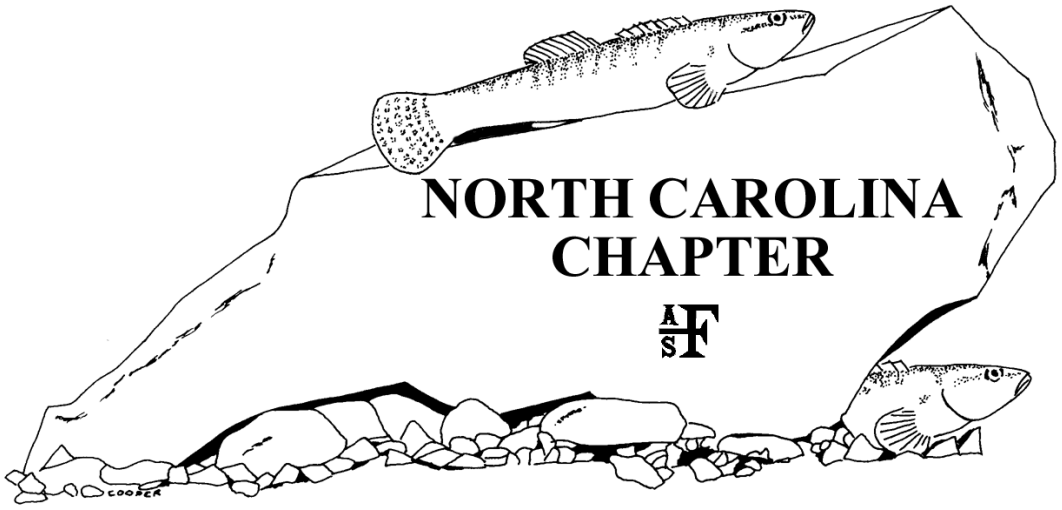


2012 Annual Meeting of the North Carolina Chapter of the American Fisheries Society

February 28-29, 2012

Brownstone Doubletree Hotel and Conference Center
Raleigh, North Carolina

Schedule and Abstracts

Tuesday, February 28th

8:00 am – 12:00 pm: **Continuing Education Workshop –** ArcMap, Web Services, and ArcGIS 10
Kim Sparks (NC Wildlife Resources Commission) and Joe Hightower (NC State University)
Location:

12:00 pm – 1:30 pm: **Lunch** (on your own)

Session 1: Habitat Use, Habitat Restoration, and Dams
Moderator: Brena Jones

1:30 pm – 1:35 pm: **Welcome and Orientation**, Current President Michael Abney

1:35 pm – 1:55 pm: **Fish Monitoring in the Tuckasegee River, NC, Relative to Dillsboro Dam Removal**, J. Coughlan*, Barry K. Baker, Michael A. Abney, William R. Doby, Mark A. Auten

1:55 pm – 2:15 pm: **Restored Habitat Use by Migratory Fishes Following Complete and Partial Dam Removals**, Joshua K. Raabe* and Joseph. E. Hightower, Student Paper

2:15 pm – 2:35 pm: **Modeling Suitable Habitat for the Robust Redhorse in the Pee Dee River: An Assessment for Reintroduction**, J. Michael Fisk*, Thomas J. Kwak, and Ryan J. Heise

2:35 pm – 2:55 pm: **Identification of American Shad Spawning Sites and Habitat Use in the Pee Dee River, North Carolina and South Carolina**, Julianne Harris* and Joseph E. Hightower

2:55 pm – 3:15 pm: **Identifying Sustainable Substrates for Oyster Restoration**, Robert Dunn*, David Eggleston, Niels Lindquist, Student Paper

3:15 pm – 3:30 pm: **Break** (snacks provided)

Session 2: Managing Sport Fisheries and Education
Moderator: Chris Wood

3:30 pm – 3:50 pm: **Undergraduate Work Experience Provides Quality Fisheries Training**, Matthew Stillwell* and Patrick Cooney, Student Paper

3:50 pm – 4:10 pm: **Overview of Genetic Evaluation of Anadromous Fish Stocking Programs in the Coastal Region**, Kevin Dockendorf

4:10 pm – 4:30 pm: **Age, Growth, Mortality of Yellowmouth Grouper from the Southeastern United States**, Michael L. Burton*, Jennifer C. Potts, and Daniel R. Carr

4:30 pm – 4:50 pm: **Brook Trout Management in North Carolina: A Review of Past, Present, and Future Efforts**, Jacob M. Rash

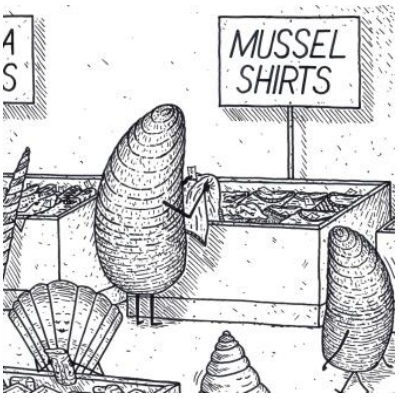
4:50 pm – 5:10 pm: **Longitudinal Telephone Surveys for Estimating Recreational Anglers Efforts, Harvest, and Released Catch**, Kenneth H Pollock

5:10 pm – 5:30 pm: **Potential New Tools for Obtaining Angler Access: Success Stories and Lessons Learned**, Kevin Hining

5:30 pm – 6:30 pm: **Break**

6:30 pm: **Dinner and NCSU Student Fisheries Society Raffle**

Win great prizes!



Support fisheries education!

