REPORT OF THE

ROBUST REDHORSE CONSERVATION COMMITTEE ANNUAL MEETING

Charlie Elliott Wildlife Center
Mansfield, Georgia
September 22 – 24, 2015

Male robust redhorse collected from the Santee Basin, SC.
Credit: South Carolina DNR

Report compiled by
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U.S. Fish & Wildlife Service

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ACRONYMS & ABBREVIATIONS

CPLC	Carolina Power and Light Company
CVIOG	Carl Vinson Institute of Government
DPC	Duke Power Company
FERC	Federal Energy Regulatory Commission
GA Coop	University of Georgia Cooperative Fish & Wildlife Resource Unit
GA DNR	Georgia Department of Natural Resources
GPC	Georgia Power Company
GRN	Georgia River Network
GWF	Georgia Wildlife Federation
NC WRC	North Carolina Wildlife Resources Commission
NCS MNS	North Carolina State Museum of Natural Sciences
NYU	New York University
SC Coop	South Carolina Cooperative Fish & Wildlife Research Unit
SC DNR	South Carolina Department of Natural Resources
SCEG	South Carolina Electric and Gas
SCA	South Carolina Aquarium
UGA	University of Georgia
USACOE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey (Biological Resources Division)

FTC	Fish Technology Center
NFH	National Fish Hatchery
SFH	State Fish Hatchery
WMA	Wildlife Management Area

CCAA	Consolidated Conservation Agreement with Assurances for the Ocmulgee River
Excom	Former Technical Advisory Group to the RRCC
GIS	Geographic Information System
IT TWG	Information Technology Technical Working Group
MOU	Memorandum of Understanding
PIT	Passive Integrated Transponder Tags
RRCC	Robust Redhorse Conservation Committee
TAG	Technical Advisory Group
TWG	Technical Working Group

AGR	Artificial genetic refuge
C	Celcius
cfs	Cubic feet per second
cm	Centimeter
g	Gram
kg	Kilogram
km	Kilometer
m	Meter
mg/l	Milligrams per liter
mm	Millimeter
MWe	Megawatts of electrical output
m3/s	Cubic meter per second
N*e*	Effective population size
ppt	Parts per thousand
rkm	River kilometer
RM	River mile
TL	Total length
YC	Year class
YOY	Young of year

E X E C U T I V E S U M M A R Y

The robust redhorse recovery effort, in its 21st year, encompasses management activities and research and conservation efforts undertaken by members of the Robust Redhorse Conservation Committee (RRCC), university scientists, and other affiliates. The RRCC, established by a Memorandum of Understanding (MOU) signed in 1995, is responsible for developing and managing a recovery approach for the imperiled robust redhorse (*Moxostoma robustum*). The effort and expertise applied to the questions of recovery are brought together at the annual meeting of the RRCC.

The seventeenth annual meeting of the RRCC was held September 22-24, 2015 at Charlie Elliott Wildlife Center in Mansfield, Georgia. Approximately 35 representatives (see Attachment 1) of the signatory agencies to the MOU, university research affiliates and other interests attended the meeting. The 11 signatory agencies include: Georgia Department of Natural Resources, South Carolina Department of Natural Resources, North Carolina Wildlife Resources Commission, Georgia Power Company, Duke Energy Carolinas/Progress LLC, South Carolina Electric and Gas Company, U.S. Fish and Wildlife Service, U.S. Geological Survey, USDA Forest Service, Georgia Wildlife Federation, and South Carolina Aquarium. University research affiliates include: University of Georgia Warnell School of Forest Resources, University of Georgia Institute of Ecology, University of Georgia Cooperative Fish and Wildlife Research Unit, Roanoke College Department of Biology, University of Georgia Carl Vinson Institute of Government, University of Georgia Department of Genetics, Cornell University Department of Molecular Biology and Genetics, Clemson University Cooperative Fish and Wildlife Research Unit, New York University School of Medicine Institute of Environmental Medicine, and State University of West Georgia. In addition, representatives of other concerns with interest in recovery of the robust redhorse include: Santee Cooper Power Company, Georgia Aquarium, Georgia River Network, and the North Carolina State Museum of Natural Sciences. The success of the recovery effort, to a large extent, depends on the willingness of RRCC members and others to participate in the annual meeting and to continue to support recovery throughout the year.

This report summarizes updates on management activities, research findings, and conservation efforts and decisions made at the 2015 RRCC Annual Meeting. The RRCC Annual Meeting Reports have become important documents of research, science, management, and recovery that are often referred to and cited. The format of this year's report closely follows the format of previous reports and it provides a more accurate record of activities. The report notes discussion points, questions, main ideas, and/or notes recorded by the participants.

I N T R O D U C T I O N

Historically, the robust redhorse (*Moxostoma robustum*) inhabited Atlantic slope drainages from the Pee Dee River system in North Carolina to the Altamaha River system in Georgia. The first scientifically confirmed sighting of robust redhorse since naturalist Edward Cope described the species in 1869 occurred when the fish was re-discovered in the Oconee River in Georgia in 1991. In the Altamaha River drainage, the species is presently known to exist in a relatively short reach of the Oconee River between Sinclair Dam and Dublin, Georgia, in a short upper Coastal Plain section of the Ocmulgee River, and an individual has been found in the Little River, a tributary to Lake Sinclair. Individuals also have been found in the Savannah River (the boundary river between Georgia and South Carolina) in the Augusta Shoals area as well as below the New Savannah River Bluff Lock and Dam. In addition, robust redhorse have been captured in the Pee Dee River below Blewett Falls Dam in North Carolina. Robust redhorse populations have also been reintroduced within their historic range into the Broad, Ocmulgee, and Ogeechee rivers, Georgia, as well as the Broad and Wateree rivers, South Carolina. The robust redhorse appears to inhabit specialized areas of large rivers, which are difficult to sample but regardless of the absence of sightings, small numbers are usually found when species-targeted surveys are conducted.

