REPORT OF THE

ROBUST REDHORSE CONSERVATION COMMITTEE ANNUAL MEETING

Charlie Elliott Wildlife Center
Mansfield, Georgia
September 20 – 22, 2016

Several electro-fishing boats are needed to sample the Pee Dee River during the spring.
Credit: North Carolina Wildlife Resources Commission

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 22nd 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 annual meeting of the RRCC was held September 20-22, 2016 at Charlie Elliott Wildlife Center in Mansfield, Georgia. Approximately 40 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 2016 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 on a 5-year basis 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 2016 annual meeting. She welcomed all the participants and gave a quick overview of the 22 years of robust redhorse recovery effort. All participants were asked to introduce themselves and their agency.

MANAGEMENT ACTIVITIES

Conservation of the Robust Redhorse in the Pee Dee River – Ryan, Rick, Doug
The Yadkin-Pee Dee Technical Work Group continued the augmentation program and spring population census. In 2016, our total spring electrofishing effort (pedal time) in the Blewett Falls reach was 70.41 hours and we captured 17 Robust Redhorse. Two additional Robust Redhorse (juveniles, TL = 165 and 307 mm) were collected in South Carolina during other sampling (Figure 1). From the TWG's spring sampling, 4 Robust Redhorse were previously untagged and 13 were among year recaptures, giving us an among year recapture rate of 76.5%. Five fish were male, 11 were female, and we also collected a juvenile (TL = 334 mm). Eight Robust Redhorse were collected from the Jones Creek shoal, 8 from the Hitchcock Creek shoal. Total length for all fish collected in 2016 ranged from 165 to 512 mm TL.

We were unable to spawn any fish this year due to the unusual spring weather and flow patterns. Many of the females were either spent or were overripe during the normal spawning timeframe. The males that we collected were spent and did not respond to hormone injection at the hatchery.

In 2016, we initiated a pilot study utilizing the hatchery-reared Robust Redhorse as tagged sentinel fish (see Grabowski and Jennings 2009) to help determine migratory behavior and habitat use of juvenile Robust Redhorse. In 2015, about 1,600 propagated fish were kept at each hatchery (SCDNR Dennis Center and NCWRC McKinney Lake) for further grow-out and to be stocked in the fall of 2016. In November, we stocked these phase II fingerings at Jones Creek Shoal and at the Cheraw Boat Ramp. We had good growth and survivorship in the hatchery ponds and we tagged and released over 1,700 juveniles. The TWG members PIT tagged every individual and we surgically implanted a Vemco tag in 30 fish. These fish are being tracked using the existing network of Vemco acoustic receivers that have been deployed for sturgeon monitoring at roughly 60 locations throughout the Pee Dee/Winyah Bay system. So far, many of the tagged fish moved upstream from their initial stocking locations.

