REPORT OF THE

ROBUST REDHORSE CONSERVATION COMMITTEE ANNUAL MEETING

Morrow Mountain State Park
Albemarle, North Carolina
October 8 – 10, 2012

Attendees of the 2012 annual meeting.

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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 18th 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 October 8 – 10, 2012 at Morrow Mountain State Park in Albemarle, North Carolina. Approximately 30 representatives of the signatory agencies to the MOU, university research affiliates and other interests attended the meeting. The 13 signatory agencies include: Georgia Department of Natural Resources, South Carolina Department of Natural Resources, North Carolina Wildlife Resources Commission, Georgia Power Company, Duke Energy Progress, South Carolina Electric and Gas Company, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Forest Service, U.S. Army Corps of Engineers, 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 2012 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 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 – Ryan Heise and John Crutchfield
Ryan welcomed the participants to the 18th Annual robust redhorse meeting. He thanked the sponsors of this year's meeting (NC Wildlife Resources Commission – state wildlife grant program, Duke Energy, SC Aquarium, and NC State Parks). Ryan introduced John Crutchfield, and he welcomed all to the meeting on behalf of Duke Energy.

Memorandum of Understanding Renewal – Ryan Heise
The MOU establishes the RRCC and allows the RRCC to establish operating guidelines. The previous MOU expired at the end of December, 2009. The newest version is valid from January 1, 2010 to December 31, 2014. Revisions made after the 2009 meeting were incorporated and representatives were sent the updated copy. At this time, Ryan has received signatures from all but 1 signatory. The Excom will discuss the next step at the next meeting.

M A N A G E M E N T A C T I V I T I E S

Georgia 2012 Update – Jimmy Evans

Recovery Phases

Phase I. After discovery, status assessment indicates risks due to low recruitment

Phase II. Hatchery program 1994 – 2008, multiple year classes stocked in:

- Refugial ponds
- Broad, Ocmulgee, Ogeechee rivers to establish refugial populations, and eventually reproducing populations
- Oconee – small augmentation stockings

Phase III. Monitoring

- Success of stockings
- Status of wild Oconee population

Phase IV. Efforts to improve status of Oconee population

- Flows modified during relicensing; additional modifications possible
- Research to evaluate responses to flow modifications
- Limited stocking of fingerlings and juveniles
- Habitat improvements, mainly gravel augmentation
- Evaluation of predation threats

Phase V. Search for other populations, potential reintroduction sites

- Upper Oconee above Sinclair and Wallace dams

Current Activities

Activities in 2012

Recently completed research

- Movement patterns, habitat use and home range of adult robust redhorse released into the Oconee River, GA. (Patrick Ely). Final report completed
- Abundance, size structure, movement patterns, and recruitment success of robust redhorse stocked into the Ogeechee River, GA. (Patrick Ely). Report in preparation
- Use of hierarchical occupancy models in the Ocmulgee River, GA. (Will Pruitt). Report in preparation

Ongoing research

- Population status and assessment of reproduction and recruitment of robust redhorse in the Broad River system. (Carrie Straight and Bud Freeman)
- Oconee River population status assessment (Oconee TWG)
- Search for wild and/or stocked populations above Sinclair Dam (Little River, Murder Creek) and above Wallace Dam (Apalachee and Oconee rivers). (Jimmy Evans)
- Monitoring of Oconee River gravel augmentation sites (Jimmy Evans)

Environmental reviews

- Expansion of water intake structure on Ocmulgee by Macon Water Authority
- Continued negotiations with Eastern Hydro on construction of Denil fish ladder at Juliette Dam on Ocmulgee
- Design of bridge and other mitigation measures for Fall Line Freeway crossing of Oconee River above Avant Mine

- Received $10,000 in mitigation funds for study to monitor Oconee River gravel augmentation sites in spring 2013
- Expansion of Franklin County wastewater treatment facility; reduced scope of impacts
- Negotiations with Savannah COE over Savannah River reservoir drought operations

Public relations

- Live fish displays at Georgia Aquarium and Go-Fish-Georgia Center
- Display at Macon Museum of Natural History
- FWS video featuring Ocmulgee River CCAA
- New state park being constructed at Balls Ferry on Oconee will increase awareness of recovery efforts

March 1- May 10, 2012 Status Survey Background and rationale: Sinclair Dam was constructed on the Oconee River near Milledgeville in 1950 creating Lake Sinclair. Wallace Dam was constructed above Lake Sinclair in 1980 creating Lake Oconee, the upper reservoir in a pump-storage operation (Figure 2). The robust redhorse was discovered in the Oconee River below Sinclair Dam in 1991 and the possibility therefore exists that a segment of this population could have been isolated above Lakes Sinclair and/or Oconee with the construction of Sinclair and Wallace Dams. However, no robust redhorse have been documented in over 20 years of standardized gillnet and electrofishing sampling on Lakes Sinclair and Oconee, suggesting that if a population exists in this area, it is probably small. The first objective of the upper Oconee robust redhorse status survey was to sample the major tributaries of Lakes Sinclair and Oconee (Little River, Murder Creek, Apalachee River, and Oconee River) to determine if a remnant wild robust redhorse population presently exists in this area.