Wednesday, February 29th

Session 3: Species Distribution, Climate, and Mussel Health
Moderator: Todd Ewing

8:00 am – 8:20 am: **Edward D. Cope's Contributions to Our Knowledge of the NC Fish Fauna and Revisiting NC's Type Localities -- Where I Left Off and My Conclusions, If I Don't Run Out of Time**, Bryn Tracy

8:20 am – 8:40 am: **Tropical Island Fish Assemblages are Resilient to Flood Disturbance Mortality**, William Smith*, Thomas J. Kwak, and Patrick Cooney, Student Paper

8:40 am – 9:00 am: **Exploring Individual and Synergistic Effects of Introduced Species on a Reservoir Food Web: an Ecosystem Modeling Approach**, Marybeth Brey*, Jim. A. Rice, and Derek. D. Aday, Student Paper

9:00 am – 9:20 am: **Biochemical and Reproductive Effects of the Synthetic Estrogen 17-α-Ethinylestradiol on the Unionid Freshwater Mussel *Lampsilis fasciola*,** Jeremy A. Leonard*, W. Gregory Cope, M. Christopher Barnhardt, and Robert B. Bringolf, Student Paper

9:20 am – 9:40 am: **Enhancing Relevance to Climate Change in Freshwater Mussel Thermal Tolerance Tests**, Jennifer Archambault*, W. Gregory Cope, and Thomas J. Kwak, Student Paper

9:40 am – 10:00 am: **Thermal Tolerances of Freshwater Mussels and Their Host Fishes: Species Interactions in a Changing Climate**, Tamara Pandolfo*, Thomas J. Kwak, W. Gregory Cope, Student Paper

10:00 am – 10:30 am: **Break** (snacks provided)

Session 3: Species Distribution, Climate, and Mussel Health
Moderator: Ryan Heise **Location:**

10:30 am – 10:50 am: **Hurricane Irene: Another Blow to Fish Populations in Northeastern North Carolina Rivers**, Jeremy McCargo* and Benjamin R. Ricks

10:50 am – 11:10 am: **Extent and Duration of Anoxic Conditions Following Hurricane Irene and Initial Assessment of Associated Fish Kills in Six Coastal North Carolina Rivers**, Justin Homan*

11:10 am – 11:30 am: **The Fisheries Blog: A Fisheries Forum to Inform and Generate Discussion**, Patrick Cooney*, Steve Midway, and Dana Sackett, Student Paper

11:30 am – 11:50 am: **The Effectiveness of Different Fish Attractors in North Carolina Reservoirs**, Jessica R. Baumann*, N. Corey Oakley, and Brian J. McRae

11:50 am – 12:10 pm: **Using Multiple Sonar Deployments to Improve Run-Size Estimates of Anadromous Fishes**, Jacob Hughes* and Joseph E. Hightower, Student Paper

12:10 pm – 12:30 pm: **Applying Acoustic Technology to Analyze Late Summer Fish Distribution and Behavior in Lower Lake Norman, NC**, Michael Abney and J. Coughlan

12:30 pm – 2:00 pm: **Lunch** (on your own)

2:00 pm – 3:00 pm: **NCAFS Business Meeting**

Thank you for your participation and have a safe trip home.

Abstracts

Tuesday, February 28th, 2012

1:35 pm: **Fish Monitoring in the Tuckasegee River, NC, Relative to Dillsboro Dam Removal**

David J. Coughlan*[1], Barry K. Baker, Michael A. Abney, William R. Doby, and Mark A. Auten
[1]Corporate Environment, Health & Safety, Duke Energy, Huntersville, NC, david.coughlan@duke-energy.com, 704-875-5236

Removal of the Dillsboro Dam on the Tuckasegee River, NC, was a key component in stakeholder settlement agreements associated with the relicensing of Duke Energy's Nantahala area hydroelectric projects. A regulatory requirement for dam removal required Duke Energy to monitor fish responses to this removal, which occurred in winter 2010. For this monitoring, fish collections (May and October) were conducted at four Tuckasegee River sampling locations (Downstream, Tailrace, Reservoir, and Upstream) prior to removal (2008) and two years following removal (2010 & 2011).
Species richness was always highest in the Tailrace and lowest in the Reservoir (and its successor) immediately upstream of the Dam. The pre-dam removal fish community in the Reservoir was dominated by rock bass and redbreast sunfish, but shifted in less than one year to a community dominated by cyprinids. Meanwhile, the communities at the other three riverine locations (Downstream, Tailrace, and Upstream) were always dominated by cyprinids. Pollution tolerance data indicated the Reservoir fish community had the highest percentage of individuals tolerant of pollution and the lowest number of species considered intolerant of pollution. Trophic data similarly indicated that the fish community in the Reservoir was atypical, though these differences decreased after dam removal. As expected, observed fish community metrics in 2008 indicated that the fish assemblage in the Reservoir was uncharacteristic of those occurring in nearby upstream and downstream riverine reaches, and was more consistent with the lentic habitat characterizing that site. Dam removal resulted in the removal of a large portion of the lentic habitat in the Reservoir, though a submerged rock ledge resulted in a portion of this habitat persisting. Sculpins and darters have yet to be collected in the Reservoir. A third year of post-dam removal fish sampling is slated for 2012.