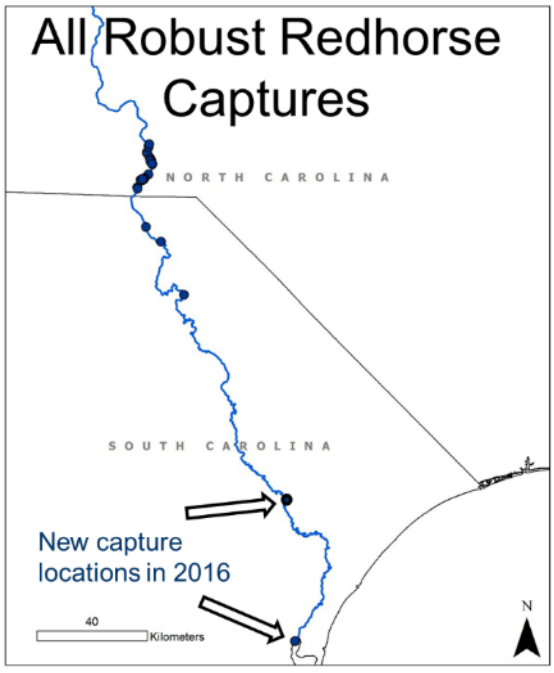

Figure 1. Pee Dee River Robust Redhorse Captures in 2016. Credit: R. Heise

Yadkin-Pee Dee FERC License Implementation – Justin Dycus

Blewett Falls Development is the lower most dam on the Pee Dee River, located at river mile 188. On April 1, 2016, Blewett Falls Development received the new licenses from FERC. New minimum flows were established within the new license, and were set at 2400 cfs to be released from February 1 through May 15, 1800 cfs May 16 through May 31, 1200 cfs June 1 through January 31, and a new absolute minimum flow of 925 cfs. Spring flows typically exceed 2400 cfs, but the absolute minimum flow is optional if other Yadkin Projects do not release enough flow to obtain new date sensitive minimum flow requirements. Streambed and gravel bars are completely inundated at all new minimum flow requirements. During weekly American Shad population monitoring below Blewett Falls Development a wild juvenile Robust Redhorse was collected on 5/12/2016, near Big Island. This juvenile weighed 512 grams and measured 334 millimeters.

Santee Basin Update – Scott Lamprecht

During 2016, Robust Redhorse population monitoring included both directed effort and incidental observations. Three days of directed effort were expended in June on the upper Congaree, Lower Broad, and upper Broad river segments. No Robust Redhorse were collected in the Congaree or Upper Broad River during these surveys. However, 6 fish were collected in the Lower Broad River segment. Fin clips were taken from all individuals and 5 individuals received new PIT tags. Coded wire tags were not detected in three fish and the absence of tags in the two the smallest fish suggested the potential for a natural recruitment source. Genetic parentage analysis confirmed the two smaller fish (414mm and 452mm) were non-cultured or "wild" fish.

Figure 2. Robust Redhorse collected in Parr Dam tailwaters in 2016. Credit: S. Lamprecht

Observations collected in the study area during other monitoring projects have been helpful in expanding our data collection. In April, and electro-fishing survey in the upper Broad River (SCANA) captured two spawning condition adult male Robust Redhorse. One fish was measured, photographed and released before it could be checked for internal tags or a tissue sample taken. However, a PIT tag was detected in the other capture and a tissue sample was obtained. This individual had been captured twice in successive years, during fall sampling, about 10 river miles downstream. Three adult Robust Redhorse, in spawning condition, were observed during Duke Energy's spring monitoring below Wateree Dam. Tissue samples were obtained from all three specimens. DNR fall monitoring in the lower Saluda River (Congaree/Wateree river segment) detected 2 Robust Redhorse and a tissue sample was retained

for one fish. Fish passage monitoring at the Columbia Fishway detected one fish, though conditions were poor following the October floods of 2015.

Wateree River Collections 2016 Update – Matt McKinney

Robust Redhorse were introduced to the Wateree River by the South Carolina Department of Natural Resources (SCDNR) in 2004. It is believed that the species once occurred in this river due to its disjunctive range. From 2004-2006, Duke Energy expended approximately 150 pedal hours of electrofishing 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. Only one Robust Redhorse was collected during this effort which occurred in the tailrace in 2006.

As a part of the FERC license, Duke Energy performs 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 2016, Duke Energy has incidentally collected 79 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 collected, 47% were male, with 34% female and 19% sex not determined (juvenile). Seventy-nine percent of these fish were tagged (coded-wire or PIT), while 21% were either untagged or tags were not read.

Three females were collected during 6.9 hours of electrofishing pedal time in 2016. All were collected near the head of a shoal along the right-ascending bank of the tailrace canal in relatively shallow, flowing habitat. A coded-wire tag was detected in the left cheek of two females (TL = 580 mm, 3.2 kg; TL = 595 mm, 3.3 kg), suggesting an age of either 6 or 11 years based on SCDNR stocking data. No existing PIT tags were detected in either female, and PIT tags were inserted proximal to the posterior origin of the dorsal fin (0A140A0357 and 0A140A0355, respectively). Both a coded wire tag (right cheek) and PIT tag were detected in the third female (TL = 627 mm, 4.1 kg, 0A140A0245). This 11 year old individual had previously been collected by the SCDNR in May 2014. Pectoral fin clips were taken for genetics analysis from all females.