The robust redhorse hatchery program began in Georgia in 1994 and continued through 2008. In June 1995 a total of 219 robust redhorse fingerlings (average total length 192 mm) that had been stocked at Walton Hatchery escaped into a small tributary of Little River due to a dam failure. Since Little River enters the upper end of Lake Sinclair, the escaped fingerlings could have moved down Little River and into Lake Sinclair. This escapement could have resulted in the establishment of a stocked robust redhorse population in Little River, Lake Sinclair, or Murder Creek (the other major tributary to Lake Sinclair). However, since no robust redhorse have been documented in over 20 years of standardized gillnet and electrofishing sampling in Lake Sinclair, if an accidentally stocked population of robust redhorse exists in this area, it is probably small. The second objective of this status survey was to sample the major tributaries of Lake Sinclair (Little River and Murder Creek) during the peak of the robust redhorse spawning season to determine if a spawning population of stocked fish exists in the upper Lake Sinclair drainage.

Methods and results: The Little River, Murder Creek, and the Oconee River between Hwy 15 and Barnett Shoals Dam were sampled by electrofishing during March 1 - May 10, 2012 (Table 1). The intent of sampling the lower reaches of these tributaries was to intercept any robust redhorse that might exist in the area as they moved upstream to

spawn. Each stream segment was sampled four times and the distances sampled were 2.1 miles on Little River, 1.3 miles on Murder Creek, and 10.7 miles on the Oconee River. Electrofishing effort per sampling event ranged from 0.5 to 3.0 hours and water temperatures varied from 14.1 to 24.5 C. No robust redhorse were collected from Murder Creek or the Oconee River, however, one robust redhorse was captured on April 17 from Little River below Hwy 129 and immediately above the impoundment of Lake Sinclair (Figure 2). This individual was a large female in peak spawning condition (total length 673 mm and weight 5,335 g) (Figure 1). Condition of the mucous coating, coloration, appearance of vent area, and flaccid abdomen indicated that this female was only a few days from spawning. It is assumed that the fish was migrating up the Little River to spawn and preliminary observations at bridge crossings above Hwy 129 following the capture indicate that spawning habitat may exist from above Hwy 129 to at least Glades Road on Oconee National Forest. However, no detailed habitat surveys have been conducted in the area. Since this fish was captured from the Little River, the receiving stream for the escaped fish from Walton Hatchery, and observations of annular rings on scale samples correspond roughly to a calculated age of 18 years, it is assumed that this is a stocked rather than a wild individual. A fin clip was collected in the event that further verification of origin is needed.

Conclusions: The capture of a single large female robust redhorse from the Little River suggests that a small spawning population of robust redhorse presently exists in the Little River and upper end of Lake Sinclair. In addition, it is probable that this population originated from the accidental escapement of about 200 robust redhorse fingerlings from the Walton Hatchery in 1995. Despite very thorough sampling of the lower end of Murder Creek above Lake Sinclair, no robust redhorse were collected and these findings suggest that a spawning population probably does not exist in this stream. Based on sampling results and habitat observations, it is unlikely that a spawning population exits in the Oconee River between Hwy 15 and Barnett Shoals Dam. However, sampling in this section of the Oconee River was significantly hampered by problems with navigation at the extreme low flows that existed during the survey.

Additional sampling should be conducted in the Oconee River above Hwy 15 in 2013 to verify these preliminary conclusions. Low flows and manpower constraints prevented the planned sampling on the Apalachee River and this work should be conducted in 2013 as well. Finally, there is a need to conduct a habitat survey on the Little River above Lake Sinclair to locate possible robust redhorse spawning areas. Visual observations of spawning activity at gravel spawning sites may be the most efficient method of evaluating the status of the existing stocked robust redhorse population in the Little River.

Table 1. Results of robust redhorse status survey conducted on the upper Oconee River, Little River, and Murder Creek, March 1 – May 10, 2012.

Stream	Distance Sampled (mi)	Dates	Temp (C)	Effort (hrs)	No. RRH Collected	Length (mm)	Weight (g)
Little River	2.1	3/14	17.4	0.5	0	-	-
		4/17	17.5	1.2	1	673	5,335
		4/25	14.1	1.2	0	-	-
		5/3	21.5	1.2	0	-	-
Murder Creek	1.3	3/14	18.2	0.5	0	-	-
		4/17	20.0	1.1	0	-	-
		4/25	18.0	1.1	0	-	-
		5/3	24.5	1.1	0	-	-
Oconee River	10.7	3/1	-	1.0	0	-	-
		4/19	18.1	3.0	0	-	-
		4/17	19.1	0.2	0	-	-
		5/10	19.5	0.4	0	-	-

Figure 1. Photo of robust redhorse collected from the Little River on April 17 during status survey conducted on the upper Oconee River, Little River, and Murder Creek, March 1 – May 10, 2012.