1:55 pm: **Restored Habitat Use by Migratory Fishes Following Complete and Partial Dam Removals**

Raabe, J. K.*[1] and J. E. Hightower[2]
[1]North Carolina Cooperative Fish and Wildlife Research Unit, North Carolina State University, Department of Biology, Campus Box 7617, Raleigh, NC, 27695, 919-513-2469, jkraabe@ncsu.edu
[2]U. S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit, North Carolina State University, Department of Biology, Campus Box 7617, Raleigh, NC, 27695, 919-515-9936, jhightower@ncsu.edu

Migratory fish species are assumed to benefit from dam removals that restore connectivity and provide access to upstream habitat, but few studies have evaluated this assumption. Therefore, we assessed behavior of migratory fishes in the springs of 2009 and 2010 on the Little River, North Carolina, a tributary to the Neuse River with three complete and one partial dam removals. We tagged migratory fishes with passive integrated transponders (PIT) at a resistance board weir near the river mouth and followed their migrations by installing PIT antennas at upstream sites. Fish migrations were strongly influenced by river flow, with most movement occurring during freshets. Use of upstream restored habitat varied by species. For example, 24-31% of anadromous American shad *Alossa sapidissima*, 45-49% of resident gizzard shad *Dorosoma cepedianum*, and 4-11% of invasive flathead catfish *Pylodictis olivaris* passed the most upstream dam removal site at river kilometer (rkm) 56. For these three species, the partially removed dam (rkm 8) impeded upstream migrations for 17-28% of individuals and caused downstream delays exceeding one day for 20-39% of individuals that successfully passed. Gizzard shad required the deepest water to pass the notched structure, followed by American shad

then flathead catfish. Delayed American shad may experience wasted energy expenditures and increased vulnerability to predation; we documented cases of predation by flathead catfish. The results provide strong support for further efforts to restore currently inaccessible habitat through complete removal of derelict dams.

2:15 pm: **Modeling Suitable Habitat for the Robust Redhorse in the Pee Dee River: An Assessment for Reintroduction**

J. Michael Fisk II*[1], Thomas J. Kwak[2], Ryan J. Heise[3]
[1]North Carolina Cooperative Fish and Wildlife Research Unit, Department of Biology, North Carolina State University, Raleigh, NC 27695-7617, jmfisk2@yahoo.com
[2]U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit, Department of Biology, North Carolina State University, Raleigh, NC 27695-7617, tkwak@ncsu.edu
[3]North Carolina Wildlife Resources Commission, 1142 I-85 Service Road, Creedmoor, NC 27522, ryan.heise@ncwildlife.org

A remnant population of robust redhorse *Moxostoma robustum* persists downstream of Blewett Falls hydro-facility, the terminating dam in the Pee Dee River, NC. Due to anthropogenic processes, including habitat fragmentation and alteration from dams, this species is assumed extirpated from upstream reaches. A reintroduction of the species into an upstream reach could buffer the species from catastrophic events or chronic decline but upstream habitat suitability is unknown. Tillery hydro-facility is the next dam upstream of Blewett Falls hydro-facility and contains a lotic reach 30 rkm long before reaching Blewett Falls Lake. A new minimum flow regime downstream of Blewett Falls Dam will create more suitable habitat for the robust redhorse, but habitat suitability has not been quantified for the Tillery reach. Habitat suitability indices based on field microhabitat measurements from downstream of Blewett Falls Dam were applied to model suitable habitat for proposed minimum flows. Our objectives were to (1) quantify suitable habitat in the Tillery reach based on these suitability indices, (2) compare the current and proposed minimum flows between the two reaches, and (3) determine what specific microhabitat variables are limiting. Modeling results indicate that suitable robust redhorse habitat exists in the lotic reach between Tillery and Blewett dams. Sensitivity analyses suggest that substrate and depth are limiting microhabitat variables throughout the reach. These results will assist managers in decisions about flow manipulations during critical periods for the robust redhorse and other species of concern and guide research and planning for potential reintroduction of the robust redhorse in its historical range.

2:35 pm: **Identification of American Shad Spawning Sites and Habitat Use in the Pee Dee River, North Carolina and South Carolina**

Julianne E. Harris*[1] and Joseph E. Hightower[2]
[1]North Carolina Cooperative Fisheries and Wildlife Research Unit, North Carolina State University
[2]U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit, North Carolina State University

We examined spawning site selection and habitat use of American shad in the Pee Dee River, North Carolina and South Carolina, to inform management in this flow-regulated river. Estimated origins of American shad eggs from plankton tows identified spawning sites, and relocations of radio-tagged adults on spawning grounds illustrated habitat use and movement with changes in water discharge rates. Most spawning was estimated to occur in a 25-river kilometer (rkm) section just below the lowermost dam in the system, in the piedmont physiographic region; however, some spawning also occurred downstream in the coastal plain. The piedmont region is higher in gradient and is predicted to have slightly higher current velocities and shallower depths on average than the coastal plain. Also, the piedmont is dominated by boulders and gravel, whereas the coastal plain is dominated by sand. Sampling at night when American shad were spawning resulted in the collection of

young eggs that more precisely identified spawning sites. In the piedmont region, most radio-tagged American shad remained in discrete areas and generally occupied water velocities between 0.20 and 0.69 m/s, depths between 1.0 and 2.9 m, and substrates dominated by boulder/bedrock and gravel. Tagged adults made only small-scale movements with changes in water discharge rates. Our results demonstrate that the upstream extent of migration and an area of concentrated spawning are just below the lowermost dam. If upstream areas are similar, access could increase the spawning habitat available to this population.