Georgia Visual Monitoring 2016 Update – Brett Albanese

GADNR, Georgia Power, Georgia Southern University, FWS-Athens and retired biologist Jimmy Evans carried out visual monitoring at known and potential spawning sites for Robust Redhorse during 2016. Results of surveys were entered into a standardized Excel workbook created by Deb Weiler (GADNR). The known spawning site on the Ocmulgee River near Juliette was visited 7 times, but no Robust Redhorse or spawning activity was documented. A significant flood occurring during the preceding winter deposited large amounts of sand all over this site and negatively impacted spawning habitat quality. In an attempt to intercept Robust Redhorse migrating to the spawning site, GADNR installed a Fkye net spanning a portion of the

river channel between an instream island and the western shoreline. Unfortunately, Otters repeatedly damaged the net within a 2 day period and fyke net sampling was aborted. Three potential spawning sites (Lloyd Shoals, Popper Tract, and Wise Creek) located upstream of Juliette dam were each visited 2 times during the spawning season, but no Robust Redhorse or spawning activity was documented. A small group of Robust Redhorse was observed near Lloyd Shoals dam during the spawning season in 2010, but no spawning activity has been documented upstream of Juliette dam since that time. The Avant Mine and the Railroad Trestle sites on the Oconee River were also surveyed two times each, but no Robust Redhorse were observed. A visual survey for Robust Redhorse was carried out during a 6.3 mile canoe float on the Little River on May 2nd. Some potential spawning habitat was documented, but no Robust Redhorse were observed. The Little River is a tributary to Lake Sinclair (Oconee River system) where a female Robust Redhorse was captured during May 2012. This fish may have resulted from an accidental release of Robust Redhorse from the Walton Fish Hatchery. Several patches of gravel were documented in the Ogeechee River near Louisville during Fall 2015. However, high flows and turbidity again precluded visual surveys during the 2016 spawning season. In addition, boat electrofishing surveys carried out at 14 sites on the Ogeechee River during Fall 2015 failed to document any Robust Redhorse. Known spawning sites on the Middle Fork and North Fork Broad rivers were surveyed 3 times this year, but no Robust Redhorse or spawning activity was confirmed. As in the Ocmulgee, habitat quality in the North Fork Broad River has been negatively impacted by the deposition of sand. Two known spawning sites were surveyed on the Savannah River during 2016. Visual observations documented a maximum number of 6 Robust Redhorse at the more downstream site (i.e., the "lower bar"), but none were observed at a site located just downstream of the New Savannah Bluff Lock and Dam. While it is promising that some Robust Redhorse were seen at a known spawning site, over a hundred fish were seen at this same spawning site during 2015. Dr. Jamie Roberts presented temperature and flow data for the Savannah River and suggested that additional observations are needed when both flows and temperatures are suitable for spawning. Proposed work for 2017 includes 1) Searching for additional spawning sites and adult Robust Redhorse in the Ocmulgee and Ogeechee Rivers and 2) Integrating additional sampling methods, such as acoustic monitoring, to assess the status of populations.

Oconee River 2016 Surveys – Tony Dodd
"Summer season monitoring of Oconee robust redhorse through a standardized fish community survey design"
Although annual monitoring surveys for Oconee robust redhorse were infrequent during 2004 through 2014, low detection of spawning season fish appears to have persisted from 2005 (10 fish) through 2014 (1 male and 1 female). Those observations combined with others about recently diminished presence of critical gravel habitats led to a 2015 meeting of the Oconee Technical Working Group where a decision was made to broaden the scope of past annual surveys. Electrofishing-based monitoring surveys conducted prior to 2015 occurred during spawning season and they focused on gravel bars (spawning habitat) and other areas shown in the past likely to produce captures. River reaches containing spawning areas occupy approximately only about a ~30-mile subset of the 70-mile reach of the Oconee River located between Sinclair Dam near Milledgeville and Dublin, GA. The 2015 standardized design attempts to replicate collection method and effort utilized in the 1993 survey based on summer

season sampling using specific transect and habitat locations distributed in each of seven river reaches spanning the entire 70 mile distance (believed to represent the known range of Oconee robust redhorse). The 2015 survey was postponed due to severe drought effects. The 2016 survey attempt was severely stalled between mid-June and mid-September due to severe drought conditions. However, the survey effort will resume and continue well past the originally intended summer season time bracket into the fall to hopefully complete the 2016 study as precipitation and workable river stage returns. Observations of sediment accrual combined with diminishing occurrence of important surface gravels in the Oconee raise key questions about wild-population sustainability. Presentation discussion may broach potential needs for a renewed assessment of habitat conditions, consideration of methods for long-term population viability through gravel habitat restoration (e.g., gravel augmentation, flow alteration).