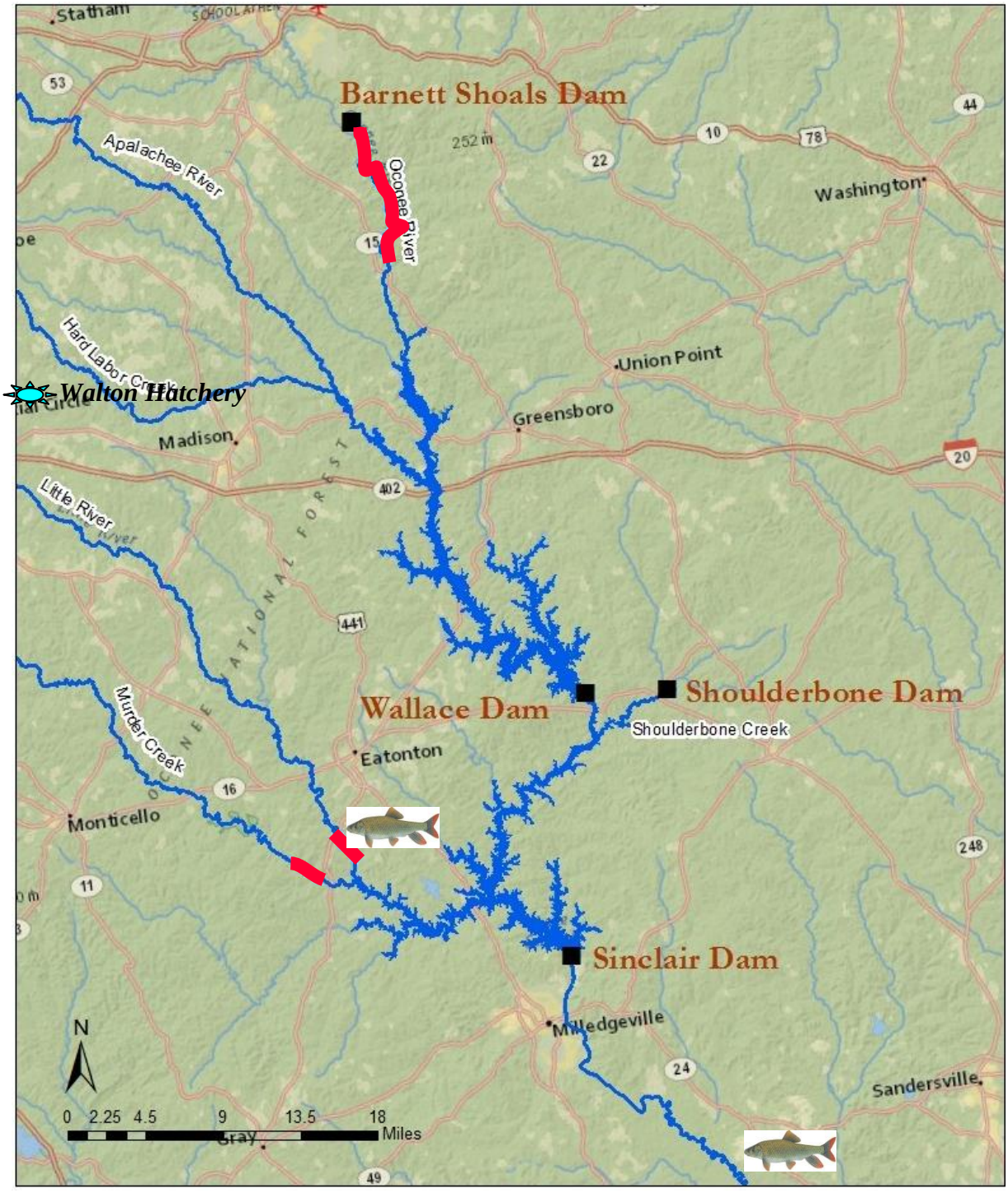

Figure 2. Sampling areas for robust redhorse status survey conducted on Little River, Murder Creek, and Oconee River, March 1 – May 10, 2012. Locations of existing wild robust redhorse population in the Oconee River below Sinclair Dam and the one robust redhorse collected from Little River during the survey are indicated. Location of Walton Hatchery in the Little River drainage is also noted.

South Carolina 2012 Update – Scott Lamprecht

Efforts to reach the Santee Drainage reintroduction goal of progeny from 100 different parental crosses have been unsuccessful over the last two spawning seasons. While adult brood stock were encountered at the Savannah River spawning bar, viable eggs were not obtained in the spring of 2012. Eleven males and 3 females were captured and processed, with two recaptures. In eleven seasons of work on the Savannah River, crews from Georgia and South Carolina have made 40 recaptures of pit tagged fish; 6 females and 34 males. Thirty of these recaptures have been collected twice, eight collected three times, 1 collected 4 times and 1 collected 5 times. The longest interval between recaptures has been 9 years. On September 11, an anadromous fish survey crew captured a juvenile robust redhorse on the leading edge of a sandbar in the lower tidal reach of the Savannah, but well upstream of any salinity.

We continue to collect stocked specimens in the Broad, Congaree, and the Wateree Rivers. Stocked individuals have been collected in mature condition and been observed in spawning behavior below Wateree Dam during typical robust redhorse spawning season and temperature regime. Duke Power personnel collected 2 specimens in 2012 during their spring anadromous fish survey of the Wateree Dam tailrace. They encountered their largest specimen ever observed; 593mm, 3,576g, Year Class 2004. During April, DNR personnel collected 18 fish and equipped 12 more adults with transmitters in the Wateree Dam tailrace. Two crews observed 2 fish in the Congaree and equipped one with a transmitter. Three individuals were captured below Parr Dam on the Broad during a general electro-fishing survey. The Columbia fishway monitor, Daniel Dieter (Kleinschmidt Associates), visually identified 9 adult robust redhorse passing upstream during the 2012 spring sample period.

