an example. Atlantic Weakfish are found along the U.S. and Canadian Atlantic coasts from Nova Scotia to Florida. The National Marine Fisheries Service (NMFS) conducts an ongoing fisheries-independent survey of Weakfish and other marine species from the Scotian Shelf, Canada, to Cape Lookout National Seashore, NC. Common models of fish growth and maturity used in stock assessments were performed and compared among eight regions and 14 years surveyed by NMFS. Analyses revealed significant differences in growth and maturity parameters among both regions and years. This suggests that the Atlantic Weakfish population exhibits both spatial and temporal heterogeneity, and that these factors should be incorporated into future stock assessments of this species.

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Student, Oral Presentation

Overview of the Dan River coal ash spill, including results with invertebrates

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On February 2, 2014 a 48-inch storm drain collapsed under a 27-acre coal ash pond on the Duke Energy site near Eden, North Carolina. The resulting spill sent 39,000 tons of spent and 27 million gallons of contaminated water into the Dan River overnight. The Dan River Basin Association (DRBA) responded to the incident, with staff and volunteers on the river by February 4 taking sediment and water samples and making photographic observations. Due to the magnitude of the spill and the unknowns of contamination over the long term, DRBA created a bio-assessment plan to determine the best strategies for sampling and data collection. The plan included researchers that had previously worked on coal ash spills, other universities, Duke Energy, the Environmental Protection Agency, Virginia Department of Environmental Quality, and North Carolina agencies to collect data and develop techniques to begin determining long-term effects and tracking. To date, DRBA has assisted seven universities and colleges with sampling and research projects which include isotope tracing, macroinvertebrate tissue sampling, sediment deposition tracking, and assessment of methyl-mercury in anaerobic sediments. Although much of the research has not yet been published, there are plans to hold a symposium in 2016 where researchers will present findings and describe ongoing efforts. This talk will focus on DRBA observations and sampling on the river from the date of the spill to the present.

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Professional, Oral Presentation

Do Macroinvertebrate and Habitat Bioassessments Reflect Presence of Clinch Dace?

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Clinch Dace (*Chrosomus sp. cf. saylori*) are an undescribed species that, with the exception of two isolated Tennessee populations, are confined to two adjacent counties in Southwest Virginia. Specific threats stem from coal mines within the region that increase siltation, reduce riparian zones, and alter water quality in headwater streams that Clinch Dace inhabit. We examined relationships between Clinch Dace occupancy and stream characteristics in order to determine water quality and habitat preference as well as to identify potential sites suitable for future species translocation. We combined Clinch Dace collection records from Virginia Tech with Virginia Stream Condition Index (VSCI) and Rapid Bioassessment Protocol (RBP) data from VA Department of Mines and Mineral Energy, VA Department of Environmental Quality, and U.S. Fish and Wildlife Service in order to make comparisons. VSCI data consisted of 64 records collected at 52 stations in spring and 50 records at 42 stations in fall. RBP data consisted of 70 records collected at 30 stations. Both VSCI and RBP stations were classified as near or absent of Clinch Dace. Comparisons were made using non-metric multidimensional scaling plots (NMDS). Mann-Whitney test were used to quantify significance of correlation of Clinch Dace presence with RBP and VSCI scores. Results suggest that Clinch Dace presence corresponds with higher overall VSCI scores as well as certain individual VSCI metrics including percent Ephemeroptera (%EPT), percent Plecoptera and Trichoptera excluding Hydropsychidae (%P+T-H), and percent scrapers (%scrap). Clinch Dace sites were not distinguishable from other sites using RBP scores. Results indicate that available monitoring records are incomplete and that increasing monitoring stations in small, headwater streams is essential.

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Student, Poster

Recreational Angler Catch, Effort, and Satisfaction in an Urban Setting

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Urban fisheries are unique in many aspects, including angler demographics and attitudes, habitat, effort, and harvest. Lake Raleigh is located on the Centennial Campus of North Carolina State University (NCSU) and is jointly managed by NCSU and the North Carolina Wildlife Resources Commission (Commission). Sport fishing was permitted at Lake Raleigh from piers and a restricted length of shoreline beginning in 2007. Urban fisheries such as Lake Raleigh provide fishing opportunities to recreational anglers that may not have the means to travel great distances to fish. Despite continued fish population and habitat assessments conducted by NCSU and the Commission, little is known about the use and satisfaction of Lake Raleigh anglers. To address this information need, NCSU collaborated with the Commission to conduct an angler survey from December 2014 through December 2015. Surveys were conducted on 68 days, and 197 anglers were interviewed. The average time spent fishing was 1.6 hours with an average catch of 0.39 fish/trip (0.24 fish/h). Although 46% of anglers were targeting multiple species, 34% targeted only Largemouth Bass, 11% targeted only catfish (bullhead catfishes and Channel Catfish), and 9% targeted only panfish (Bluegill, Redear Sunfish, White Crappie, and Black Crappie). A total of 61% of anglers used artificial lures, 28% used live bait, while 11% used a combination of both methods. We also surveyed the overall satisfaction of anglers with their fishing experience using a five-category designation. Of all anglers surveyed, 21% were very satisfied, 52% satisfied, 20% neutral, 5% dissatisfied, and 2% very dissatisfied. Our survey found that most anglers were satisfied with their experience even if no fish were caught. As such, Lake Raleigh anglers commonly reported enjoying being outdoors and pleased to be able to fish in an urban setting. These results highlight the multiple functions and values of urban fisheries.

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