River impoundments, predation by introduced nonnative species, and significant deterioration of habitat due to sedimentation and water pollution are believed to have contributed to the decline of the species. The complex and diverse problems facing the robust redhorse require an interdisciplinary approach, using a broad spectrum of experience, expertise, and management authority to maintain and restore this imperiled species. In addition, it is essential that recovery efforts include a process that works closely with the private sector as well as government agencies potentially impacted by and interested in robust redhorse conservation.

The Robust Redhorse Conservation Committee (RRCC) was established by a Memorandum Of Understanding (MOU) signed in 1995 and renewed in 2010 to develop and manage a recovery approach for the robust redhorse (*Moxostoma robustum*), previously a Category 2 candidate for Federal listing under the Endangered Species Act. The RRCC is actively committed to the recovery of the imperiled robust redhorse throughout its former range. It identifies priority conservation needs for the robust redhorse and its habitat and coordinates implementation of research and management programs for addressing those needs.

A D M I N I S T R A T I O N

Welcome & Introductions – Jaci Zelko

Jaci Zelko, Chair of the RRCC gave the opening remarks for the 2015 annual meeting. She welcomed all the participants and gave a quick overview of the 21 years of robust redhorse recovery effort. All participants were asked to introduce themselves and their agency.

MANAGEMENT ACTIVITIES

Yadkin-Pee Dee TWG 2015 Update – Ryan Heise

We had another successful sampling season on the Pee Dee River thanks to the efforts of the Yadkin Pee Dee Technical Working Group. The goals of our spring electrofishing surveys are to monitor the population abundance and to collect brood fish for the hatchery program. In addition, we are assessing the population size structure to see if additional recruitment has occurred since the change in minimum flows from Blewett Falls Dam.

In 2015, our total electrofishing effort (pedal time) in the Blewett reach was 61.2 hours. We captured 18 Robust Redhorse this spring which includes 3 within season recaptures. Five Robust Redhorse were previously untagged and 10 were among year recaptures, which means our among year recapture rate was 66.7%. Seven fish were male and 8 were female. Ten Robust Redhorse were collected from the Jones Creek shoal and 8 from the Hitchcock Creek shoal (see Figure 1 and 2, some points on the map represent multiple captures). Total length ranged from 552 to 760 mm TL.

Figure 1. Pee Dee River Robust Redhorse capture locations at the Hitchcock Creek shoal. Credit: NCWRC

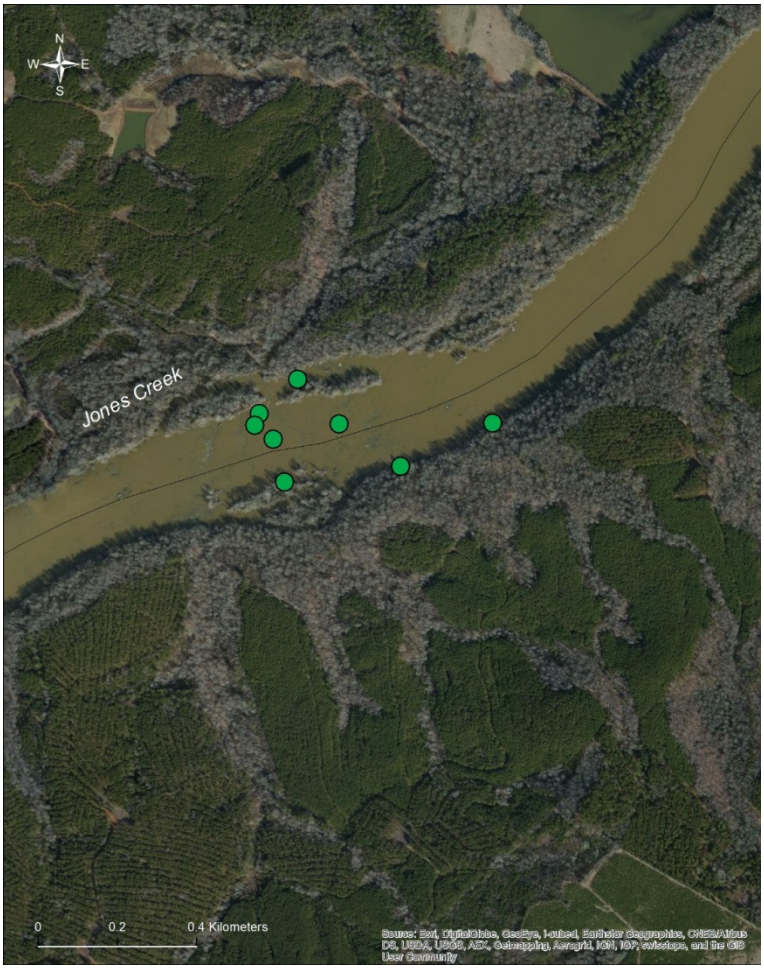

Figure 2. Pee Dee River Robust Redhorse capture locations at the Jones Creek shoal. Credit: NCWRC

Yadkin-Pee Dee Propagation – Doug Hinshaw

Three females were spawned this year and roughly 70,000 eggs were split between NC WRC and SC DNR hatcheries for rearing. Both hatcheries had excellent hatching rates and the fish were stocked into hatchery ponds for grow-out.