Telemetry observations show a pattern of movement within the Wateree-Congaree-Santee River system that would suggest selection for cooler summer water temperatures produced by hypolimnetic water released by Lake Murray Dam. Multiple spawning season return trips to the fall-line shoals below Wateree Dam, suggest favorable spawning habitat. However, upstream spawning season movement in the Broad River suggests additional spawning habitat exists there also. For the most part, the seasonal movement pattern of the newer study animals corresponded to that of the older specimens, with some deviation. All the study fish occupied the Wateree Tailrace during spawning season, even though the 2012 water temperature rose so quickly. Study fish have repeatedly moved downstream in the early fall and overwintered in the lower reaches of the Wateree River before ascending it in the spring. The repeated use of the Congaree River is interesting because it is significantly cooler than the Wateree River during the summer and this difference may influence summer robust redhorse movement. It is interesting to note that while we observed fish exhibiting spawning behavior in the Wateree Dam tailrace, we observed significant numbers of fish ascending the Columbia Fishway. Long distance movement of these fish can occur relatively quickly; one fish moved downstream 124 km in 2.6 days and there are numerous instances of fish moving more than 30 km/day.

In 2013, DNR personnel will continue to follow tagged robust redhorse and will endeavor to produce another 15 crosses from Savannah River broodstock to be stocked in the Broad and Wateree Rivers.

North Carolina 2012 Update – Ryan Heise

The long term goal of Yadkin-Pee Dee technical working group (TWG) is to ensure a viable, self-sustaining population of robust redhorse in the Pee Dee River. Thus, the TWG has continued discussions about supplementing the small population downstream of Blewett Falls Dam and reintroduction downstream from the Tillery Dam. Duke Energy (previously Progress Energy) has already begun implementing parts of the proposed FERC (Federal Energy Regulatory Commission) license and the issuance the new license is expected in 2013. The Yadkin-Pee Dee TWG has conducted numerous studies in the Pee Dee River allowing us to make informed decisions about robust redhorse management (see previous annual reports and publications on our website). We are pursuing a long term hatchery program at the Wildlife Resources Commission's McKinney Lake Fish Hatchery and a pilot project is scheduled to begin in the spring of 2013. Discussions are ongoing between Duke Energy, U.S. Fish and Wildlife Service, NC Wildlife Resources Commission, SC Department of Natural Resources concerning a possible conservation agreement.

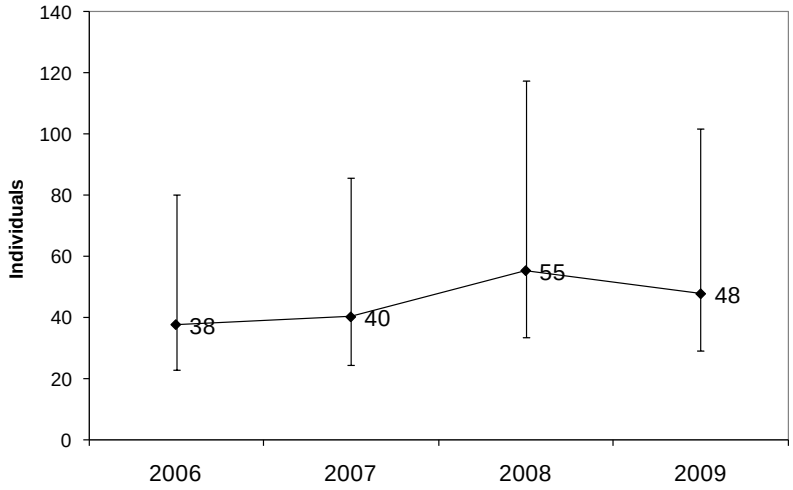

Figure 3. Adult population size of robust redhorse in the Pee Dee River.

Wateree River Collections 2012 Update – Dave Coughlan

Duke Energy continued its springtime sampling program for diadromous fish downstream of the Wateree Hydro in 2012. This program has been in place since 2004 though robust redhorse collections only began in 2006, after introductions of fingerlings by the SCDNR in December 2005. A steadily increasing trend in numbers caught, CPUE, and 'best day' CPUE were evident through 2011. The unusually warm winter and spring of 2012 may have impacted our ability to sample fish at an appropriate time. Poor catches from spring 2012 sampling were discouraging but mirror those from other rivers within the robust redhorse range. Despite the collection of only two robust redhorse in

2012, the trends of annually increasing maximum total length and weight continued. Collection efforts will continue in 2013.

Table 2. Number of fish collected from 2006 to 2012 downstream of Wateree Hydro Dam.

	#	Pedal Time (hr)	CPUE	Best Day CPUE	Max TL (mm)	Mac WT (g)
2006	1	6.52	0.15	1	243	217.5
2008	4	3.92	1.02	2	475	1164
2009	10	9.04	1.11	3	521	2176
2010	11	9.06	1.21	3	548	2716
2011	22	9.03	2.44	7	569	3066
2012	2	9.15	0.22	1	593	3576

Figure 4. PIT Tag is inserted into a Phase II fish prior to stocking in the Wateree River.