2:55 pm: **Identifying Sustainable Substrates for Oyster Restoration**

Robert Dunn*[1], David Eggleston[1], Niels Lindquist[2]
[1] Department of Marine, Earth, and Atmospheric Sciences, NC State University, Raleigh, NC, rpdunn@ncsu.edu, eggleston@ncsu.edu, 919-515-6368
[2] UNC Chapel Hill-Institute of Marine Sciences, Morehead City, NC, nlindquist@unc.edu, 252-726-6841

Restored oyster reefs in high-salinity areas of Pamlico Sound have recently experienced population crashes, potentially brought on by Clionid boring sponge infestation of oyster shells and the limestone reef substrate. *Cliona* species of boring sponge are a widespread bio-eroder on reefs that can impact shell strength, oyster health, and reef structural integrity. The composition and porosity of limestone marl, the material commonly used to construct artificial reefs, may make it particularly vulnerable to bio-erosion by sponges. To address this problem, alternative substrates must be assessed for use in future reef building efforts. In this study, combined lab and field work are being used to investigate the efficacy of four materials that can be used for restoration- oyster shell, limestone marl, granite, and concrete- based on substrate-specific rates of oyster settlement, oyster mortality, oyster growth, and boring sponge invasion. In a laboratory settlement experiment, larval oyster settlement was highest onto oyster shell, second highest onto marl and concrete with no difference between them, and lowest onto granite with almost zero settlers. Substrate materials were also deployed in two estuaries, where sampling continues for percent oyster mortality, oyster growth, and percent sponge cover on each substrate. Future work will include additional lab-based and in-situ experiments to test the influence of substrate on oyster settlement, growth, and mortality. This work could ultimately support a switch to alternative materials for future reef construction, and could serve as a model for oyster restoration in other locations where sponges are impacting restored or commercial oyster populations

3:15 pm: **Break**

3:30 pm: **Undergraduate Work Experience Provides Quality Fisheries Training**

Matthew Stillwell*[1] and Patrick Cooney[2]
[1]1520 Lilley Ct Apartmrnt L4, Box 58, Raleigh, NC 27695, (252) 286-5718. mjstillw@ncsu.edu
[2]North Carolina Cooperative Fish and Wildlife Research Unit, Department of Biology, NC State University, Campus Box 7617, Raleigh, NC 27695, (352) 262-1986

Undergraduate students rarely gain direct work experience in the professional fisheries field while in school. Often, they are relegated to punctuated summer internships and school labs, and are accustomed to the statement “You need more experience” when being declined for a job following graduation. In the early summer of 2011, Progress Energy advertised a contract employee position that was flexible enough to work around class schedules. Experiences with the Student Fisheries Society and the North Carolina State University Fisheries and Wildlife Program gave me the confidence to apply and interview for the position. Since starting the job, I have had countless field and lab opportunities that would not have been available in a classroom setting. In the field, I have conducted snorkel surveys, freshwater mussel identification, aquatic insect and fish indexes of biotic integrity (IBI), water and sediment collection, and larval and juvenile entrainment and impingement surveys at power plants. In the lab at Progress Energy I conducted trace element processing and

analysis of fish tissues and sediments, water quality procedures, larval fish and invertebrate identification, mass spectrophotometry, and learned the importance of proper data recording, and broadened my experiences beyond those of the classroom. Having quality work experience while in school tremendously helps students in their preparation for a career after school and in conducting research while furthering one's education. Additionally, I have been able to pass these experiences on to fellow scholars. These opportunities need to be more available to students to supply properly trained future fisheries professionals.

3:50 pm: **Overview of Genetic Evaluation of Anadromous Fish Stocking Programs in the Coastal Region**

Kevin J. Dockendorf*
NC Wildlife Resources Commission, 1701 Mail Service Center, Raleigh, NC 27699-1701, 252-335-9898, kevin.dockendorf@ncwildlife.org

Supplementing anadromous fish stocks with hatchery produced fry and fingerlings is a common management tool used by the Wildlife Resources Commission. Evaluations of stocking programs are conducted with various methods, including external tags, internal marks or a combination of external and internal tags. Recent advances in genotyping broodstock in fish hatcheries will provide a non-lethal and reliable method to ascertain fish origin and contribution to spawning stock as well as recreational and commercial fisheries. I present an overview of the Commission's long term strategies and project goals to evaluate stocked progeny with specific genetic markers analyzed by expert geneticists at regional genetic laboratories. Our investigations will be focused on endemic stocks of striped bass in the Cape Fear River, American shad in the Roanoke River and blueback herring in the Chowan River to enhance these anadromous stocks with abilities to document hatchery contribution with certainty.

4:10 pm: **Age, Growth and Mortality of Yellowmouth Grouper from the Southeastern United States.**

Michael L. Burton*, Jennifer C. Potts, and Daniel R. Carr.
National Marine Fisheries Service, Southeast Fisheries Science Center, 101 Pivers Island Rd., Beaufort NC 28516-9722

Yellowmouth grouper, *Mycteroperca interstitialis*, sampled from recreational and commercial vessels along the southeastern United States coast from 1980-2011 (n = 348), were aged by counting opaque bands on sectioned sagittal otoliths. Analysis of otolith edge type (opaque or translucent) revealed that annuli formed May-August, peaking in May and June. Maximum age of yellowmouth grouper was 28 years, and the largest fish measured 859 mm FL (fork length in mm). Body size relationships were: $W = 2.55 \times 10^{-8} FL^{2.91}$ (n = 349), direct non-linear fit; $\ln(W) = 3.06 \times \ln(TL) - 18.63$ (n = 166, $r^2 = 0.89$), where W = whole weight in kilograms and TL = total length in mm; and $TL = 10.09 + 1.05 * FL$ (n = 162; $r^2 = 0.98$). Mean observed sizes at ages 3, 5, 10, 15, and 20 years were 422, 496, 600, 695, and 718 mm FL, respectively. The von Bertalanffy growth equation for yellowmouth grouper was $L_t = 769(1 - e^{(-0.11\,(t + 4.03))})$. Growth data from this study were similar to those reported in a previous study of yellowmouth grouper from the Gulf of Mexico, but differed considerably from growth data from both a Caribbean yellowmouth grouper and a study of the congeneric species scamp, *Mycteroperca phenax*, from the Carolinas. Natural mortality, M, was 0.15 using Hoenig's lifespan method, while age-specific estimates using Lorenzen's weight based method ranged from 0.23-0.11. Results from studies of less common species such as this are important as inputs into comprehensive ecosystem-based management efforts.