Broad/Savannah Fall 2016 Sampling – 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 second juvenile robust redhorse in November 2013 in the mainstem Savannah River. Similarly, Robust Redhorse Conservation Committee (RRCC) representatives and additional FWS personnel collected a third juvenile robust redhorse in November 2014, located below Ebenezer Landing and slightly upstream of the earlier two captures. The three collection locations were approximately seven river miles apart. Because of these three juvenile captures that were closely collected in proximity and time of year, RRCC representatives have plans to sample the Lower Savannah River to investigate an area above these known capture locations in Fall 2016. Two sets of dates have been set aside in October and November as options. Alice will not be able to complete the planning for the survey event due to a long-term detail with the Service's Regional Office in Atlanta, but will assist Jamie Roberts (Georgia Southern University) in planning for the sampling event as much as possible.

RESEARCH UPDATES

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.

Relation of intersex and fish health to contaminants in riverine fishes – Casey Grieshaber
Robust redhorse (RRH) populations in the Yadkin-Pee Dee River (Y-PD) currently include approximately 28-47 adult individuals with minimal 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, sediment, muscle tissue, and roe contaminants, occurrence and severity of the intersex condition in fish, and survival of young fish in the river. Organic and inorganic compounds were measured longitudinally along the river in sediment samples and in passive sampling devices (PSDs) that integrate waterborne contaminant occurrence over time. PSD data has been analyzed and results indicate that polycyclic aromatic hydrocarbon (PAH) and ethinyl estradiol (synthetic birth control ingredient) concentrations are above threshold values in water. These high levels of synthetic estrogen hormones and organic contaminants are important because of the impact they may have on intersex. Sediment samples have also been analyzed and PAH, mercury, cadmium, and manganese concentrations exceeded known threshold limits. Muscle tissue samples of black bass, sunfish, and catfish have been analyzed for contaminant concentrations. Mercury and polychlorinated biphenyl (PCB) concentrations exceeded known thresholds and were generally higher in larger catfish and bass at downstream sites.

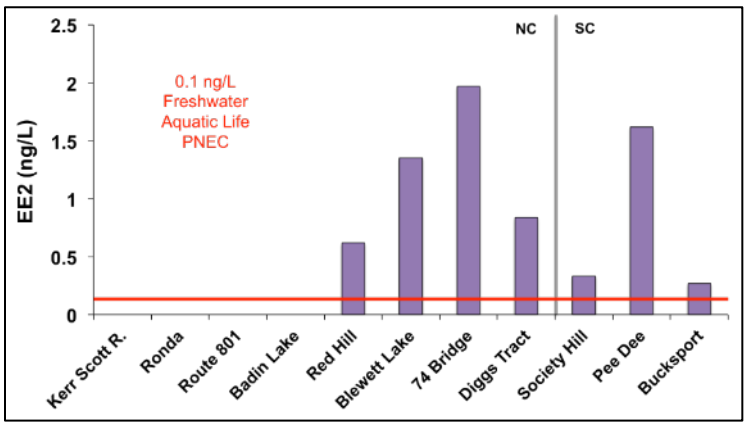

Figure 3. Levels of hormones detected in samples from multiple sites. Credit: C. Grieshaber

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 and no strong patterns of occurrence or severity were observed. All subsets regression modeling and model selection procedures revealed that black bass intersex was associated with waterborne organochlorine pesticides (OCP) and sediment-associated mercury. Sunfish intersex was related to waterborne PAHs.

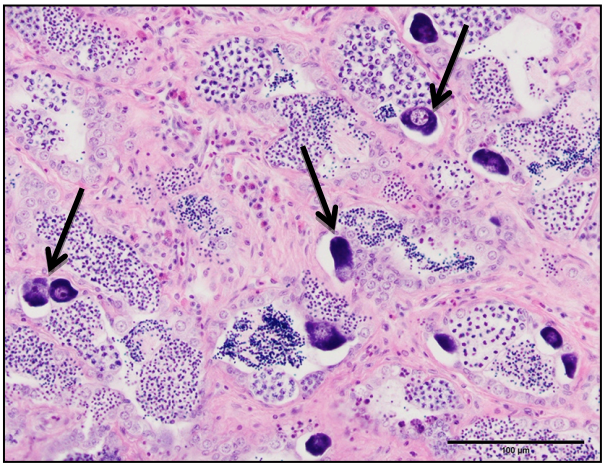

Figure 4. Cross-section of tissue that shows endocrine disruption. Credit: C. Grieshaber