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

Robust Redhorse Recovery and Habitat Restoration: Assessing Water Quality Stressors and Food Web Contaminant Dynamics – Tom Kwak, Greg Cope, and Ryan Heise

The robust redhorse (*Moxostoma robustum*) is a rare and imperiled, large catostomid fish found in only three regulated river drainages in the southeastern U.S. It has large pharyngeal teeth for crushing mollusks and other invertebrates known to sequester anthropogenic contaminants. The robust redhorse has been negatively affected by habitat modification and fragmentation from hydroelectric dams, introduced species, sedimentation, and water pollution and is protected by state endangered status in Georgia and North Carolina. Previous research by the authors and their students on physical instream habitat suitability has shown that habitat suitability will be enhanced by prescribed flow augmentations from hydroelectric dam releases; however, the impacts of water quality and contaminant loads remain unknown. In addition to the unknown effects of traditional organic and inorganic contaminants, recent research suggests that the impact of emerging contaminants, such as endocrine disrupting compounds, may be of significant detriment to fishes in the Pee Dee River.

To further elucidate the impact and potential threat of water quality and contaminant dynamics on the robust redhorse, we proposed six research objectives to pursue in the Pee Dee River of North Carolina and South Carolina. We will (1) conduct systematic field sampling of habitat and food web components, (2) conduct experimental field bioassay exposures with captively-propagated fish, (3) perform laboratory analyses of traditional and emerging contaminants (4) determine aquatic food web structure, (5) develop population and food web models to describe effects of habitat and water quality modifications, and (6) synthesize results for robust redhorse recovery from population and ecosystem perspectives. This research is unique in that it will yield results and inference that are descriptive (systematic sampling), explanatory (experimental bioassays, food web analyses), and predictive (population and food web modeling) at multiple scales and across disciplines to inform decision making and management. If the proposed research is funded and conducted, it will guide management objectives and goals for species recovery and habitat restoration.

Genetic guidelines for Robust Redhorse reintroduction and supplementation in the Pee Dee River – Greg Moyer and Tanya Darden

A draft genetic guideline for robust redhorse reintroduction and supplementation in the Pee Dee River has been developed by the USFWS. This stocking plan describes how to minimize genetic risks and provides recommendations for the mating design, number of individuals to release, and collection and release techniques.

Table 3. The number of robust redhorse progeny needed to obtain 15 year classes of approximately 20-100 adults/age class assuming age-specific survival. Note that the overall estimate of adults in this scenario is 791 (sum of # of individuals from age-5 to age-20).

Age	# individuals	*S*
0	15,542	0.1
1	1,554	0.5
2	777	0.5
3	388	0.5
4	194	0.5
5	97	0.9
6	87	0.9
7	78	0.9
8	70	0.9
9	63	0.9
10	57	0.9
11	51	0.9
12	46	0.9
13	41	0.9
14	37	0.9
15	33	0.9
16	30	0.9
17	27	0.9
18	24	0.9
19	22	0.9
20	20	0.9

Robust redhorse, *Moxostoma robustum*, in the Broad River, Georgia 2012 Update – Carrie A. Straight and Byron J. Freeman

Movements. In 2010 and 2011, we tagged 20 robust redhorse with sonic tags (see table). Fifteen of the 20 individuals had coded-wire tags detected in a location indicating they were from the 1997 YC. We did not detect coded-wire tags in the remaining five individuals. We tagged all individuals within the influence of Clark's Hill Reservoir (Anthony Shoals) suggesting that they spent the winter prior to their tagging year within the reservoir. We had over 93,500 detections of 18 individuals. One individual (a male) either lost its tag or died within two weeks of its tagging. We failed to detect one individual (a female) since its tagging day. At least two individuals appeared to remain within the river during the winter of 2011-2012. Of the ten individuals detected within the main portion of Clark's Hill Reservoir, seven individuals were relocated upstream of the Broad River arm and three individuals were detected moving within the area downstream of the Broad River arm. One individual moved 16 km downstream of Anthony Shoals within Clark's Hill Reservoir. In the springs of 2010, 2011, and 2012, we documented 10 of 18 tracked fish at or within 250 m of known spawning sites within the upper portion of the Broad River system. Five additional fish travelled at least 55

river km from Anthony Shoals upstream in the vicinity of known spawning locations, but were not located at any specific spawning location.

Sex, weight, and length of 20 robust redhorse, tagged and tracked within the Broad River system, Georgia.

	Weight (g)	**SL (mm)**	**TL (mm)**
Male (15)	2801 (1890-4330)	475.9 (439-555)	585.5 (535-690)
Female (5)	2974 (2490-3350)	482.2 (465-510)	589.4 (563-620)

Locale-scale Spawning Site Characteristics. There are five known spawning sites used by robust redhorse between 2007 and 2012. We have observed robust redhorse at two of these sites every year (except 2009 when water levels were too high to observe spawning fish). Two other sites have been used either intermittently and one site was first discovered in 2012.