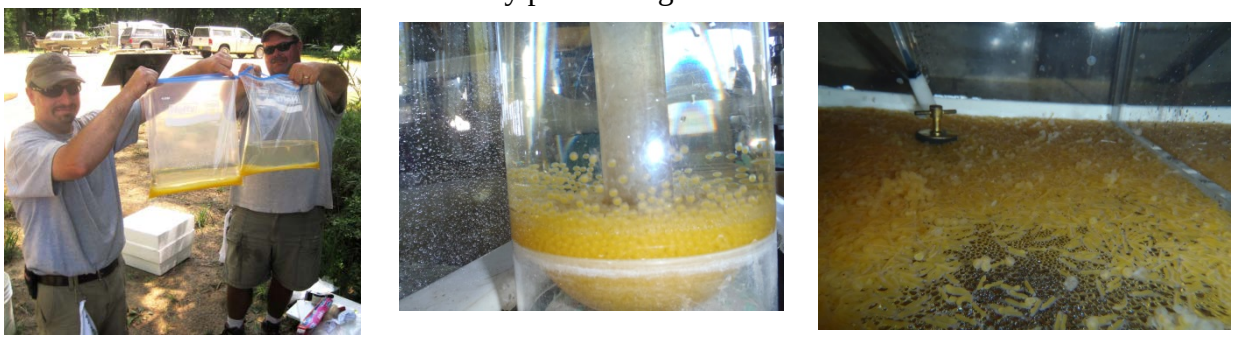

Figure 3. (L to R) Doug and Rick hold up bags of fertilized eggs. Eggs are rolled in jars. Newly hatched fry on the bottom of the aquarium. Credit: NCWRC

On November 4 we stocked over 22,000 individuals into the Pee Dee River which is a substantial increase from last year (2014 total was 13,000). Fish raised at the Dennis Center were stocked at Cheraw, SC and fish raised at McKinney Lake were stocked at Hitchcock Creek Shoal. We were not able to release fish at Jones Creek Shoal this year because the Diggs Tract boat ramp was inaccessible due to high water. In addition, we held back roughly 1,500 fish at each hatchery for further grow-out and to stock next fall.

Yadkin-Pee Dee FERC License Implementation – Jason Brown

Duke Energy is in the process of relicensing the Blewett Falls Hydroelectric plant on the Pee Dee River. As part of the relicensing efforts, Duke Energy has received a North Carolina Division of Water Resources 401 Water Quality Certificate (WQC). This WQC outlines new water quality standards related to river flow and dissolved oxygen. Duke Energy received a new license for the Yadkin Pee Dee projects April 1, 2015 and had 60 days to comply with the new standards outlined in the WQC.

Based on Spring Flow Management Team suggestions, the minimum flow at Blewett Falls will be 2,400 cfs from February 1 – May 15; 1,800 cfs from May 16 – May 31; and 1,200 cfs from June 1 – January 31.

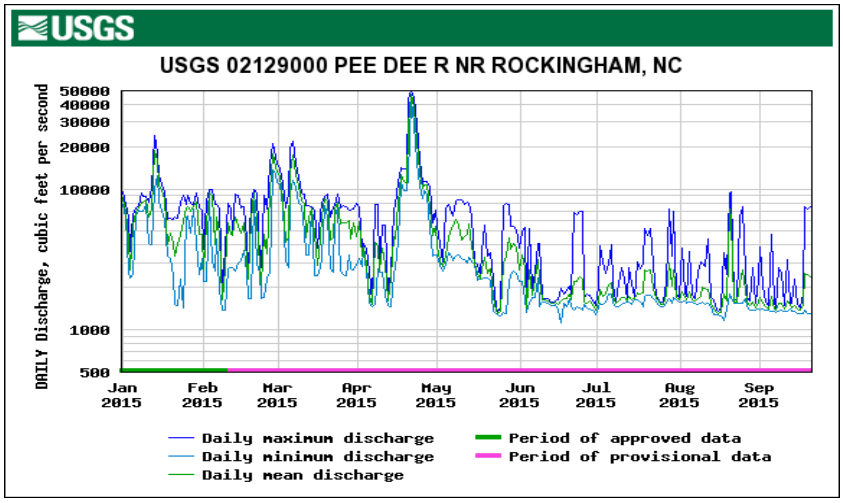

Figure 4. Daily discharge chart from Jan to Sept 2015 for Pee Dee River at Rockingham, NC. Credit: USGS

Wateree River Collections 2015 Update – Matt McKinney

Residing in the Santee River basin, Duke Energy's Catawba-Wateree Hydroelectric Project (Project) (FERC No. 2232) provides 841 megawatts of renewable power in the Carolinas. The Project is comprised of 13 hydroelectric developments and 11 reservoirs along the Catawba-Wateree River from Lake James near Morganton, North Carolina to Lake Wateree near Camden, South Carolina. Downstream from the Wateree development, the Wateree River flows approximately 80 river miles before joining with the Congaree River to form the Santee River. Robust Redhorse (*Moxostoma robustum*) were introduced to the Wateree River by the South Carolina Department of Natural Resources (SCDNR) in 2004. It was believed that the species once occurred in the river

due to its presence in the Pee Dee and Savannah River basins. In 2004-2006, Duke Energy expended approximately 150 electrofishing pedal hours and 540 gillnet soak hours at multiple locations in the Wateree River, including the Wateree tailrace in an effort to target anadromous fish, as well as rare suckers. No Robust Redhorse were collected during this effort except for one individual from the tailrace in 2006, following stocking efforts by the SCDNR.

Since 2003 and as a part of the FERC licensing process, Duke Energy continues to perform annual boat electrofishing surveys in the Wateree tailrace. The approximately 1-hour (pedal time) sampling occurs weekly from April to June of each year from the immediate tailrace to approximately 400 meters downstream. The sampling effort targets spawning runs of American Shad (*Alosa sapidissima*) and Blueback Herring (*Alosa aestivalis*), although other species are incidentally collected, including Robust Redhorse. As of 2015, Duke Energy has incidentally collected 76 Robust Redhorse during these annual surveys, with the highest number (22) being collected in 2011. Some of these individuals have been recaptures from previous years based on presence of PIT tags. Of all individuals collected, 49% were male, with 31% female and 20% sex not determined. Seventy-seven percent of these fish were tagged (coded-wire or PIT), while 22% were either untagged or tags were not read. One female (TL = 640 mm, 5.1 kg) was collected during 8 hours of pedal time in 2015. The large female was collected along the right-ascending bank of the tailrace canal in relatively shallow, flowing habitat with boulder substrate. A coded-wire tag was read in the left cheek, suggesting an age of either 6 or 11 years based on SCDNR stocking data. No PIT tag was read, or inserted; however, a fin clip was taken for genetics analysis. Surveys will continue in 2016, and incidental collections of Robust Redhorse will be reported.