4:30 pm: **Brook Trout Management in North Carolina: A Review of Past, Present, and Future Efforts**

Jacob M. Rash*
North Carolina Wildlife Resources Commission, 645 Fish Hatchery Road, Marion, North Carolina 28752

Brook trout *Salvelinus fontinalis* is the only salmonid native to North Carolina. Anthropogenic alterations to the landscape and introductions of nonnative salmonids have greatly reduced its range. Intensive stockings of northern strain brook trout also diminished the genetic integrity of many native Southern Appalachian strain brook trout populations. Stockings of northern-strain fishes served as the primary form of brook trout management until the 1960s, when interest in preserving wild populations increased and more restrictive regulations were applied to those fisheries. In 1978, the first rigorous effort by the North Carolina Wildlife Resources Commission (NCWRC) to inventory North Carolina's trout streams began. Since that initial 4-year study, the NCWRC has identified approximately 602 wild brook trout populations, and of these 480 have been genetically typed via allozyme analysis. Results from testing indicate that 38% of the populations are Southern Appalachian origin, 10% are northern origin, and 52% are of mixed genetic origin. Microsatellite DNA analysis will be employed by the NCWRC to gain further insight into the historic distribution of Southern Appalachian brook trout, examine current population relatedness, and develop a genetically-based restoration framework. Continuing protection of existing Southern Appalachian brook trout populations, and the restoration of those extirpated, can only be achieved if managers have a firm understanding of the genetic diversity and variation associated with the species.

4:50 pm: **Longitudinal Telephone Surveys for Estimating Recreational Angler Effort, Harvest, and Released Catch**

Kenneth H. Pollock*
North Carolina State University, Raleigh NC USA 27695-7617, 919-513-7566 office, 919-906-3147 cell, pollock@ncsu.edu
Recreational angling is of growing importance and therefore recreational harvest and released catch should be included in stock assessments for many fisheries throughout the world. Telephone surveys are becoming widely used to assess recreational fishing in many countries. Much of the cutting edge research and development of these surveys has been in Australia. In this talk I discuss the key issues involved in designing these surveys. I illustrate my talk using the current I-Survey being implemented in Western Australia that I was involved in developing. The integrated or I survey involves multiple components to enhance robustness and validity of the survey. I conclude by discussing and contrasting the new recreational surveys being developed by NOAA Fisheries in the US.

5:10 pm: **Potential New Tools for Obtaining Angler Access: Success Stories and Lessons Learned**

Kevin Hining*
North Carolina Wildlife Resources Commission, kevin.hining@ncwildlife.org, 336-877-1087

A critical component of the North Carolina Wildlife Resources Commission mission statement is the provision of public access to aquatic resources. Historically, Commission driven aquatic access projects in western North Carolina have typically occurred on lands owned by government agencies, local municipalities, or power utilities. However, the Commission has recently experienced success obtaining long-term public access to aquatic resources on private lands. This has largely been the result of a section of the North Carolina Administrative Code that allows the Commission to designate angler access areas. Signed agreements between the Commission and private landowners have been implemented to help ensure long-term commitments for these new angler access areas. These signed agreements are also being used to secure private lands prior to initiating regulation changes, such as public mountain trout water additions. While possibly counterintuitive, there

appear to be several reasons private landowners are willing to allow public access for fishing on their property. The intent of this presentation is to provide examples of some of the recent access acquisitions on private lands in the western part of the state, and discuss some of the things learned since implementing these methods. A brief overview will also be provided on a new website tool that will be used to transfer access information to potential anglers.

Wednesday, February 29th, 2012

8:00 am: **Edward D. Cope's Contributions to Our Knowledge of the North Carolina Fish Fauna and Revisiting North Carolina's Type Localities – Where I Left Off and My Conclusions, If I Don't Run Out of Time.**

Bryn H. Tracy*
NC Division of Water Quality, 4401 Reedy Creek Road, Raleigh, NC 27607, 919-743-8474, bryn.tracy@ncdenr.gov

The first 5 of 203 described and indigenous freshwater fish species known from North Carolina were scientifically named in 1758 by Carolus Linnaeus, though generally from locales in the northern USA. A flurry of activity in the late 1810s by Constantine Rafinesque ascribed names for 25 more nominal species, again from locales outside North Carolina. Between 1860 and 1870, 48 species were described, 43 of them by Edward D. Cope. As a young man of 29 years with a wife and an age-three daughter in tow, Cope spent from late August until early December 1869 in North Carolina. Equipped with only a small seine of fine mesh, a great fervor, and a penchant for interacting with the local commercial fishermen and their weir traps, his travels took him from Warm Springs in Madison County to Wilmington in New Hanover County including stops at Pleasant Garden, the Koontz Plantation, and Raleigh. He collected more than 95 described and undescribed species during his travels. By June 7, 1870, less than six months since leaving Raleigh, Cope had described approximately 20 percent of the species presently recognized in North Carolina.
As regards currently recognized species, there are 36 type localities in North Carolina, including 15 of Cope's. A study was begun in 2008 to visit each locality to determine if species' topotypes were present and what were the current environmental conditions, or conversely, determine/speculate why the species was absent. A portion of my study was presented at the February 2009 NC AFS meeting in Burlington, NC. By November 2010, the field work was completed with assistance from several NC AFS chapter members. Twenty of 36 species were extant at their type locality and 16 had been locally extirpated. Examples of re-discovering four type localities will be discussed – North Fork New River at Crumpler (Kanawha Darter – Raney, Lachner, and Kezer's 's 1940 spring break collecting trip), Walnut Creek at Raleigh (Glassy Darter - Cope's 1869 travels), Neuse River at Milburnie (Carolina Madtom - Jordan et al.'s 1888 summer explorations), and Lake Waccamaw (Waccamaw Killifish, Waccamaw Silverside, and Waccamaw Darter - Raney, Lachner, and Pfeiffer's 1941 spring break collecting trip). Suspected causes for each of the 16 localized extirpations will also be summarized.