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 with 70% of LMB and 67% of RRH surviving. Surviving FHM were evaluated for intersex condition, physical abnormalities, and were also evaluated for contaminant accumulation. No fish were found to have the intersex condition however, a loss of tubercles was evident, possibly indicating endocrine disruption. FHM whole-bodies were evaluated for total PCB, OCP, and metal concentrations. PCB, OCP, and mercury concentrations increased drastically in river-exposed individuals when compared to baseline sample concentrations.

Three roe samples were collected from adult, female RRH individuals in the summer of 2014. Mercury levels were low in roe samples but they did increase with size of adult female. PCB and OCP concentrations also increased with adult size.

Water quality stressors and contaminants in this river system appear to adversely impact juvenile and adult fish. The occurrence of intersex, contaminant accumulation within organisms and roe,

and low survival of juvenile fish all have presumed assemblage and community level effects, which may impact fish sustainability and RRH populations. These findings enhance the understanding of the relationship between contaminants and fish health and provide information that can guide ecologically comprehensive conservation and management decisions in the Yadkin-Pee Dee River.

Food Web and Contaminant Trophodynamics in the Pee Dee River – Tiffany Penland
Widespread impairment of the Yadkin-Pee Dee River, caused by increasing landscape 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 their 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.

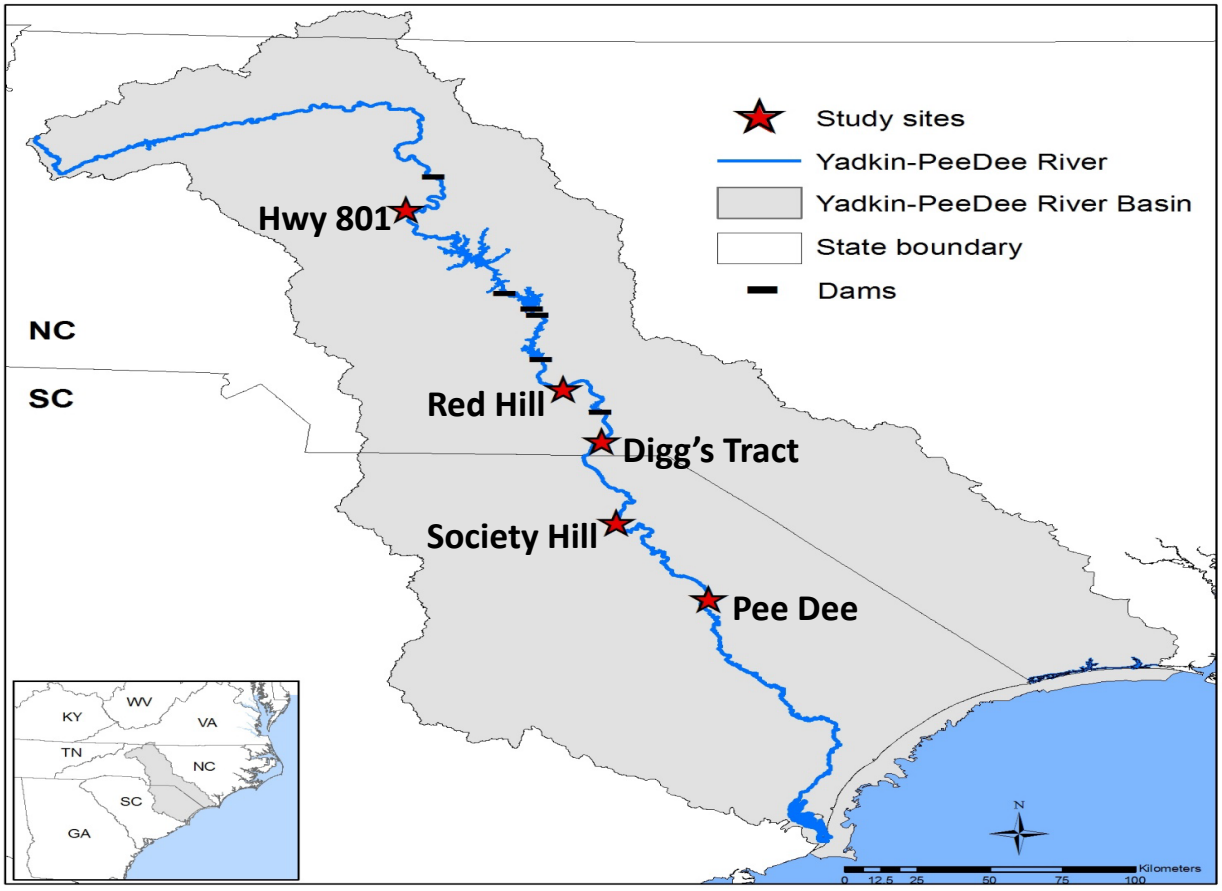

Figure 5. Yadkin Pee Dee River sites for the contaminants study. Credit: T. Penland

We conducted intensive field 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. Major food web components were determined by the collection of representative producers, consumers, and

organic matter. Contaminant analyses performed on biotic and abiotic samples revealed that organic and inorganic contaminants were present and that PCBs, mercury, PFOS, and legacy organochlorine compounds (e.g., DDT metabolites) were dominant. Mercury and PCB concentrations in several fishes approached and surpassed the established fish health thresholds. Analysis of PFOS in Robust Redhorse roe shows an extremely high concentration (482.9 ng/g ww) suggesting that maternal transfer is a major source of exposure for this persistent compound. Contaminant concentrations show a general increasing longitudinal pattern downstream. The current Robust Redhorse range possesses some of the highest chemical compound occurrence and should be of concern for their recovery. The results suggest that water quality is a likely stressor to the Robust Redhorse and other priority species. It is essential to increase water quality monitoring and determine the major sources of contaminant input to elucidate the problem sources and move forward with conservation management efforts.