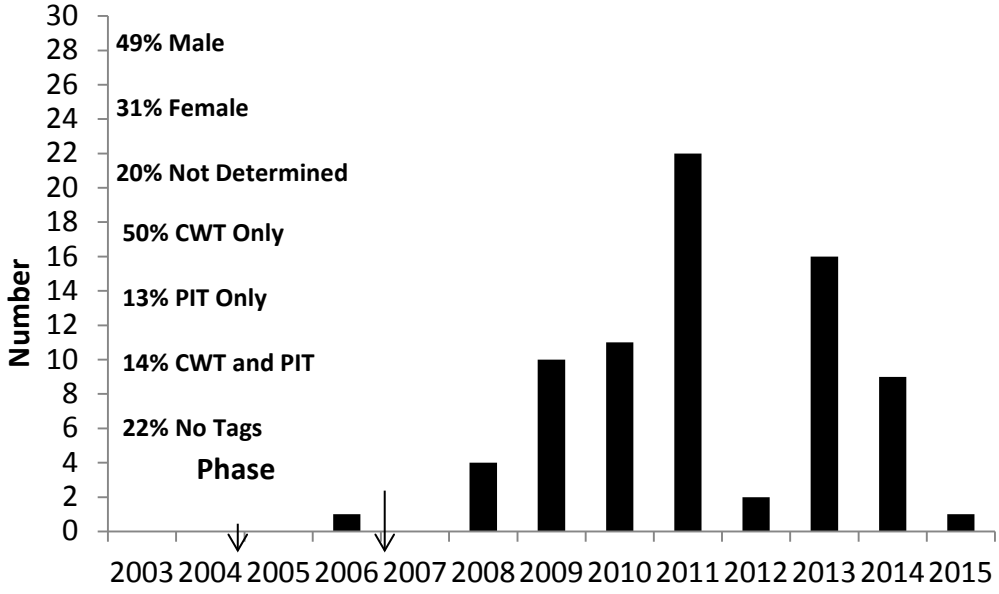

Figure 5. The number of robust redhorse collected in the Wateree tailrace from 2006-2015. Credit: Duke Energy

Santee Basin Update – Scott Lamprecht

The work conducted on the Santee Basin for the past 12 years work was largely funded by a State Wildlife Grant Program and the SC Department of Natural Resources. Efforts in 2015 were focused on three reaches of the basin based on habitat similarity to existing Robust Redhorses populations.

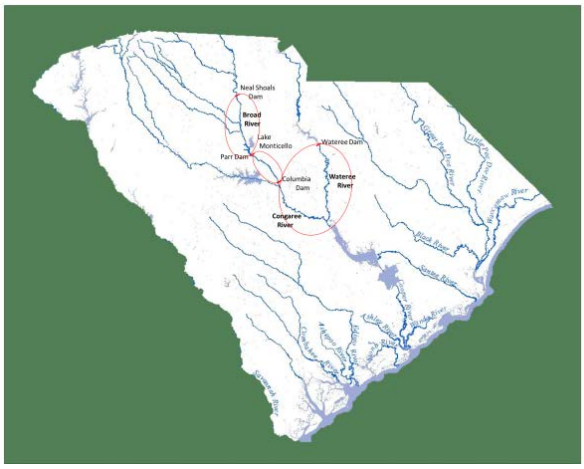

Figure 6. Three river segments of the Santee Basin. Credit: SCDNR

Santee Basin Robust Redhorse stockings were conducted from 2004 to 2013. The 71,934 fingerlings stocked were comprised of 9 separate year-classes. This represents 101 unique parental crosses.

Since 2006, the adult collections total nearly 250 and about 150 more robust redhorse have been observed at the fish ladder. Of the nearly 250 adults collected, fish from 7 year classes have been identified. Sexual maturity has been observed in all segments and spawning aggregations were seen in two of the river segments. Five years of telemetry data have also been recorded.

Figure 7. (L-R) Robust redhorse collected from Upper Congaree River on May 5 2015 (419mm, 991gm, YC 2011 or 2012). Robust collected from Upper Santee River on June 10, 2015 (315 mm, YC 2013). Credit: SCDNR

Santee Basin Genetics Update – Tanya Darden, Forrest Sessions, Scott Lamprecht, Daniel Farrae, Jason Bettinger

Robust Redhorse (Moxostoma robustum) is a large-bodied and long-lived Catastomid with a native range that encompasses the major rivers from the Carolina's Pee Dee River south to the Altamaha River (GA), with the notable exception of the Santee River basin. In an effort to increase the long-term viability of Robust Redhorse within its native range, we began a restoration effort to establishing a self-sustaining population in the Santee River Basin. Broodstock from the Savannah River were used to stock 72,000 juveniles from 9 year classes that involved 101 independent parental crosses during 2004 - 2013. Fingerlings were stocked in two Broad River segments and one Wateree/Congaree River section. Incidental electrofishing collection of adult fish began 2 years after stocking began. Males in spawning conditions were first observed in 2008 and the first spawning triad was encountered in 2010. To date, over adults have been collected and adults in spawning condition have been encountered in every stocked segment. Spawning behavior has been documented in two segments. Over 150 mature adult Robust Redhorse have been observed ascending a fish ladder on the Broad River preceding spawning season. Telemetry study has shown extensive movement and repeated seasonal use of the specific river reaches. Genetic tagging evaluation and population characterization using a suite of 10 microsatellite markers (64 individuals) confirms that stocked fish are surviving in the new population, movement behaviors are similar to native populations, many year classes are present, genetic health metrics are optimistic and similar to the source population, and successful wild-spawned recruitment is occurring. Monitoring of the new Santee River population will continue, but all initial indications are optimistic for the restoration effort.