8:20 am: **Tropical island fish assemblages are resilient to flood disturbance mortality**

William E. Smith*[1],Thomas J. Kwak[1,2], and Patrick Cooney[1]
[1]North Carolina Cooperative Fish and Wildlife Research Unit, Department of Biology, NC State University, Campus Box 7617, Raleigh, NC 27695, wes2316@gmail.com
[2]U.S. Geological Survey

Aquatic communities are structured by a combination of deterministic and stochastic processes. Periods of stable environmental conditions, favoring the development of communities regulated by deterministic processes, are interrupted by random periods of disturbance that may restructure communities and populations by killing or displacing individuals. We quantified fish movement, density, and habitat before and after a major

flood disturbance in a Caribbean island river using radiotelemetry, passively monitored PIT tags, three-pass removal fish population estimates, and habitat surveys. Native stream fish populations showed evidence of acute mortality, but little evidence of downstream displacement in those fish that remained. Although most stages of all fish species were reduced in number after the disturbance, populations responded with high recruitment and migration into presumably vacated upstream habitats. Changes in densities were uneven among size classes, indicating an altered size structure for some species. Rapid recovery processes acting at the population level appeared to dampen effects at the community level, as community parameters (species richness and diversity) demonstrated that the overall structure of the fish assemblage changed minimally. The native fish assemblage appeared to be resilient to the flood disturbance, rapidly compensating for mortality during the flood with improved recruitment and recolonization of upstream habitats. On tropical volcanic islands, major flood disturbances may act as a community filter that eliminates exotic species while having minimal net effect on natives, thereby maintaining native stream fish assemblages.

8:40 am: **Exploring Individual and Synergistic Effects of Introduced Species on a Reservoir Food Web: an Ecosystem Modeling Approach**

Marybeth K. Brey*, J. A. Rice and D. D. Aday
North Carolina State University, Department of Biology, Campus Box 7617, Raleigh, NC 27695

Though current literature is replete with studies on the effects of introduced species on ecosystem structure and function, only recently has research highlighting the importance of interactive effects of multiple introductions emerged. Further, though often assumed to be undesirable, the effects of single introductions are frequently unclear, and the combined effects of multiple, sequential invasions are even less understood. Reservoirs are particularly susceptible to invasion and often contain several introduced fish species, making them optimal systems in which to quantify the ways that invaders alter community structure and trophic dynamics. Lake Norman, the largest reservoir in North Carolina, has been subjected to multiple species introductions since its impoundment in 1963, and negative effects of four specific species (flathead catfish, alewife, spotted bass, and white perch) on established populations and trophic dynamics in the system have been implied (e.g., population declines in certain sportfish) but not directly quantified. We used an Ecopath with Ecosim modeling approach to help understand the effects of these introductions and to provide insight into potential management strategies. We parameterized an Ecopath model with eighteen functional group using data collected from 2007-2010. Because synergies among multiple invaders may produce effects greater than the sum of their parts, we ran Ecosim to investigate the effects of each introduced species individually, and combinations of species simultaneously. This investigation provides a rare opportunity to quantify the ways in which multiple introduced species impact an established reservoir ecosystem, and allows modeling of potential mitigation or management strategies for these frequently invaded systems.

9:00 am: **Biochemical and Reproductive Effects of the Synthetic Estrogen 17-α-Ethinylestradiol on the Unionid Freshwater Mussel *Lampsilis fasciola*.**

Jeremy A. Leonard*[1], W. Gregory Cope[1], M. Christopher Barnhart[2], and Robert B. Bringolf[3].
[1]Department of Environmental and Molecular Toxicology, Box 7633, NC State University, Raleigh, NC 27695, (919) 515-2274, (919) 515-7169, jaleonar@ncsu.edu
[2]Department of Biology, 901 South Avenue, Missouri State University, Springfield, MO 65897
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The endocrine disrupting effects of estrogenic compounds in surface waters on fish such as intersex, feminization of males and altered sex ratios may also occur in aquatic invertebrates. However, the underlying mechanisms of action and toxicity, especially in native freshwater mussels (Order Unionida), remain undefined.

We evaluated the effects of sub-chronic exposure of 17α-ethinylestradiol (EE2), a synthetic estrogen found in oral contraceptives on the behavior, condition, metabolism, and reproductive status of the unionid mussel *Lampsilis fasciola*. Mussels were exposed to a control and 3 concentrations of EE2 (5 ng/L, 1 µg/L, 50 µg/L) and samples of gill and other tissues were taken on days 4 and 12. Observations of mussel behavior (mantle display, siphoning) were made daily. At the greatest test concentration (50 µg/L), we found significantly greater mortality of larvae (glochidia) relative to the control, whereas no differences were observed in conglutinate condition. Female marsupial gills of exposed mussels weighed significantly less than those of controls after 4 days, despite similar gill fullness at the 1 and 50 µg/L treatments. After 12 days of exposure, the marsupial gills of females in the two greatest treatments weighed significantly more than on day 4, despite depletion in fullness due to EE2-stimulated conglutinate release. Exposure to EE2 altered female mantle display behavior, suggesting that EE2 may cause complications in attracting suitable host fish in wild populations. Biochemically, all EE2 exposures led to decreases in glycogen metabolism end products, and the two greatest concentrations resulted in decreased glucose and glucose intermediates and increases in Krebs cycle intermediates. These changes indicate EE2-related reductions in energy reserves that would be available for growth and reproduction in exposed wild populations of mussels.