State Wildlife Grant Update – Brett Albanese

Brett Albanese presented an overview of the upcoming State Wildlife Grant project that will begin in January 2017 and continue through December 2019. The objectives of this multi-state (GA, SC, and NC) project are to: 1. Determine if populations of Robust Redhorse in the Ocmulgee, Oconee, Ogeechee, Broad, Savannah, Santee, and Pee Dee River systems are self-sustaining using a combination of visual, acoustic, and genetic monitoring techniques, 2. Improve adaptive management for Robust Redhorse populations across their range and identify key management actions needed to preclude listing under the ESA, and 3. Implement management actions and monitoring according to the results of Objectives 1 & 2 and support continued stocking of the Pee Dee River population. The overall project is being coordinated by Georgia DNR, with project leaders designated in all three states. Georgia DNR intends to hire a new Robust Redhorse biologist and technician that will spend 50% or more of their time on project activities. Dr. Brian Irwin (Georgia Cooperative Fish and Wildlife Research Unit) will be leading objective 2 and is currently recruiting a PhD student for the project. Dr. Jamie Roberts will be carrying out monitoring efforts on the Ogeechee and Savannah Rivers and is currently recruiting an M.S. student for the project. Anyone with questions about project implementation should not hesitate to contact Brett Albanese.

BUSINESS & TECHNICAL WORKING GROUP REPORTS

Savannah TWG – Discussion
A discussion was held on the possibility and need of a Savannah River TWG. Participants have noted that a TWG has worked well in other basins for setting goals and coordinating jobs and efforts. As more monitoring work is conducted in the Savannah River, it makes sense that a TWG would be formed so that joint participation from Georgia and South Carolina is coordinated to focus on research and monitoring of that population. Representatives from agencies that would have a member on the Savannah TWG will check with their respective agencies and report back.

Financial Supporters & RRCC Bank Account – Jaci Zelko
Jaci gave an update on the balance of the account. The Committee received donations from Georgia Aquarium, Georgia Power Company, and South Carolina Electric & Gas in 2016. These agencies have continually supported the Committee. The RRCC has also received donations or in-kind services from the following: Duke Energy/Progress, 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.

IT TWG Database and Website – Jaci Zelko
The ITTWG is charged with two responsibilities: data management and website management. The website has been reorganized on some of the pages and a new YouTube video has been added as well as many other pictures and documents. The Committee has renewed the website domain name for 9 years for $315.00, which expires September 21, 2025. All updates are done by Morgan Nolan at UGA and she was given a Certificate of Appreciation by the RRCC in October. 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.