Georgia Visual Monitoring 2015 Update – Brett Albanese

GADNR is developing a method to monitor the number of adult Robust Redhorse on spawning sites each year using visual observations. The approach involves making repeated counts of Robust Redhorse within a short time period (i.e, within 15 minutes), at several times during the day, and on several days within the spawning season and is designed to capture variation associated with observer error and the number of animals on the spawning site at any one time. As part of a pilot study, counts were attempted at a known spawning site on the Ocmulgee River near Juliette during May 2015. Daily average counts ranged from 3.5 fish on May 7th to a maximum of 13.3 fish on May 13th. Differences between counts made within short periods, when the number of fish on the spawning site was expected to be relatively stable, ranged from 0-2 fish. Counts were also repeated 3 times within a short time period at a much larger site on the Savannah River and ranged between 105-112 fish. This approach has the potential for providing valuable information about populations, including the persistence and approximate size of the adult breeding population as well as the detection of recruitment. Limitations include a dependence on low stream flows and low turbidity and failure to account for fish that are not detected by observers. Utilizing a double-observer approach, where 2 observers make simultaneous counts to estimate capture probability, can help account for this latter bias. We are planning to implement this approach at additional sites in GA during the 2016 spawning season.

In addition to the Ocmulgee and Savannah observations reported above, additional efforts to document the status of Robust Redhorse in other Georgia populations were made in the past year. GADNR and Georgia Southern University visited the only known spawning site in the Ogeechee River (near Louisville) in May 2015, but did not document any Robust Redhorse or spawning habitat. Relatively deep and turbid water decreased their ability to search the site effectively. Spawning has not been documented in the Ogeechee River since May 2011. In addition, standardized boat electrofishing surveys conducted by the Georgia DNR Fisheries Management Section in Fall 2014 only documented 3 adult Robust Redhorse. These results contrast markedly with prior catches of about 30 fish in 2010-2011. Two Oconee River sites were surveyed for Robust Redhorse during the spawning season this year, Avant Mine and the upstream site at Beaverdam WMA. No Robust Redhorse or spawning activity were observed. The last confirmed spawning activity documented in the Oconee River system was at the Avant Mine site in 2007. Four Robust Redhorse were observed at one of two Broad River sites visited during 2015, but no spawning activity was documented. Georgia RRCC members are planning to increase the frequency and number of sites monitored for Robust Redhorse during the 2016 spawning season. They are also planning to document gravel habitat in the Ogeechee River during a low-flow period.

2015 Surveys for Oconee Robust Redhorse – Tony Dodd (Georgia Power Company) and Wayne Clark, Aquatic Escapes

In 2015, two areas of the Oconee River, Georgia, were targeted for boat electrofishing collection of robust redhorse (*Moxostoma robustum*). Updating the aging population estimate for robust redhorse in the Oconee system, last determined from the 2004 to 2010 data set, has been hampered by continual low and possibly declining fish numbers based on electrofishing collections made mostly annually since 2010. The goal of the 2015 surveys was to collect robust redhorse, record traditional fishery metrics, collect fin clip material, then tag and release any previously untagged specimens during the surveys. One survey area was the ~6,000 ft remnant riverine-like segment of the Oconee between Wallace Dam and GA Highway 16. The other survey area included the ~80 mile segment of the Oconee River between Sinclair Dam and Dublin, GA. Observations collected in this long segment in the 2014 survey indicated apparent changes in instream habitat (diminished gravel deposits and sediment accrual) and possibly shifts in the fish community (much lower abundance of sucker species and others) since surveys in the same area during the early 1990s to early 2000s.

Figure 8. The Wallace Dam and tailrace survey area 2015. Credit: Georgia Power Company

An added objective of the 2015 survey was to collect mid-summer fishery data, including robust redhorse, in a standardized manner (7 study area sub-segments each with six pre-established 500-meter sampling areas) and provide a comparison and analysis of that result with earlier data collected in the 1993 study – otherwise a period when robust redhorse (and other sucker species) were relatively abundant. The springtime tailrace survey yielded no robust redhorse. Other species expected to be most common for Lake Sinclair were collected. Multiple survey attempts in the greater Oconee area downstream of Sinclair Dam were met with repeated and extreme difficulty for sampling and on-river logistics due to localized drought conditions. The low flow condition, statistically well below historic means, persisted in the Oconee from late June into mid-August at which point the survey was cancelled as the timing of survey effort began to drift out of the designed seasonal time frame of comparability. Two subsections of the Oconee were successfully sampled but no robust redhorse were collected nor observed. The Oconee Technical Working Group will convene before end of 2015 to discuss Oconee robust redhorse sampling goals for the 2016 season.

Lower Savannah River Update – Alice Lawrence

In September 2012 South Carolina Department of Natural Resources (SCDNR) collected a juvenile robust redhorse (*Moxostoma robustum*) in the mainstem Savannah River near Hardeeville, South Carolina while sampling for American shad. Subsequently, while conducting a fish community assessment in and near Savannah National Wildlife Refuge (NWR), U.S. Fish and Wildlife Service (FWS) personnel collected a young-of-year (yoy) robust redhorse in November 2013 in the mainstem Savannah River. The two collection

locations were approximately four river miles apart, and the uppermost capture is approximately 131 miles below the lowermost gravel bar known for robust redhorse spawning.