9:20 am: **Enhancing Relevance to Climate Change in Freshwater Mussel Thermal Tolerance Tests**

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Because the global climate is warming, and available lethal temperature (LT) data on early life stages of freshwater mussels suggest they may already be living near their upper thermal tolerances in some systems, we expanded mussel LT research to include ecological factors that affect mussels in natural systems, such as sediment and flow regimes. We developed a method for assessing the thermal sensitivity of juvenile freshwater mussels in sediment, thus incorporating their benthic ecology into the tests. Using these sediment testing protocols, we evaluated the relative sensitivity of juveniles of four species of mussels to a range of common and extreme temperatures during summer in streams with low flow and dewatered (e.g., drought) conditions in the southeastern and central United States, using two temperature exposure regimes. We also conducted water-only LT tests with glochidia and juveniles of four previously untested mussel species and tested adult *Lampsilis fasciola* to determine thresholds of sublethal effects with biomarkers of thermal stress and tissue damage. The median lethal temperatures (LT_{50}s) for all tests ranged from 33.3 to 37.2 °C, indicating a narrow range of upper thermal sensitivity, regardless of life stage, test type, species, or conservation status. Preliminary analysis of biomarker data indicates that mussels may become stressed at temperatures as low as 31° C, well below the lethal temperature. Future tests will incorporate a vertical temperature gradient into sediment testing protocols, providing additional realism and relevance to the benthic ecology of freshwater mussels. Finally, our data will be incorporated into regional mussel occupancy models to predict the response of imperiled mussels to changes in water temperature, as related to flow and climate change scenarios.

9:40 am: **Thermal Tolerances of Freshwater Mussels and Their Host Fishes: Species Interactions in a Changing Climate**

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Rising environmental temperatures can cause significant shifts in the composition and distribution of species within communities. In freshwater systems, the larval life stage, glochidia, of Unionida mussels develops as an obligate parasite on host fish gills or fins before transforming into the juvenile stage. Because of the relationship between freshwater mussels and their host fish, mussels are not only limited by their own variable thermal tolerances, but also by those of their hosts. Our intent was to compile data from available literature regarding thermal sensitivities of eight species of freshwater mussels and their host fishes, to determine if the community structure of these systems is at risk from rising environmental temperatures. Mussels were both more and less thermally sensitive than specific host fish species (2.9 ºC mean absolute difference between mussel and host; range = 0 – 6.8 ºC). In 62% of mussel-host fish comparisons, freshwater mussels were more thermally tolerant than their hosts (3.4 ºC mean difference; range = 0.2 – 6.8 ºC). Further analysis revealed that variation in mussel thermal tolerance could not be attributed to mussel acclimation temperature, species, life stage, or mean host fish thermal tolerance, suggesting that mussel thermal tolerance is controlled by multiple interacting and complex factors. Our findings in this meta-analysis suggest that thermal effects of anthropogenic landscape alteration and climate change may be compounded for freshwater mussels via their obligate life cycle interaction with fish and highlight the importance of considering global change effects in a community context.

10:00 am: **Break**

10:30 am: **Hurricane Irene: Another Blow to Fish Populations in Northeastern North Carolina Rivers**

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Hurricane Irene is the latest in a long line of hurricanes to impact coastal North Carolina over the last two decades. Heavy rains and storm surge during hurricanes can inundate coastal rivers and their tributaries with hypoxic water and organic solids from backwater habitats, which greatly increases biological oxygen demand and subsequently decreases dissolved oxygen. Hurricane Irene was no exception. After making landfall on 27 August 2011, strong, easterly winds caused a storm surge of approximately two meters in the western end of Albemarle Sound near the Roanoke River mouth, and heavy rainfall caused extensive flooding throughout northeastern North Carolina. Consequently, dissolved oxygen levels rapidly fell and remained at or near 0 mg $\cdot L^{-1}$ for 18 days in the lower 75 kilometers of the Roanoke River. Similar conditions extended into a large portion of the Chowan River, but smaller Albemarle Sound tributaries were less affected. The prolonged oxygen depletion resulted in widespread fish kills throughout the Roanoke River from Williamston to the river mouth and the upper Chowan River from the Virginia border to Holiday Island. Recent Wildlife Resources Commission surveys demonstrated that sportfish populations in the Roanoke and Chowan rivers had fully recovered from fish kills following Hurricane Isabel in 2003; however, surveys conducted in October and November 2011 following

Hurricane Irene indicated that population levels were much lower than in previous samples. Additional sampling will be conducted in spring 2012 to determine the full extent of the fish kills caused by Hurricane Irene.

10:50 am: **Extent and Duration of Anoxic Conditions Following Hurricane Irene and Initial Assessment of Associated Fish Kills in Six Coastal North Carolina Rivers**

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Hurricane induced fish kills have been reported to have major impacts on sportfish populations in rivers of coastal North Carolina. Therefore it is important for fishery managers to assess anoxic conditions and fish kills following hurricanes. Wildlife Resources Commission staff investigated the extent and duration of anoxic conditions following Hurricane Irene on 27 August 2011 and conducted an initial assessment of fish kills associated with those conditions in six coastal rivers (Tar, Neuse, Trent, White Oak, New, and Northeast Cape Fear rivers). The extent of anoxic conditions was determined by measuring dissolved oxygen for approximately three weeks following the hurricane. Using boat-mounted electrofishing gear, fish populations were surveyed at fixed sampling sites one month after the hurricane during October 2011. Relative abundance at these sites was compared to relative abundance estimates from past samples (fall 2007 to spring 2011). Dissolved oxygen levels reached 0 $mg \cdot L^{-1}$ in all six rivers at some point following the storm. Duration of anoxic conditions lasted between three and 21 days and covered river distances up to 100 km on the Northeast Cape Fear River. Fish kills were witnessed in every river except the New River. Relative abundances were drastically reduced at most study sites. The majority of largemouth bass collected were larger than 200 mm; most sunfish collected were also adults. It is evident that major fish kills occurred in these rivers; however the presence of adult fish may help these populations recover naturally. Commission staff will monitor these populations over the next few years to track their recovery, and to recommend enhancement strategies.