Annual Report Update – Jaci Zelko
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 – 2014 reports. These documents have been uploaded to the RRCC website. The missing report from 2002 and 2015 are currently being written.

MOU Renewal
The current Memorandum of Understanding that established the Robust Redhorse Conservation Committee expired 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. The current MOU was edited to adhere to the new format and was sent out for review to the signatory representatives. Once an updated and signed MOU is completed, it will be added to the website.

Genetics TWG Update
The Genetics TWG has been inactive in the past few years but a discussion was held to restart the TWG. Tanya Darden and Daniel Farrae will work out the new Chair for this TWG and inform the RRCC of their decision. They asked that anyone will data and emails that may be relevant to the TWG to be forwarded to them.

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 2016 – 2017.

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

Other Business
A discussion was held for planning the 2017 annual meeting. It was agreed that a September date at a South Carolina location would work best for most participants. Tanya Darden will gather information and send it to the entire Committee on possible dates and locations.

Installation of New Committee Chair
Tanya Darden, SCDNR was elected as the new Committee Chair and she will serve a 2-year term.

A T T A C H M E N T S

Attachment 1. Attendees of the 2016 Meeting:

Name	Affiliation	Email
Jaclyn Zelko	USFWS - Warm Springs FTC	Jaclyn_Zelko@gmail.com
TIFFANY PENLAND	NC STATE UNIVERSITY	PENLAND.TIFFANY@GMAIL.COM
Allen Beown	USFWS - Fisheries - Atlanta	allan_brown@fws.gov
Allie Laurinu	USFWS - Georgia GG	Allie_Laurinu@fws.gov
Wayne Clark	Aquatic Escapes LLC.	LWC8411@Gmail.com
Casey Grieshabes	NC State University	cagriesh@ncsu.edu
Michael Abney	Duke Energy	michael.abney@duke-energy.com
Alan Stuart	" "	Alan.Stuart@DukeEnergy.com
Justin Ayers	Duke Energy	justin.ayers@duke-energy.com
Tanya Darden	SCDNR	dardent@dnr.sc.gov
Stephen Beaman	SC Aquarium	sbeaman@scaquarium.org
Jarrett Gibbons	SCDNR	GibbonsJ@DNR,SC.GOV
Forrest Sessions	SCDNR	Sessionsf@dnr.sc.gov
Bryan Tompkins	USFWS	bryan_tompkins@fws.gov
Caleb Gaston	SCANA	Caleb.Gaston@scana.com
Zack Abouhamdan	GADNR WRD	NGTEMP3@dnr.ga.gov
Deb Weiler	GA-DNR	Deb.Weiler@dnr.ga.gov
Peter Dimmick	GA-DNR	pjdimmick@gmail.com
Matt McKinney	Duke Energy	matt.mckinney@duke-energy.com
William Bailey	USACE Savannah	william.g.bailey@usace.army.mil
Wayne Starnes	Retired NC Museum nat. Sci.	wstarnes99@gmail.com
Ryan Heise	Duke Energy	Ryan.Heise@duke-energy.com
Jimmy Evans	GADNR (Retired)	—
Ellen Cheng	GA Coop.	echeng@uga.edu
Daniel Farrell	SCDNR	farrcd@dnr.sc.gov
Brandon Stutts	SCANA	bstutts@scana.com
BRIAN IRWIN	GA CRU	irwin@uga.edu
Tom Kwak	NCSU/USGS	tkwak@ncsu.edu
CECIL JENNINGS	GA COOP Unit	jennings@uga.edu
JASON WISNIEWSKI	GADNR WRD	jason.wisniewski@dnr.ga.gov
Jamie Roberts	GA Southern Univ.	jhroberts@georgiasouthern.edu
Scott Lamprecht	SC DNR	Lamprechts@DNR.SC.GOV
Mike Joyce	USFS - Chattahoochee-Oconee NF	mjoyce@fs.fed.us
Patrick O'Rourke	GA Power	pmorourke@southernco.com
Jon Ambrose	GA DNR	jon.ambrose@dnr.ga.gov
Tony Dodd	GA Power	ardodd@southernco.com
Mary Pfaffko	GA DNR	mary.pfaffko@dnr.ga.gov
Bob JENKINS	Roanoke College "RETIRED"	JENKINS@ROANOKE.EDU

2016 Group Photo!!