Because of these two incidental captures of juveniles that were closely collected in proximity and time of year, SCDNR, FWS, Georgia Department of Natural Resources (GDNR), and South Carolina Aquarium sampled the Lower Savannah River encompassing these capture locations on November 18-21st, 2014 via boat electrofishing. Bank habitats were sampled over 16.2 river miles resulting in pedal time of approximately 23.27 hours: the mainstem Savannah River from Ebenezer Landing down to the confluence with Collis Creek, the lowermost kilometer of Collis Creek, and two kilometers of Union Creek. Water temperatures ranged from 11.0-13.5 degrees C and salinities in the sampled reach ranged between 0.04-0.09 parts per thousand (ppt).
A 297 mm TL juvenile robust redhorse (336 grams) was captured on November 18, 2014 along the west bank of the mainstem Savannah River below Ebenezer Landing; a fin clip was subsequently genetically verified as robust redhorse by FWS Warm Springs Genetics Laboratory. This individual was captured over sandy substrate with overhanging vegetation in approximately 7.4 feet water depth and water velocity of approximately 1.0 feet/second. Water temperature was 13.5 degrees C, dissolved oxygen was 9.88 mg/L, and salinity was 0.06 ppt. This now totals three yoy/juvenile robust redhorse captures in the mainstem Lower Savannah River, all in or around Savannah National Wildlife Refuge within a 6.8 river mile reach.

R E S E A R C H U P D A T E S

Water quality, food webs, intersex fish, and Robust Redhorse in the Pee Dee River – Casey Grieshaber

Robust redhorse (RRH) populations in the Yadkin-Pee Dee River (Y-PD) currently include approximately 38-55 adult individuals with little evidence of recruitment. These low population numbers have prompted the investigation of issues that could be impacting the reproductive success and overall survival of the species. We pursued a series of related objectives to examine water and sediment contaminants, occurrence and severity of the intersex condition in fish, and survival of young fish in the river. Point and non-point sources of pollution in the river were identified. Organic and inorganic compounds were measured longitudinally along the river in water and sediment samples, as well as passive sampling devices (PSDs) that integrate contaminant occurrence over time. PSD data has been analyzed and results are currently in ng/sample/day and will be converted to ng/L soon. Estrogenecity was measured at 13 river sites using grab samples of water, and levels were all below the predicted-no-effect concentration of 2.0-ng/L. In the 2012-2013 sampling period, PSDs were used to measure naturally occurring and synthetic estrogens in the water column at one of our study sites during four seasons. Naturally occurring estradiol levels were all below the predicted-no-effect level. Ethinylestradiol (synthetic estrogen) levels, however, were all measured above the 2.0-ng/L level. These high levels of synthetic estrogen hormones are important because of the impact they may have on intersex. Patterns of other contaminants from our 2014 sampling period indicate an accumulation of PCBs in our downstream sites and a spike in polycyclic aromatic hydrocarbons (PAHs) upstream. Muscle tissue samples of black bass, sunfish, and catfish have been analyzed for contaminant concentrations. So far, only mercury appears to be of concern, specifically in larger catfish and bass at downstream sites. Past research by Hinck et al. (2009; Aquatic Toxicology 95:60-70) examined nation-wide intersex occurrence and discovered that the highest rates of largemouth bass (LMB) intersex occurred in the Y-PD. In the summer of 2014, we sampled 11 of the 13 sites longitudinally located along the Y-PD for black bass, sunfish, and catfish and determined intersex condition and severity. 43% of black bass, 7% of sunfish, and 1.4% of catfish displayed the intersex condition and severity varied for each species. Intersex occurrence varied between sites. Patterns in site contaminant loads and intersex occurrence will be evaluated. In-situ bioassays were conducted at 8 of the 13 sites along the Y-PD. Each bioassay was conducted for a maximum of 28 days and consisted of placing 20 juvenile RRH, LMB, or adult fathead minnows (FHM) into a plexiglass cage that allowed water and food to flow through. The goal of this research component was to determine if young fish could survive in the Y-PD. Fish were checked approximately every 3 days and mortality was recorded. The same assay was also conducted in hatchery ponds, where fish were originally reared, to test for cage and transport effects. LMB had a mean survival of 9.7 days, and RRH had a mean survival of 12.1 days in river assays. FHM survived for an average of 22.2 days in the river. Survival in hatchery ponds was much higher. Low in-situ survival rates of young fish, occurrence of intersex, and contaminant levels are a concern for the already imperiled RRH populations, and future results will further enhance our understanding of this fish's biology and ecology to inform conservation and management.

Embryo Survival – Jessie Fischer
Initial work was conducted on hatchery vs. in situ egg survival for Robust Redhorse in the Pee Dee River in 2015. The controls at the hatchery had 0.7% hatch while the river had 0.5% hatch. No chorion was observed in any of the eggs from the river sample.

Food Web and Contaminant Trophodynamics in the Pee Dee River – Tiffany Penland
Widespread impairment of the Yadkin-Pee Dee River, caused by increasing human development and eutrophication from sources such as wastewater discharges and agricultural runoff are of utmost concern for the Robust Redhorse (*Moxostoma robustum*) and other imperiled species. Persistent or bioaccumulative contaminants often reach concentrations that adversely impact aquatic life and consumers. The objectives of this research were to determine the aquatic food web structure and trophic transfer and accumulation of contaminants within the food web. We conducted intensive sampling at five sites, associated with Robust Redhorse conservation, along the Yadkin-Pee Dee River of North Carolina and South Carolina. The sampling sites span a range with diverse physical characteristics, land uses, and influx of point and nonpoint source pollution that facilitated longitudinal examination. Detritus, algae, macrophyte, invertebrate, and fish samples were collected for a comprehensive food web analysis at all five sites during the summer. Leaf packs and coarse and fine particulate organic matter samples were also collected at each site. A total of 8 different species of macrophytes, 28 aquatic insect families, 9 crustacean species, 20 mollusk species, and 26 fish species were collected to provide a comprehensive representation of the producers and consumers in the Yadkin-Pee Dee River. Major food web components and pathways will be determined by stable isotope ratios of representative producers, consumers, and organic matter. Samples will also be submitted for contaminant analyses when the minimum amount of material required is met. This research is ongoing and results will be forthcoming.