In the spring of 2012, robust redhorse spawning occurred from April 26 to May 7. At peak spawning, the maximum number of fish at three sites totaled 103 individuals. We observed evidence of spawning at one additional site (freshly manipulated gravel similar to those at sites where fish were observed), but we observed no fish at this site. Using long-term temperature monitors, water temperatures in the Broad River ranged from 19.1-25.6 C with an average of 22.3 C. Spawning water temperatures in the Hudson River water temperatures ranged from 22.1-26.8 C and averaged 24.4 C. Water depth at 66 spawning locations averaged 0.4 m (SE = 0.01). Water velocity at the 66 sites averaged 0.57 m/s at 60% and 0.27 m/s on the bottom. At each spawning group in 2011 and 2012, we collected substrate samples that we sieved according to size fractions and weighed. The dominant size fraction for spawning sediment from 2011 was between 12.5 and 50 mm in diameter. We are in the process of completing 2012 samples.

Juvenile Sampling. In 2009, we randomly chose 21 sites between the influence of Clark's Hill reservoir upstream to above the known spawning locations. At 16 of 21 sites, we captured young-of-year suckers and included 13 *Moxostoma* sp. (jumprocks), 37 *Moxostoma collapsum*, and 34 *Minytrema melanops*. All of the young-of-year suckers occurred in sites within the upstream half of the area sampled. In 2011, we focused our efforts in the upstream section and sampled 14 sites. We sampled some of these locations both during the day and at night. Thirteen of fourteen sites had young-of-year suckers and included 12 *Moxostoma* sp. (jumprocks), 10 *Moxostoma collapsum*, and 12 *Minytrema melanops*.

Landscape-scale Spawning Site Characteristics. We are currently conducting a landscape scale analysis of stream characteristics of known spawning sites in the Broad River. We have divided the mainstem of Broad River and its major tributary into fine scale segments (100m) and coarse scale segments (16 segments based on contributing watershed area). Within these segments, we have calculated standardized slope, bank width, valley width, valley confinement (ratio of bankfull width to valley width), and elevation. Using these

variables, we hope to define characteristics of spawning sites relative to areas not used for spawning.

Acoustic Surveys of Spawning Suckers. One topic concerning reproductive behavior of robust redhorse is the influence of water releases from dams on interrupting spawning. If water levels permit, we will be looking at the influence of water releases on spawning behavior of river redhorse (*Moxostoma carinatum*) in the Coosawattee River and robust redhorse in the Savannah River in the spring of 2013. Spawning suckers create a distinctive acoustic signature relative to ambient river noises. Using long-term acoustic recordings, we can look at spawning frequency relative to time in the spawning season, time of day, and changes in water velocity. We plan to compare these measurements in regulated river reaches to those in the Broad River system that are not influenced by water releases from dams. In the spring of 2012, we collected 395 hours of acoustic data from the Broad River system and 120 hours from the Coosawattee River. We did not collect any data within the Savannah River because of low water levels and the odd timing of spawning robust redhorse in the Savannah River.

Occupancy and Habitat Use of Stocked Robust Redhorse in the Upper Reaches of the Ocmulgee River, GA – William A. Pruitt, James T. Peterson, Cecil A. Jennings
As part of Candidate Conservation Agreement with Assurances (CCAA) between Georgia Power, Georgia Department of Natural Resources, and the U.S. Fish and Wildlife Service, robust redhorse of mixed age classes of Oconee River broodstock were stocked into the upper reaches of the Ocmulgee River in attempt to establish a refugial population. Prior studies on the Ocmulgee examined the movement of introduced fish, and determined that robust redhorse capture probability was extremely low, and other methods (e.g., occupancy models) should be explored to determine the status of the Ocmulgee River population.

To determine habitat use of robust redhorse, we assessed physical instream habitat (woody structure and substrate composition) using side-scanning sonar imagery, which was used in combination with other habitat data (current velocity, secchi depth, temperature, etc.) and fish capture data (via boat electrofishing), to be incorporated into zero-inflated occupancy models. We used an information theoretic approach to evaluate the scale of influence of various habitat characteristics on robust redhorse distribution in the upper reaches of the Ocmulgee River.

Our confidence set of occupancy models revealed that robust redhorse had an average conditional detection probability of 0.518 (±0.046); meaning samplers had about a 51.8% chance of detecting robust redhorse if the species was present in that unit at the time of sampling. Although detection was much higher than expected, occupancy was low in units containing shoals (0.281 ±0.049) and even lower in non-shoal habitats (0.038 ±0.011); meaning robust redhorse are 28.1% likely to be present in units containing shoals and 4.8% likely in units without a shoal present. In 2010-2012 sampling seasons, only seven robust redhorse were captured – all of which were captured within 1 km of Lloyd Shoals Dam. Robust redhorse occupancy was highest in units where coarse

substrates (bedrock, boulders, gravel, etc) dominated the streambed, and fish generally avoided units containing abundant woody debris. Our results suggest that fish are either (1) residing in the inaccessible portions of the project site that contain relatively large amounts of coarse substrates, or (2) robust redhorse have left the project site entirely in search of the coastal plain habitats similar to those used by their Oconee River counterparts.

Size structure and spawning location of robust redhorse *Moxostoma robustum* stocked in the Ogeechee River, Georgia – Patrick Ely and Cecil Jennings

A population of robust redhorse has been established in the Ogeechee River, Georgia by the eventual stocking of 40,000 fingerlings (comprised of seven year classes) during the period 1997 - 2004. Limited monitoring of this population has documented that individuals have spread throughout the Ogeechee River and many have reached sexual maturity. However, the overall status of this population, including size-structure and abundance is unknown. Further, successful reproduction and recruitment of wild-spawned fish have not yet been documented for this population.