11:10 am: ***The Fisheries Blog*: A Fisheries Forum to Inform and Generate Discussion**

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Each year, the American Fisheries Society (AFS) holds an annual writing contest for students to promote communicating the value of fisheries research in popular press-style writing. Outside of this contest, there is little incentive for students or professionals to reach an audience interested in fisheries research while writing in a creative manner. Additionally, vast amounts of pertinent fisheries information are in scarcely-read reports or inaccessible professional journals. We have created an opportunity, through a free online forum called *The Fisheries Blog*, to share short, information-packed articles on topical fisheries themes accessible to anyone with internet access. Each week, a popular-style article will be featured on the blog. Articles will range from reviews of primary literature and reports, synopses of ongoing research projects, information on topical fisheries themes, and details of professional meetings, among others. It is not intended to be exhaustive of fisheries material, but rather an easily accessible forum to disseminate information and generate discussion. Additionally, we welcome others that have unique fisheries related topics to join in the writing efforts and share their information and views. *The Fisheries Blog* is specifically designed to reach the widest audience possible. It

is our hope that the articles are of use to the seasoned fisheries professional all the way to the fisheries undergraduate who is still identifying the fundamental concepts of fisheries science.

11:30 am: **The Effectiveness of Different Fish Attractors in North Carolina Reservoirs**

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Fish attractors have been widely used by fisheries managers to enhance fish habitat, but are often deployed without any validation for how well they meet management goals. The objective of this project was to evaluate the effectiveness of four different types of fish attractors to concentrate fish in North Carolina Piedmont reservoirs. ANOVA using a complete block design with repeated measurements was used to compare fish abundance from three types of artificial attractors, one natural attractor, and a control area devoid of structure. Attractors encompassed approximately equal volumes of water, but varied in materials and design. Fish abundance at unmarked attractors was evaluated once per season during a three year period using instantaneous counts from images taken by a dual-frequency identification sonar device. We found that all attractors held significantly (α =0.05) more fish than the control area and that significantly more fish concentrated around the corrugated pipe structure as compared to the other structures. A year-by-year analysis was also performed. During years one and two, the only significant difference was between fish attractors and the control area. In year three, the corrugated pipe structure held significantly more fish than the barrel and porcupine structure, which held significant more fish than the tree structure, and all structures held more fish than the control area. This study validates the effectiveness of fish attractors to concentrate fish, highlights the benefits of artificial structures as compared to natural structure, and will help fisheries managers make informed decisions when attempting to enhance angling opportunities.

11:50 am: **Using Multiple Sonar Deployments to Improve Run-Size Estimates of Anadromous Fishes**

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Anadromous fishes are important commercial, recreational, and ecological resources, so reliable population estimates are needed to ensure proper management. Riverine hydroacoustic techniques are a proven and effective method of monitoring upstream migration of anadromous fishes. We used a combination of side-looking split-beam and side- and down-looking multibeam imaging sonars in a Bayesian framework to assess spawning run size of striped bass *Morone saxatilis*, American shad *Alosa sapidissima*, hickory shad *A. mediocris*, alewife *A. pseudoharengus*, blueback herring *A. aestivalis*, and semi-anadromous white perch *M. americana*, in the Roanoke River, NC during 2010 and 2011. A 430 kHz split-beam transducer was aimed cross-channel to gather count data on upstream-moving fishes in mid-channel and near-bottom zones of the river. The longer range is a major advantage of split-beam sonar (relative to the multibeam sonar) but river bottom unevenness can result in 'blind-spots'. Also, the narrow beam width near the transducer can cause near-shore fish to pass undetected. We used a down-looking multibeam sonar technique to address blind-spots in split-beam coverage and monitor cross-channel and vertical distributions. A side-looking multibeam sonar technique monitored near-shore passage. The side-looking multibeam sonar was more effective than our split-beam in covering the

first 10 m from the transducer, observing more fish in 2011 than total split-beam counts in 2010 and 2011combined. Multibeam sonar deployments also provided size and shape information that is useful in partitioning run size estimates by species. A Bayesian framework allows us to conform our analysis to our study design and easily combine data from multiple sources. Our monitoring protocol should be widely applicable for estimating run size of migratory fishes because it can be adapted to rivers of any width or cross-sectional topography.

12:10 pm: **Applying Acoustic Technology to Analyze Late Summer Fish Distribution and Behavior in Lower Lake Norman, NC**

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The alewife, an anadromous species native to the northern and mid-Atlantic coast, was introduced into Lake Norman in the late 1990's and serves as forage for many sport fish including blue catfish and striped bass. During natural, late-summer stratification adult alewife follow cooler water to the deepest areas of the lake becoming a fouling issue for McGuire Nuclear Station. In addition, foraging striped bass may become trapped in the hypolimnion leading to fish mortality. Since 2003, Duke Energy personnel have used hydroacoustic technology to document the summer distribution of these hypolimnetic fish. Beginning in 2008, a DIDSON camera has been deployed concurrently to record real-time fish behavior including predation, schooling under hypoxic conditions, and the presence of both forage and predator fish under anoxic conditions.