Update on Early Genetic Data Retrieval – Discussion
- Determine if wild recruitment but hard to do if big data gaps
- Baseline genetic marker sets used in other systems

Robust Redhorse Cryopreservation as a Recovery Tool – Jaci Zelko
The Warm Springs Fish Technology Center has developed cryopreservation protocols for several species, which can be used for spawning populations, transport of semen over long distances, long-term storage in the event of catastrophes, and preservation of genetic materials. A cryopreservation protocol was developed for robust redhorse in 1997 and refined thru spawning efforts in 2005. The FTC currently maintains a cryopreserved sperm repository of 55 males from the Savannah River and 51 males from the Oconee River. Efforts are currently underway to include males from the Pee Dee River in North Carolina. The development of a successful protocol for robust redhorse sperm cryopreservation will allow the establishment of a sperm repository for future restoration efforts.

BUSINESS & TECHNICAL WORKING GROUP REPORTS

Future Management of the Savannah Population, a Savannah TWG? – Discussion
With SCDNR's broodstock collection coming to an end and the recent discoveries of two juveniles in the lower Savannah River, is it time to form a Technical Working Group (TWG) for the Savannah population? We have an Oconee TWG and a Pee Dee TWG at this point. There is a great deal of robust redhorse monitoring work that needs to take place in the Savannah (Augusta Shoals, gravel bars below NSBLD, lower Savannah for juvenile monitoring, etc.) and many anthropogenic modifications to the waterway.

Alice said that Carrie has started drafting a "purpose and charge" for a Savannah TWG, per the direction of the 2002 RRCC Policies. Carrie was unable to make this year's RRCC Meeting, but Alice will follow up with Carrie to circulate the draft purpose and charge to the RRCC for review.

ITTWG & Annual Report Update – Jaci Zelko
The ITTWG is charged with two responsibilities: data management and website management. Ryan Heise has taken the lead in the past few to years to maintain and update the robust redhorse website. He sends all changes and new information to be uploaded to Morgan Nolan. She has done an excellent job of keeping the website looking great. The website has also been reorganized on some of the pages and a new YouTube video has been added as well as many other pictures and documents.

Jaci gave an update on the status of the master capture database. She asked all participants to check on their latest dataset and send updated copies to be included in the master spreadsheet. As of this meeting, the only dataset received from the 2015 surveys was from Pee Dee captures.

Jaci relayed that the new protocol of each presenter submitting an abstract has greatly streamlined the annual report process. As of this meeting she has completed the 2003 – 2013 reports. These documents have been uploaded to the RRCC website. The missing report from 2002 and 2014 are currently being written.

RRCC Finances – Jaci Zelko
Jaci gave an update on the balance of the account. The Committee received donations from Duke Energy/Progress, Georgia Power Company, and South Carolina Electric & Gas in 2015. These agencies have continually supported the Committee. The RRCC has also received donations or in-kind services from the following: Georgia Dept Natural Resources, South Carolina Aquarium, PBS&J, WRC State Wildlife Grants, and NC State Parks. The funds are used to pay for the annual meeting, incidentals, and the website domain name www.robustredhorse.com.

RRCC ExCom Member Update – Jaci Zelko
Within the RRCC Policies, adopted in 2002, is a policy that deals specifically with the Executive Committee (Excom) and Technical Working Groups. The Excom is empowered by the RRCC to deal with the day-to-day issues associated with the regional recovery effort. The members of the Excom should be confirmed or reconfirmed by the RRCC at each annual meeting.

The updated list of Excom members for 2015 – 2016.

Affiliation	Name
RRCC Chair	Jaci Zelko
RRCC Past Chair	Alice Lawrence
GADNR	Brett Albanese
SCDNR	Ross Self
NCWRC	Ryan Heise
USFWS	ES Primary: Carrie Straight
USGS	Cecil Jennings
Utility Rep	Tony Dodd
Utility Rep	Jason Brown
Academia	Bud Freeman

MOU Renewal
The current Memorandum of Understanding that established the Robust Redhorse Conservation Committee is set to expire Dec 15, 2015. The renewal period set forth in the MOU is five years. Signatory representatives were informed of the deadline and new guidance issued by the U.S. Fish &Wildlife Service regarding MOU format and content. The new guidance is based on compliance for all MOU's to adhere to the National Archives and Records Administration (NARA) requirements. Jaci will be editing the current MOU to adhere to the new format and will then send out the MOU for review to the signatory representatives. Once an updated and signed MOU is completed, it will be added to the website.

Misc. News & Notes – All

- Reminder to all field personnel: please start fin clipping every robust redhorse captured for any survey reason (standardized sampling, broodstock, etc.). Fin clip supplies will be provided by Tanya Darden, South Carolina DNR Marine Resources Research Institute, or Warm Springs Conservation Genetics Lab. Samples collected from Georgia fish should be submitted to Warm Springs and all remaining samples should be submitted to Tanya's Lab. If anyone is holding onto fin clip samples from previous sampling efforts, please submit them ASAP. Jaci will send out a Tissue Collection Protocol to all members as a refresher.

- The Excom will be investigating the possibility of some using a type of SharePoint or similar site for our use to share our robust redhorse files that would not be appropriate for uploading to the website.

- The Committee's domain name for www.robustredhorse.com is set to expire in Oct 2016. The consensus from attendees is to renew the subscription. Jaci will coordinate payment. A 9-year subscription is $315.