The goal of our project was to evaluate reproduction and recruitment success for the population of robust redhorse stocked into the Ogeechee River. Our specific objectives were to: 1) document spawning and non-spawning location(s), 2) determine if reproduction and recruitment are occurring, and 3) estimate the size structure and year-class strength of the population. Between December 2010 and April 2011, 30 adult robust redhorse were captured via electrofishing, checked for a coded wire tag (to determine year class), surgically implanted with radio transmitters, and released in the Ogeechee River. During spawning season (May) of 2011, one spawning location with gravel substrates was located (~0.8 km) upstream of the Louisville boat ramp. Eight tagged individuals (30%) were located at the spawning site at least once, and five individuals were relocated there multiple times. Results of a helicopter telemetry flight conducted in November 2011 show that non-spawning adult robust redhorse were located primarily in the ~80 km stretch of river between Louisville and Millen, GA. During spawning season of 2012, movement of tagged individuals was limited; fish were generally confined to deeper pools and mean daily discharge was lower than it was in previous years. Additionally, eight gravel bars were identified and visually monitored for spawning activity; spawning activity was not observed. However, scoured out pockets of gravel were documented at the Louisville spawning site following a brief increase in water levels. To document natural reproduction and recruitment, 14 sampling stations were established at various locations along the length of the river and sampled multiple times with boat electrofishing (n= 14.41 hours), backpack electrofishing (n= 4.74 hours), and seining (n= 123 hauls) techniques. All suckers (adult and juvenile) were collected and either identified in the field or preserved and returned to the lab for later identification. Between July and October 2011, three adult robust redhorse were collected; none of the samples contained juvenile robust redhorse. The juvenile catch was comprised of about 70% spotted suckers *Minytrema melanops*, 27% chubsuckers *Erimyzon sp.*, and 3% jumprock *Scartomyzon sp.* The adult catch was comprised of about 88% spotted suckers, 7% jumprock, 3% notchlip redhorse *Moxostoma collapsum*, 1% chubsuckers, and 1%

robust redhorse. Current length-frequency histograms demonstrate that robust redhorse in the Ogeechee River are between 46 and 60 cm, with a majority being between 50 and 54 cm. A coded wire tag was located on 22 of 33 (67%) of robust redhorse; most coded wire tags were determined to be from the 2002 year class (64%; n=14). Evidence for juvenile robust redhorse recruitment in the Ogeechee River remains lacking.

TECHNICAL WORKING GROUP REPORTS

Oconee River Technical Working Group – Alice Lawrence

This presentation summarizes the tasks in the management plan that we addressed during the past year and presents the tasks that we are considering as our top priorities for the upcoming year:

Task: Continue to document spawning activity at known sites and identify any additional sites, and
Task: Continue evaluation of habitat augmentation and identify augmentation strategies to address habitat bottlenecks.

The Oconee TWG deemed monitoring of the gravel augmentation sites as one of the top three priorities for 2012. GDNR visually monitored gravel augmentation sites over a two-day period this spring; no robust redhorse were detected. An intern has been hired by GDNR, via mitigation funding from GDOT, to monitor the five gravel augmentation sites in the Oconee River more intensively in 2013. Monitoring will include visual observations for robust redhorse, collecting and analyzing subsequent seine samples for larval robust redhorse, and developing a summary report.

Task: Survey areas not specifically targeted in the past, sampled only sporadically, or outside the management unit, and
Task: Evaluate the need for establishing additional refugial populations.

The Oconee TWG deemed exploring if a remnant population exists above Sinclair Dam as one of the top three priorities for 2012. This is a necessary step before the group would consider introducing robust redhorse above Sinclair Dam. Reconnaissance surveys above Sinclair Dam took place in Fall-Winter 2012 in the Oconee River to Barnett Shoals Dam, Little River, Murder Creek, Apalachee River, Shoulderbone Creek, and Hard Labor Creek to assess available habitat and accessibility. Based on the results of those reconnaissance surveys, electrofishing surveys took place in spring 2012 in the Oconee River to Barnett Shoals Dam, Little River, and Murder Creek. One robust redhorse was collected in Little River. In Spring 2013, electrofishing and/or gillnet surveys are planned for the Oconee River to Barnett Shoals Dam, Wallace Dam tailrace, Little River, Apalachee River, and Shoulderbone Creek.

Task: Review existing data on habitat quality and quantity to develop a more accurate estimate of available habitat.

The Oconee TWG deemed providing Georgia Power with a formal flow tweak recommendation as one of the top three priorities for 2012. A sub-task in the management plan specifically mentions updating the flow regime at Sinclair Dam. Since the FERC license was issued for the project in the mid-1990's, we now have more information including robust redhorse population estimates, catch-per-unit-effort data, and now Jennings et al. 2008 that correlates abundance of larval and age-0 redhorse with April-June flow parameters. The Jennings et al. 2008 results include parameters that are slightly different than the current flow regime. A Flow Advisory Team meeting is to be

scheduled for fall 2012, in which the data results will be translated into a management recommendation for Georgia Power.

Task: Expand public outreach and outreach efforts.
The Service, with participation from Georgia Power, USGS, and GDNR, produced a short video highlighting the story of the robust redhorse and the benefits of CCAA's. The video has been featured on the Service's national homepage, the Service's regional Candidate Conservation webpage, GDNR's webpage, and the RRCC webpage. YouTube has recorded approximately 1,400 views in a six-week timeframe.