- Brett Albanese, GADNR, informed the attendees that he will be submitting a proposal for a Robust Redhorse Competitive State Wildlife Grant. Part of the scope of work would include a visual monitoring study, looking for juveniles in the lower parts of Oconee, determining newer genetic markers across the robust redhorse range, outreach activities, and on the ground management actions. This is just the first outline and could change, as all three states have expressed interest in participating. The final application is due Feb 19, 2016. Brett is preparing the outline and is asking for suggestions and support from partners.

A T T A C H M E N T S

Attachment 1. Attendees of the 2015 Meeting:

Name	Affiliation	Email
Jaci Zelko	WSFTC	Jaclyn_Zelko@fws.gov
Tanya Darden	SCDNR	dardent@dnr.sc.gov
Daniel Farrae	SCDNR	FarraeD@dnr.sc.gov
Alan. Stuart	DUKE ENERGY	Alan.Stuart@Duke-Energy.com
Brandon Stutts	SCANA	bstutts@scana.com
Caleb Gaston	SCANA	caleb.gaston@scana.com
Tony Dodd	GPC	ardodd@southernco.com
Matt McKinney	Duke Energy	matt.mckinney@duke-energy.com
Doug Hinshaw	NCWRC	doug.hinshaw@ncwildlife.org
Wayne Starnes	NC Museum [illegible]	wstarnes99@gmail.com
Ryan Heise	NCWRC	ryan.heise@ncwildlife.org
Scott Lamprecht	SCDNR	Lamprechts@dnr.sc.gov
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Wayne Clark	Aquatic Escapes	lwc8411@gmail.com
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Peter Dimmick	GA DNR	pjdimmick@gmail.com
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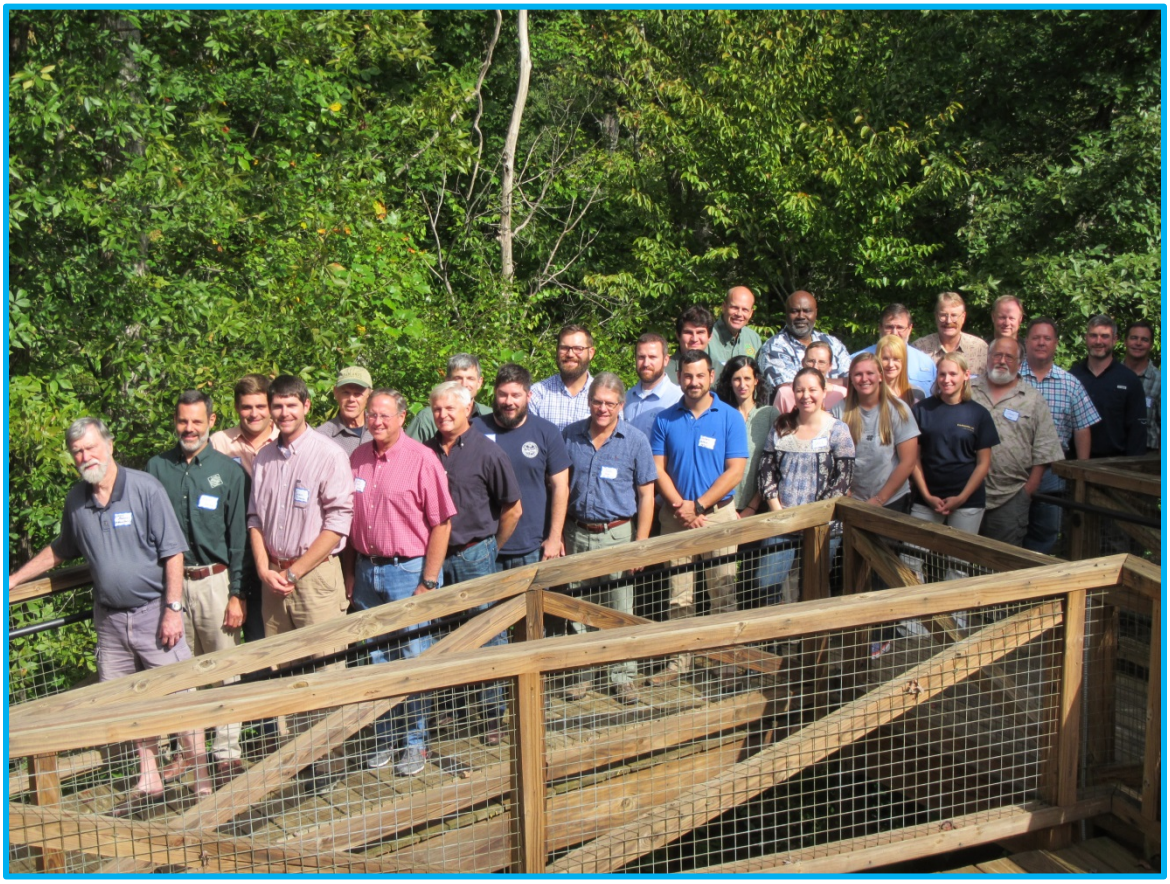
Steve Zimpfer	UGA	szimpfer@uga.edu
Jamie Roberts	GA Southern Univ.	jhroberts@georgiasouthern.edu
Brett Albanese	GADNR	brett.albanese@dnr.ga.gov
Jimmy Evans	GA DNR (Retired)	—
Forrest Sessions	SCDNR	SessionsF@dnr.sc.gov

Patrick O'Rourke	GA Power	pmorourke@southernco.com
~~Wayne Starnes~~	~~NCMus. Nat. Sci.~~	~~WSTARNES99@gmail.com~~
Jason Brown	DUKE Energy	Jason.Brown2@Duke-Energy.com
Alan Stuart	Duke Energy	Alan.Stuart@Duke-Energy.com
Greg Cope	NC State Univ.	greg_cope@ncsu.edu
Mike Joyce	USFS / GA	mjoyce@fs.fed.us
Mary Pfaffko	GADNR	mary.pfaffko@dnr.ga.gov
Jeff Slaughter	GA Power	jeslaugh@southernco.com



Group Photo!!