Task: Actively participate in the environmental review process, as appropriate.
Both the Service and GDNR are involved in the ongoing review process for an auxillary Macon Water Authority proposed water intake on the Ocmulgee River. The resource agencies have provided environmental recommendations including construction and operational timeframes, alternate designs, and monitoring recommendations to reduce impacts to anadromous fishes and robust redhorse.

Yadkin-Pee Dee Technical Work Group Activities – Ryan Heise
The long term goal of Yadkin-Pee Dee technical working group (TWG) is to ensure a viable, self-sustaining population of robust redhorse in the Pee Dee River. Thus, the TWG has continued discussions about supplementing the small population downstream of Blewett Falls Dam and reintroduction downstream from the Tillery Dam. Duke Energy has already begun implementing parts of the proposed FERC (Federal Energy Regulatory Commission) license and the issuance the new license is expected in 2013. The Yadkin-Pee Dee TWG has conducted numerous studies in the Pee Dee River allowing us to make informed decisions about robust redhorse management (see previous annual reports and publications on our website). We are pursuing a long term hatchery program at the Wildlife Resource Commission's McKinney Lake Fish Hatchery and a pilot project is scheduled to begin in the spring of 2013. Discussions are ongoing between Duke Energy, U.S. Fish and Wildlife Service, NC Wildlife Resources Commission, SC Department of Natural Resources concerning a possible conservation agreement.

Information Technology Technical Working Group – Jaci Zelko
Jaci asked all participants to check on their latest dataset and send updated copies to be included in the master spreadsheet.

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 – 2007 and 2009 – 2011 reports. These documents have been uploaded to the RRCC website. The missing reports from 2002 and 2008 are currently being written. 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.

B U S I N E S S

Update on the 404 Species Petition – Sandy Tucker
The Service was taken to task for having a long list of candidate species. We agreed to review and address the needs of 251 candidate species over 6 years, to determine if they should be added to the ESA list. Sixty-one of these are in the Southeast Region.

The Service's 90-day finding, issued in September 2011, was prompted by an April 2010 petition to list 404 aquatic, riparian and wetland fish, plants and animals. The status reviews for 374 species will likely follow work on the court-approved, multi-year listing for the 251 species sometime after 2016. The robust redhorse is included in this group. With such a long list of species, and the fact that most of the species occur on private land, the FWS is engaging many partners in efforts to find out about and conserve these species.

Listings decisions are made solely on the basis of the best available scientific and commercial information. Listing determinations consider these five factors:

- The present or threatened destruction, modification, or curtailment of its habitat or range
- Overutilization for commercial, recreational, scientific or educational purposes
- Disease or predation
- The inadequacy of existing regulatory mechanisms
- Other natural or man-made factors affecting survival

The Policy for Evaluating Conservation Efforts addresses each of those five factors, and is guidance for how the FWS can evaluate the conservation efforts of the RRCC. The RRCC can give the 5 factors serious scrutiny and prepare a status assessment for the FWS that explains, with justification, why the RRH is stable or improving. Additional CCA/As would be useful – use the PECE to make them rock solid.

Candidate conservation agreements are formal partnerships involving any agency, specific conservation measures and no permit or regulatory assurances. A candidate conservation agreement with assurances involves non-Federal landowners and covers species whose threats are adequately understood. The conservation activities embodied in the agreement are expected to typify those needed to preclude listing. A permit is included that provides for incidental take of the species if it becomes listed. By signing onto the CCAA, the signatories receive assurance that no additional conservation actions will be required of them for that species within the covered area.

Installation of Incoming RRCC Chairperson – Ryan Heise
Alice Lawrence was installed as the new RRCC Chairperson by outgoing Chair Ryan Heise. She is very excited to be the new chair and was thankful for all of our dedication over the years to the robust redhorse recovery effort.

A T T A C H M E N T S

Attendees of the 2012 Meeting:

Name	Organization
Ryan Heise	NCWRC
David Wilkins	SC Aquarium
BRENA JONES	NCWRC
Jaci Zelko	USFWS
Will Pruitt	UGA
Tom Kwak	NC State / USGS
Tom Thompson	Duke Energy
TOMAS IVASAUSKAS	NCSU
Laura Belica	NCSU
CARRIE STRAIGHT	UGA Ecology
JOHN FRIDELL	USFWS
Dave Tonghlan	Duke Energy
CECIL JENNINGS	USGS / UGA
Patrick Ely	UGA
Steve Zimpfer	UGA
Tanya Darden	SCDNR
Jimmy Evans	GADNR
Milton Quattlebaum	SCANA / SCE&G
Tom Bowles	SCE&G
Andrea Leslie	NC NHP
Alice Lawrence	USFWS - Georgia Ecological Services
Nathan Farnau	Georgia Aquarium
Cory Brooks	Georgia Aquarium
Wayne STARNES	NC Museum Nat. Sciences
Greg Moyer	USFWS Warm Springs FTC
LAURA FOGO	USFWS RFO
Cuddy Carr	WRC
Sandy Tucker	USFWS
Scott Lamprecht	SCDNR
Rick Bradford	NCWRC